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Preface

The 35th Annual Conference of the Australian and New Zealand Regional Science Association International (ANZRSAI) was held at The Brassey in Canberra from 6th to 9th December, 2011. A broad range of papers from academics, policy advisors and practitioners was presented to the conference. This publication contains the refereed proceedings of those contributed papers.

Participants who submitted their full paper by the due date were eligible to be considered for these refereed proceedings. There were 22 papers submitted to a double blind refereeing process, after which 21 papers were accepted for presentation in this publication. One accepted author had to withdraw from the conference, so that 20 papers are reproduced in this publication. As in previous conferences, I am very grateful to referees for their work within a short timeframe.

Three awards were presented at the conference dinner. The John Dickinson Memorial Award for best article in the *Australasian Journal of Regional Science* 2011 was awarded to Stuart Mounter (University of New England) for his article "Latecomers: Charting a Course for the Wine Industry in the New England Region of Australia".

The ANZRSAI Award for Best Conference Paper 2011 was awarded to Paul McPhee for his article "Policies to Stimulate Exports – Simulations and Analysis Using Information Flows and Innovation Indicator Matrices within a Modified Input-Output Framework". This paper is the first paper presented in these proceedings, and will also be reproduced in the conference issue of the *Australasian Journal of Regional Science* (April 2012).

The ANZRSAI Award for Best Conference Paper by a Current or Recent Student 2011 was awarded to Matthew Campbell-Ellis (University of Tasmania) for his paper "Adaptive Regions, Deliberative Power Spaces and the Sustainable Development Platform Method". This paper will also be reproduced in the conference issue of *AJRS*.

The committee highly commended two other entrants for this Award: Hyunsu Choi (Kyoto University) for his paper co-authored with Dai Nakagawa, Ryoji Matsunaka and Tetsuharu Oba "International Research on the Relationship between Urban Structure and Transportation Energy Consumption According to Economic Level" and Xin Liu (University of Melbourne) for his paper co-authored with Sun Sheng Han "Economic Transformation and Creative Industries: A Case Study of Metropolitan Beijing".

The 2011 ANZRSAI Awards for Best Conference Paper and for Best Conference Paper by a Current or Recent Student were sponsored by the Bureau of Infrastructure, Transport and Regional Economics. On behalf of the ANZRSAI Council, I thank BITRE for this and other support provided for the 2011 conference.

The conference included my Presidential Address and a keynote address by Caroline Saunders (both of which are presented in these *Proceedings*). There were also three panel sessions in the conference programme. One of the participants (Andrew Sense) submitted a full paper in advance, and this paper is included in these proceedings. The contributors and subjects in the panel sessions are listed below.

Plenary Panel I

David Admans (Innovative Regions Innovation Centre)
Adaptive and Innovative Regions in Australia

Sylvia Admans (R E Ross Trust)
Philanthropy and Adaptive Regions

Assoc Prof Andrew Sense (University of Wollongong)
Building Regional Adaptive Capability through a Local Government Insider-Researcher Network

Plenary Panel II

Professor John Tomaney (CURDS, Newcastle University)
Place-based Approaches to Regional Development

John Daley (Grattan Institute, Melbourne)
Investing in Regions: Making a Difference

Richard Walker (Economic Development Australia)
Commentary

Plenary Panel III

Professor Bob Stimson (Australian Urban Research Infrastructure Network)
Introduction to the Australian Urban Research Infrastructure Network

Dr Anthony Hogan (National Institute for Rural & Regional Australia)
Social Policy in Rural and Regional Australia: A Scoping Study

Finally, I thank all the participants for their involvement in our 35th Annual Conference, particularly those who had travelled some distance from overseas to attend. The international community of regional science scholars is strengthened when people gather to share their research and expertise at conferences such as this.

Professor Paul Dalziel
Editor, 35th Annual ANZRSAI Conference Proceedings

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Export Driven Regional Development: A Comparison of Policies Based on Tiberi-Vipraio-Hodgkinson Innovation Strategies and Networked Information Flows

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ABSTRACT

Sixteen supply-side and seven demand-side export promoting policies were simulated and examined for export and associated employment impacts. Policy design considered the spatial distributions of export promoting and constraining variables defined within the Tiberi-Vipraio Hodgkinson (TVH) regional innovation context typology (2000), and examined movements in their value-added industry support export enhancing information multipliers. These were derived using innovation indicator matrices (IIMS) within an extended input-output framework as designed by the author. The information sector was derived using a modified decomposition and aggregation (Karunaratne, 1988) whilst IIMs build upon DeBresson's (1999) innovative interactive matrices to show innovation strategy information spillover contributions rather than innovation inputs and outputs as an intermediate transactions quadrant subset. Policy simulations showed that information sharing consistent with the innovative milieu theory best stimulated exports and associated employment. That is, assistance to promote related scientific research delivered the best export, associated employment outcomes and related flow-on effects.

1. INTRODUCTION

The literature identifies many innovation strategies and information sources as influencing export product and production process developments and sales. In more recent times the Australian studies have included those of Tiberi-Vipraio and Hodgkinson (2001), Hodgkinson (2004, 2008) and McPhee (2010). Specifically, these studies have examined the performances and innovation behaviours of 146 surveyed regional New South Wales exporting firms and the variables of analysis were referred to as the Tiberi-Vipraio and Hodgkinson (TVH) strategy variables. Innovation indicator matrices (IIMs) within an input-output framework containing an information sector were since used to determine the spatial distributions and dependencies of these TVH variables and their information induced product and process multiplier values (McPhee, 2010).

Analysis of variance (ANOVA) and Chi-Squared Dependency tests were used to determine TVH strategy distributions and dependencies and the ANOVA tests found significant variations in innovation strategy use across the network, region and sector levels. These were strongest at the sector than the regional level, with the competitive advantage and specific product or production process development strategies being the exception suggesting a sourcing of innovation information from a larger geography than the firm's region of location (McPhee, 2010). In summary, networked information sharing was found crucial to export product and process development with main influences being: networking with agencies and

partners, using internet and e-mail facilities; sourcing information from attending capital city conferences; and travelling to or visiting service providers, clients, agents and partners. These findings emphasize the need for policies based on sector interconnectivities.

This paper describes and compares several policies that are based on these TVH spatial qualities. The policies are designed to promote the generation, and sharing of information for export development and are simulated for 2000/01, 2006/07, and over the whole period, using the GRIMP input-output software. Their impact upon export and associated employment multipliers are then compared to determine the most supportive.

2. BACKGROUND

The debate continues regarding the importance of sector connectivity in policy design. For example, a UK Department of Trade and Industry study (2001) identified that sector connectivity could be utilized to improve the export performance and associated employment levels of already clustered firms in the services, manufacturing, media and computer related biotechnology industries. It also identified same industry non-manufacturing, national and international innovation and learning networks which were as, if not more important than locally based networks (Bathelt, 2005; Swann *et al*, 1998) suggesting that local networks as supply chains may not be as important as national and international links for such industries. These results suggest that these firms seek non-local lower cost better quality factors across space rather than source locally. This strategy was also observed in studies of the German and Italian industrial districts by Paniccia (2002) and Staber (2001) and Birkinshaw and Hood (1998) who suggested that this behaviour is often demonstrated by transnational corporations that choose locations where available assets, organizational and institutional structures provide the required innovation information.

Within Australia, national clusters have comprised nation-wide networks of regionally based firms within the fishing, wine, tourism, film and education industries occasionally collaborate and innovate collectively as well as independently through a range of alliances, federations, commissions and associations (Roberts and Enright, 2004). In contrast, regional clusters have an acknowledged national or international competitive advantage and these are localized, very small and have a strong export focus. Examples of this latter group have included: the high speed catamaran industry in Cairns, Hobart and Fremantle, and the equine clusters around Scone in New South Wales (Roberts and Enright, 2004). Roberts and Enright (2004) also suggest that many Australian regional firms are members of business networks rather than clusters and that the cluster related policy initiatives have meet with considerable difficulties.

Contrary to expectations, Marceau (1999 cited in National Economics, 2000) first found evidence of cluster shrinkage associated with increased globalization and structural change from 1975 to 1989 using national input-output tables. This was substantiated by the State of the Regions Report (National Economics, 2000; Table 1) which showed declining domestic supply chains and information networks compared to other OECD nations. Brown and Duguid (2000) identified that three main problems for Australian clusters were: insufficient critical mass, lack of focus and distinctiveness and various political and administrative difficulties.

Roberts and Enright (2004) have since claimed that many Australian cluster initiatives have failed because of a lack of experience, resources and training, and the failure of regional development agencies to facilitate the development programs. These failures were in clusters that were developed in some of the national industry restructuring programs (termed natural or deductive clusters) as well as some of the Federal, State and Local Government initiatives. Those that evolved from the national industry restructuring programs were intended to be

driven by market forces to enable location specific competitive advantages to develop via industry agglomerations in a manner described by Weber (1929) and it is now considered that many of these initiatives failed to recognize the functional links between the regional, state and national firms. Those Federal Government initiatives that experienced difficulties were identified in:

- the Australian Manufacturing Report (Pappas Carter Evans & Koop and Telesis, 1990) which proposed that core and other regional industries work together to strengthen regional networks and encourage innovation and technology transfer;
- the McKinsey report titled *Lead Local, Compete Global* (McKinsey and Company, 1994) which suggested that governments adopt clustering as an approach to industry and regional economic development through soft infrastructure, leadership and entrepreneurship (Roberts *et al*, 1996);
- the 'Working Nation' (Keating, 1994) report which encouraged Federal and State governments to use cluster policies to stimulate regional industry;
- the Regional Summit and Regional Solutions program (Federal Department of Trade and Regional Development, 2001) which underwent several administrative changes to the Federal Department of Transport and Regional Services then the Regional Assistance Program within the Department of Workplace Relations and Small Business.

Roberts *et al*, (1996) and Roberts and Enright (2004) have suggested that these initiative also failed because of an inherent lack of support for metropolitan regions where some of the major structural adjustment problems and greatest potential to develop industry clusters were located. Consequently, the preferred Federal initiative has become the industry-university Cooperative Research Councils (CRCs) partnership program (Roberts and Enright, 2004).

The Queensland Government initiated innovation centres within the information, food, biotechnology, and new materials technology-based industries with limited success (Markusen and Hall, 1985 cited in Roberts and Enright, 2004) and one spin-off was the Queensland Cape York International Spaceport (1988) which failed to raise sufficient development funds. In Queensland the State Government developed several joint industry task forces for example: the Tourism and Trade Coast Development taskforce was established to facilitate the development of logistics, chemicals and processing industries in the Brisbane Gateway Ports area and the Cairns region of Far North Queensland. In addition, the fair go for local industry campaign (Queensland Department of State Development, 2000) encouraged major project investors to use local supply chains as a means of promoting clustering.

A Japanese consortium also proposed the Multi-function Polis (MFP) in partnership with the Queensland Government in 1986 and this was based upon the Japanese Technopoles where the purpose was to facilitate international technological and cultural exchange driven by networked and clustered industries (Castells and Hall, 1994 cited in Roberts and Enright, 2004). Whilst the Japanese participants took a real estate view of the project, the Australian partners viewed it as a new urban development, lifestyle and working environment concept. In reality the project encompassed several themes including biotechnology, IT and CAD/CAM based industry production. The project collapsed when the Queensland Government refused to purchase the Northern Gold Coast site so it was moved to Adelaide. Since then, the project has subsequently attracted very little international interest and the corporation was wound up in 1998 with very little to show for the efforts.

In South Australia, the Departments of Industry and Trade, Transport and Urban Planning and the Arts investigated and mapped clusters using Geographical Information Systems (GIS) and

investigations of the defence, spatial, water and multi-media industries led to the formation of several clusters. The South Australian Regional Development Taskforce Report (Bastion, 1999) has supported cluster located in the Upper Spencer Gulf region for the environment, conventions and food industries.

In New South Wales, Sydney has been promoted as a global financial centre where firms in the finance sector are well connected to information technology, biotechnology and producer service industries (Brotchie, *et al*, 1995). In addition, the Sydney central business district, northern suburbs and Ryde corridor contains information services and technology industry clusters. Furthermore, the Sydney airport corridor contains clusters in transportation, logistics; whilst the Sydney mid-west contains biomedical clusters and the west and south-west component manufacturing clusters (Roberts and Murray, 2002; cited in Roberts and Enright 2004). O'Neill and McGuirk (2002) argue that all of these clusters are driven by international factors as Sydney becomes more integrated into the global market, and the State Development Strategy is driven by the assumption that attracting international corporations to Sydney should have beneficial multiplier effects. They argue that this strategy has worked well with over forty percent of Australia's largest national and international corporations based in Sydney but it has done little to support new industry developments within the regions (Roberts and Murray, 2002; O'Neill and McGuirk, 2002).

The Victorian Government cluster initiatives of the mid 1980s were designed to develop specialized high technology industrial districts in Werribee and East Melbourne regions (Blakely *et al*, 1987). Roberts and Enright (2004) argue that their success was limited because they were driven by political rather than market considerations. Following the election of the liberal government in the 1990s interest in these projects waned and in 2000, the Department of State and Regional Development audited the automotive, environmental management, renewable energy, metal fabrication, precise engineering, professional and technical servicing, textile clothing, footwear, leather, transport and logistic industries, to identify their needs and Roberts and Enright (2004) suggest that the development initiatives have since followed a non-cluster approach.

3. METHOD AND SIMULATIONS

In a review of government regional development policies concern is expressed regarding regional disparities and growing skill shortages when regions have a narrow base for their economies (Collitts, 2008). A main question arising in the policy debate is whether assistance should go to all regions equally, to growing regions, to declining regions, or to regions that suffer sudden economic shocks? A further question follows as to whether assistance should be given to firms, regional bodies or to a combination of both or infrastructure projects. A study by Epps (1999) of New South Wales assistance programs found little relationship between the types of firms assisted by the State Government and the objectives of the Regional Development Board which emphasizes the need to determine the precise policy objectives before implementing a policy program. Collits (2008) also suggested that Australian governments have often introduced new programs without first identifying the desired objectives and again it raises the issue of what kinds of regions should be helped. The policies simulated in this paper help address these issues as there are eight simulation scenario categories that generate information sharing to facilitate export-induced economic growth whilst minimizing disparities across geographical space.

Such simulations were based on earlier identified TVH spatial strategy distributions. Specifically, that information sharing stemming from the use of networks was found to be an important driver of export performance. Using suitably constructed input output tables, a

random value of $22.6M AUD with no particular significance, is first allocated at the beginning of 2000/01 and a value of $33.96M AUD is then allocated at the beginning of 2006/07 and this assistance was assumed to run over the whole time period till the end of 2006/07. The 2000/01 input-output tables include the sales and export data from the survey firms whilst the 2006/07 tables are an update of the 2000/01 tables using ABS data. The tables for each time period were decomposed to illustrate an innovative milieu and no information sector; and no innovative milieu but having the information sector split into its primary and secondary components (see Karunaratne, 1988). The later year's allocation is based on a 50.27 percentage increase in total economic output of over the time period as measured from the respective input-output tables. All scenarios were simulated by adjusting upwards those cell values where the *targeted sector-flows* intersected with *gross fixed capital formation in the private sector*, as well as for *public enterprises* and *general government*. This assumes capital building through information sharing, goodwill, and reputation and that general government bodies, public enterprises and private firms were cooperating to implement the policies and achieve the desired outcomes.

There are specific reasons why 2000/01 and 2006/07 were used. First, the final year of the TVH survey data was 2000/01. Second, 2000/07 was considered a medium-term projection from 2000/01 and used the most recent data available at the time. Third, projecting the input-output tables and simulating the policies too far into the future would overlook structural changes that cannot be anticipated at the projection time. However the exercise successfully demonstrated that these policies can be simulated and analysed using the input-output methodology.

Whole system impacts were examined using total demand and supply multipliers for output, income, employment, value added, exports, imports and final consumption and additional supply multipliers such as: government expenditure; gross fixed capital formation for the private sector, public trading enterprises and general government. Net exports multiplier change values were calculated as the export change values less import multiplier change values. The two most successful simulations are identified and discussed in section 5.

Table 1 illustrates the policy simulations that are performed and shows how they cause TVH strategies to be chosen as regional context and global markets interact to cause all multiplier changes (it also lists the on-disk appendices where the relevant input-output tables and proportioning exercises are stored). Specifically, the TVH variables do not have multiplier values in their own right, but derive these through their interaction with the intermediate sector and global interface. This table also indicates the questions from the Survey of New South Wales regional exporters that are used to gather these data and their choices within each strategy category. Table 2 provides a more descriptive listing of the simulated demand and supply flows as based on the TVH strategy usages, and describes how these policy scenarios allocate a final demand or final supply increase to a targeted sector as follows:

- *The equity scenarios* are intended to promote economic growth and resultant exports with minimum growth divergence across the sector-flows. They take into account the concerns expressed in the Collit's review (2008) that one region's gain may be another region's loss and spread the induced growth benefits in a manner so that no region is overwhelmingly disadvantaged. As such the strongest performing sectors receive the smallest assistance and vice-versa, and this scenario contains the policy simulations D1, D2, and S1. Allocations are made to the three weakest non-zero balance regional sector-flows chosen from the three weakest regions respectively in reverse proportion to the demand–induced relative sector-flow output so that the weakest flows receive the most assistance in order to minimize growth divergence. D2 allocations are made similarly to

D1 but to the five regional sector flows that have a zero balance and final demand increases are made in reverse proportion to their respective demand induced regional output balances so that the weakest region receives the most assistance and vice-versa. This stimulates the non-performing export sectors within the lowest performing regions. For the S2 simulation (sector specific) the allocation is made to the five weakest non-zero balance supplying regional sector-flows respectively in direct proportion to the supply-induced relative output multiplier values.

Table 1 Policy Simulation Summary

Simulation		On-Disk Appendices			Regional Context, Global Interaction and Survey Details		
Scenario	**Identi-fication Demand / Supply**	**2000/01 Input-Output Tables**	**2006/07 Input-Output Tables**		**TVH Strategy (and number of choices),**	**Survey Question**	**Innovation Indicator Matrix**
Equity	D1	9.13(RO1), 6F	9.14(RO7), 9.1		Corporate primary strategy (3)	2.1	1
Equity	S1	9.13(RO1), 6F	9.14(RO7), 9.1		Competitive advantage (7)	2.2	1
Equity	D2	9.13(RO1), 6F	9.14(RO7), 9.1		Production strategy (4)	2.3	1
Sector Specific	S2	9.13(RO1), 6F	9.14(RO7), 9.17	=>	Perceived leadership position (4)	1.5	1
Sector Specific	S3	9.13(RO1), 6F	9.14(RO7), 9.18	=>	R&D (innovation) (4)	25	1
Sector Specific	S4	9.13(RO1), 6F	9.14(RO7), 9.19	=>	Primary exporting reason (12)	3.4	2
Sector Specific	S5	9.13(RO1), 6F	9.14(RO7), 9.20		Exporting strategies (7)	3.6	2
Sector Specific	S6	9.13(RO1), 6F	9.14(RO7), 9.21		Perceived export expansion difficulties (15)	3.5	2
Sector Specific	S7	9.13(RO1), 6F	9.14(RO7), 9.22		Domestic sales	5.7	2
Sector Specific	S8	9.13(RO1), 6F	9.14(RO7), 9.23	=>	Sourcing of inputs (35)	4.4	3
Sector Specific	S9	9.13(RO1), 6F	9.14(RO7), 9.24	=>	Cost of information about new technologies (6)	2.6	3
Sector Specific	S10	9.13(RO1), 6F	9.14(RO7), 9.25	=>	Cost of information about market developments. (12)	4.9	3
Innovative Milieu	D3	9.11(MO1), 6J	9.12(MO7), 9.3		Primary inputs		3
Innovative Milieu	S11	9.11(MO1), 6J	9.12(MO7), 9.3		Australian Government attitude (4)	5.1	4
Information Split	D4	9.15(SO1), 6J	9.16(SO7), 9.4	=>	New South Wales Government attitude (4)	5.2	4
Information Split	S12	6J	9.4 Trans.	=>	Local Government attitude (4)	5.3	4
Information Combined	D5	9.9(I01), 6H transposed	9.10(IO7), 9.5	=>	Overseas market information (4)	5.4	4
Information Combined	S13	9.9(IO1) Trans. 6H transposed	9.10(IO7), 9.5		Exporting process advice (8)	5.5	4
Region. Inform. Combined	D6	6H	9.6		Non-information exports		4
Region. Inform. Combined	S14	6H	9.6 Trans, 9.26		Domestic sales		4
Sector Inform. Combined	D7	6H	9.7		Corporate primary strategy (3)	2.1	1
Sector Inform. Combined	S15	6H, 6H transposed	9.27 Trans. 9.27		Competitive advantage (7)	2.2	1
Small Business	D8	6H	9.8,		Production strategy (4)	2.3	1
Small Business	S16	6H, 6H transposed	9.8 Trans, 9.28		Perceived leadership position (4) (Q 1.5)	1.5	1
					R&D (innovation) (4)	25	1
					Domestic sales	5.7	2
					Imports		
					Exports		

Explanatory Notes:

1. Fist line on-disk appendices refer to the proportioning and re-allocation files;
2. Second line on disk appendices refer to the input-output tables the allocations are based on and thereby applied to;
3. RO1, MO1, SO1 and IO1 denote regional sector-flow, innovative milieu, information split, and information combined for 2000/01 respectively;
4. RO7, MO7, SO7 and IO7 denote regional sector-flow, innovative milieu, information split, and information combined for 2006/07 respectively.

Table 2 Policy Simulation Details, 2000/01 and 2006/07

Simulation Identification Code		IO Table Used	Shock Direction	Simulation Scenario	Sector Targeted	Allocation / Stimulation Method
2001	**2007**					
D1	**D1(7)**	6R	Demand	Equity	The 3 weakest non-zero balance sector-flows, chosen from the 3 weakest regions respectively	According to and in reverse proportion to the demand-induced relative sector-flow output totals
D2	**D2(7)**	6R			The 5 sector-flows with a zero balance	
S1	**S1(7)**	6R	Supply		The 3 weakest sector-flows, chosen from the 3 weakest regions respectively	According to and in reverse proportion to the supply-induced relative sector-flow output totals
S2	**S2(7)**	6R	Supply	Sector Specific	The 5 weakest non-zero balance supplying sector-flows chosen from the 5 weakest regions respectively according to relative output multiplier values	According to and in direct proportion to the supply-induced relative output multiplier values
S3	**S3(7)**	6R			The 7 strongest supplying whole system sector-flows according to relative output values	According to and in direct proportion to the supply-induced relative output values
S4	**S4(7)**	6R			The 7 strongest supplying whole system sector-flows according to relative output multiplier values	According to and in direct proportion to the supply-induced relative output multiplier values
S5	**S5(7)**	6R			The 7 strongest supplying whole system sector-flows according to relative export values	According to and in direct proportion to the supply-induced relative export values
S6	**S6(7)**	6R			The 7 strongest supplying whole system sector-flows according to relative export multiplier values	According to and in direct proportion to the supply-induced relative export multiplier values
S7	**S7(7)**	6R			To the strongest sector-flow in each region according to relative output multiplier values	According to and in direct proportion to the supply-induced relative output multiplier values
S8	**S8(7)**	6R			To the strongest sector-flow in each region according to relative output values	According to and in direct proportion to the supply-induced relative output values
S9	**S9(7)**	6R			To the strongest sector-flow in each region according to relative export multiplier values	According to and in direct proportion to the supply-induced relative export multiplier values
S10	**S10(7)**	6R			To the strongest sector-flow in each region according to relative export values	According to and in direct proportion to the supply-induced relative export values
D3	**D3(7)**	6M	Demand	Innovative Milieu	Innovative Milieu	All to the Innovative Milieu
S11	**S11(7)**	6M	Supply			

Table 2 Policy Simulation Details, 2000/01 and 2006/07 (Continued)

Simulation Identification Code		IO Table Used	Shock Direction	Simulation Scenario	Sector Targeted	Allocation / Stimulation Method
2001	2007					
D4	**D4(7)**	6S	Demand	Information Split	Primary and Secondary Information Sectors	According to and in direct proportion to relative sector balances
S12	**S12(7)**	6S	Supply			
D5	**D5(7)**	6I	Demand	Information Combined	Combined Information Sectors	All to the Combined Information Sector
S13	**S13(7)**	6I	Supply			
D6	**D6(7)**	6R	Demand	Regional Information Combined	The demand (supply) induced sector-flow of each region with the weakest information component according to the relative information coefficient values[1]	According to and In direct proportion to the demand / supply-induced relative sector-flow export values
S14	**S14(7)**	6R	Supply			
D7	**D7(7)**	6R	Demand	Sector Information Combined	The 11 most demand (supply) induced information deficient sector-flows regardless of their region, according to the relative information coefficient values[2]	According to and in direct proportion to the demand / supply-induced relative total output values
S15	**S15(7)**	6R	Supply			
D8	**D8(7)**	6R	Demand	Small Business	To every demand (supply) induced sector-flow's small business component	According to and in direct proportion to the demand / supply-induced small business export contributions (assuming the proportions remain unchanged from 2000/01 to 2006/07
S16	**S16(7)**	6R	Supply			

1,2: 2006/07 sector flows and proportions are the same as for 2000/01, as the information coefficients are assumed unchanged and the disaggregated information value added and output multipliers are at zero value for both time periods.

- *The sector-specific scenarios* are designed to take advantage of the targeted sectors well established input supply networks. Assistance is allocated proportionally to the relative values of total output, export sales, total output or export multiplier for the targeted sector as these values provide some indication of the strength of the connectivity with the input suppliers. Earlier analysis (McPhee, 2010) indicated that firms in these targeted sectors were drawing on inputs networks that spanned a geographical area much larger than the defined regions. Targeting these sectors would then increase final supplies to specific regional sector-flows in the manner specified in column 3 of Table 3 (presented later in this paper) and this scenario contains simulations S2 to S10 inclusive.
- *The innovative milieu scenarios* are chosen to stimulate the scientific research component of the state economy. Subsidizing such research encourages more of this activity and benefits are considered to flow into the product and process developments of exporting industries. Theoretical discussion suggested that information stemming from the milieu will benefit a network of SMEs, MNCs, customers, suppliers, competitors, universities and research bodies (Maillat *et al*, 1994, Maillat, 1998; Capello, 1999b) whilst Nelson and Winter (1982) and Dosi *et al*. (1988) emphasized it role in reducing decision making uncertainty and associated costs in times of innovation. These researchers have also emphasized the long-term benefits in that the milieu collectively directs research and scientific information to benefit future exporting industries as well as controlling it at a specific point in time. In summary, the simulations in these scenarios are based upon the assumption that increasing scientific research will have beneficial flow-on effects for the linked sector-flows and they contain the simulations D3 and S11.
- *The information split scenario* stimulates both the primary and secondary information components. It is believed that increasing the primary and secondary information contributions to the state economy will have beneficial flow-on effects to strongly linked sectors. Earlier analysis (McPhee, 2010) showed that declines in both the primary and secondary information components were associated with declines in export sales and associated employment. Stimulating the secondary component is actually subsidizing the internal communication costs of firms within the connected sectors and this assists in the delivery of the primary information component stimulation. The increases in final demand and final supply are made in direct proportion to the respective primary and secondary information state balances. This is equivalent to increasing the secondary and primary information coefficient of the linked sectors in proportion to the strength of their linkages and these scenarios contains the simulations D4 and S12.
- *The information combined scenarios* contain simulated increases in final demand and final supply which are allocated to the complete information sector. It is believed that increases in total information will flow on to sector-flows that use this information and this is equivalent to increasing the total information coefficient of the linked sectors in proportion to the strength of their linkage. These scenarios contain simulations D5 and S13.
- *The regional information combined scenarios* stimulate the sector-flow of each region that has the weakest information component as measured by their information components to enhance export performance. The choice is made using the lowest value information coefficients so that more than one sector-flow can be chosen for each region. The simulated increases in final demand and final supply are made in direct proportion to the demand or supply induced relative export values. This is based upon

the belief that increases in final demand and final supply for the information deficient regional sector-flows will cause an increase in the information content and provide beneficial flow-on effects to other strongly linked flows within the region. These scenarios contain simulations D6 and S14.

- *The sector information combined scenario* stimulates the eleven most information deficient regional sector-flows regardless of their region. For these scenarios, the increases in final demand and supply are allocated in direct proportion to their demand and supply induced relative output values. These allocations are based on the belief that increasing demand and supply for these sector-flows will draw information into these flows or will increase its supply respectively. Some information deficient sector-flows will be stimulated to source their information from other linked flows within the system, and this will spread through the flow-on effects. These scenarios contain the simulations D7 and S15.
- *The small business scenarios* are those in which the small business components of each regional sector–flow experiences increases in either final demand for simulation D8, or increases in final supply for simulation S16. These simulations should increase the small business information component and be beneficial for their export related product or process developments. McPhee (2010) identifies significant and wide SME dispersion throughout all sectors and some innovative milieu connections. Schumpeter (cited in Marshall, 1987; Davelaar, 1989) also considered that SME entrepreneurs would import exogenously produced inventions before and during the peaks and troughs of economic change for reuse as commercial innovations. Furthermore, a study by Williams (2005) reports that SMEs with marketing and exporting budgets are more likely to use all of the marketing information sources and that this would improve their export performances.

Two similar but slightly different analytical methods were used to identify which simulation policies should be chosen as a basis for maximizing export sales without losing any industry-support induced contributions. These were referred to as the *combined multiplier-shift rank* and the *average rank* methods of analysis. The similarities of these methods were in identifying the simulations that first, deliver the highest overall exports increase; and second, deliver the highest industry-support induced contributions in recognition of factor-supply importance for the production process and product development. The differences in these methods were that with the *combined multiplier shift rank method* the final choices were based upon the multiplier change that occurred over the whole study period plus the rankings for the 2006/07 year whilst the *average rank* method choice was based solely on the whole of study period average ranks. The *combined multiplier-shift rank approach* consists of:

- First, choosing the policy simulation that delivers the largest net-exports increase over the study period, and illustrating its export and import component changes, as induced by the consumption and industry-support activities;
- Second, choosing the policy simulation that delivers the largest industry-support induced changes for both export increases and import decreases;
- Third, recommending from a combination of the identified stage one and stage two simulations.

Alternatively, the *average rank method* consists of:

- First, calculating average ranks for the whole study period of the total, consumption, and industry-support policy simulation contributions;

- Second, choosing the policy simulations that deliver the highest export performance overall alongside the highest industry-support induced contributions;
- Third, recommending from a combination of the identified stage one and stage two simulations.

4. METHOD CONTRIBUTION

The simulations identify ways to stimulate information generation and exchange in a manner that maximises export induced economic growth and associated employment using multipliers whilst minimising spatial or regional divergence. Such multipliers contain an information spillover that came into existence as the chosen innovation strategy, regional context and global markets interacted. The policy simulation effects were measured by analysing the resultant multiplier direction and magnitudes whilst the design, implementation and analysis of earlier policies did not consider these approaches. For example, cluster analysis by Knoke and Burke (1980) used hierarchical log-linear models, logistic regressions, Pearson chi-squared and likelihood ratios to show that stage of cluster development and sector were significantly associated with employment growth, and that international significance was associated with sector growth. The *combined multiplier-shift* rank and *average rank* analysis methods as described earlier were unique in their methods.

5. RESULTS AND DISCUSSION

Simulations D3 and S11 emerged as the leading export and associated employment stimulating policies over the whole time period when examined from an industry-support rather than consumption induced effect. This ensures that the development and stimulation of export products or production processes is driven by innovation and technology changes rather than wage earners spending their incomes. Simulation results for each year are presented in Table 3 below in descending order of their net-exports and then employment multiplier changes for the total impact, consumption-induced impact and industry-support induced impact. This table clearly shows that:

- For the total impact changes, S9 followed by S14 are the leaders for 2000/01; and S10 followed by S5 are the leaders for 2006/07;
- For the consumption-induced impact changes, D3 followed by S11 are the leaders for both 2000/01and 2006/07;
- For the industry-support induced impact changes, S12 followed by D4 are the leaders for 2000-01 while D3 and S11 are the leaders for 2006/07;
- Simulations D3, S11, S12 and D4 all demonstrated gradual increases in their net-export multipliers from 2000/01 to 2006/07;
- These gradual increases in net-export multipliers were caused by gradual increases in export multipliers associated with gradual decreases in import multipliers;
- This is evident with increasing consumption-induced export to import ratios of 0.0746 and 0.4674 for both D3 and S11 for 2000/01 for 2006/07 respectively, followed by industry-support induced export to import ratios of 0.8179 and 1.72 for S12 and D4 in 2000/01 and 1.72 for D3 and S11 by the end of 2006/07 (not shown due to space considerations);
- Simulations D3 and S11 are also associated with positive employment increases of 534.57 and 498.02 equivalent full-time persons respectively.

Table 3 Policy Simulation Multiplier Totals, $M AUD

TOTALS 2000/01													TOTALS 2006/07											
Sim.	**Net Exports**	**Employ[1]. (Persons)**	**Output**	**Value Added**	**Exports**	**Imports**	**Income**	**FC[2]**	**GG[3]**	**PE[4]**	**PR[5]**	**Total**	**Sim.**	**Net Exports**	**Employ[1]. (Persons)**	**Output**	**Value Added**	**Exports**	**Imports**	**Income**	**FC[2]**	**GG[3]**	**PE[4]**	**PR[5]**	**Total**
S9	-70.11	5542.22	753.88		30.48	100.59	285.60	68.10	9.39	7.33	61.77	1115.96	**S10**	-0.1	1884.20	357.26		73.50	73.60	158.86	56.22	3.87	3.09	27.49	606.69
S14	-71.15	5521.61	751.09		34.27	105.42	284.43	67.82	8.26	6.63	59.86	1106.94	**S5**	-0.1	1883.79	357.18		73.53	73.63	158.81	56.20	3.86	3.07	27.49	606.51
D6	-71.25	13395.62	1804.31	976.44	34.32	105.57	866.56					3576.06	**S8**	-0.1	1883.69	357.16		73.51	73.61	158.08	56.19	3.86	3.10	27.50	605.79
D8	-72.20	13382.35	1804.31	976.44	33.37	105.57	866.56					3575.11	**S3**	-0.1	1883.63	357.14		73.51	73.61	158.81	56.20	3.87	3.09	27.50	606.51
S1	-72.39	5554.06	742.33		33.05	105.44	280.76	66.95	8.75	6.98	60.19	1093.57	**D6**	-0.1	3076.05	580.92	372.12	73.08	73.18	292.99					1245.93
D1	-72.48	13385.85	1804.31	976.44	33.09	105.57	866.56					3574.83	**S4**	-0.1	1882.81	357.00		73.52	73.62	158.72	56.16	3.86	3.08	27.49	606.21
S6	-72.50	5526.43	752.13		31.52	104.02	284.86	67.94	8.95	7.26	61.24	1109.88	**S14**	-0.11	1874.99	356.89		79.19	79.30	158.64	56.11	3.94	3.14	27.64	606.25
D7	-73.58	13373.82	1804.31	976.45	31.99	105.57	866.56					3573.74	**S9**	-1.44	1881.42	356.60		71.18	72.62	158.38	56.08	4.46	3.65	28.63	606.36
S15	-73.58	5332.13	727.58		31.99	105.57	274.62	65.48	9.24	7.51	60.27	1071.12	**D8**	-1.45	3160.40	580.92	372.13	71.73	73.18	292.98					1244.58
D5	-75.82	15576.35	2060.97	917.18	28.95	104.77	897.65					3799.98	**S16**	-1.45	1957.26	355.51		71.73	73.18	157.78	55.84	4.39	3.52	28.30	603.89
S13	-75.82	7579.73	1010.37		28.95	104.77	315.87	76.79	9.03	6.92	64.14	1407.30	**D3**	-1.59	3050.84	627.35	317.62	69.22	70.81	240.78					1184.16
S5	-75.95	5536.44	753.54		34.43	110.38	285.45	68.09	8.19	6.51	59.85	1105.68	**S11**	-1.59	2639.58	549.30		69.22	70.81	176.96	71.24	5.99	4.83	29.79	836.52
S10	-75.97	5536.42	753.53		34.44	110.41	285.44	68.09	8.19	6.52	59.84	1105.64	**S6**	-2.28	1881.37	356.77		70.37	72.65	158.48	56.12	4.67	3.86	29.05	606.67
S8	-75.99	5534.98	753.34		34.45	110.44	285.35	68.05	8.19	6.52	59.84	1105.30	**S2**	-2.28	1830.82	347.06		70.31	72.59	153.10	54.14	4.85	4.08	28.72	589.67
D2	-76.08	13413.37	1805.32	279.98	34.49	110.57	866.70					2875.92	**D1**	-2.30	3079.45	580.92	372.12	70.88	73.18	292.99					1243.73
S2	-76.08	5541.56	753.69		34.49	110.57	285.52	68.09	8.43	6.73	60.32	1106.70	**S1**	-2.3	1881.34	356.17		70.88	73.18	158.17	55.99	4.54	3.73	28.79	605.09
S7	-76.08	5537.08	753.28		34.49	110.57	285.33	68.05	8.43	6.74	60.31	1106.06	**D7**	-3.16	3078.91	580.92	372.12	70.02	73.18	292.99					1242.87
D4	-76.10	15575.37	1913.32	1004.60	28.92	105.02	893.55					3735.37	**S15**	-3.16	1843.44	349.61		70.02	73.18	154.44	54.63	4.87	4.09	28.97	593.45
S12	-76.10	8337.77	1104.67		28.92	105.02	319.37	77.75	9.08	7.02	63.90	1505.69	**D2**	-4.08	3077.68	580.97	372.24	69.11	73.19	293.11					1242.24
S3	-76.11	5534.75	753.32		34.46	110.57	285.36	68.04	8.19	6.52	59.84	1105.16	**D5**	-5.81	4898.48	846.10	400.36	62.51	68.32	326.04					1566.69
S16	-76.26	5595.37	761.94		34.57	110.83	288.97	68.92	8.27	6.56	60.56	1118.96	**S13**	-5.81	3951.76	679.09		62.51	68.32	213.52	77.36	5.34	4.11	36.03	1009.64
S4	-76.28	5596.53	761.83		34.58	110.86	288.91	68.90	8.27	6.55	60.56	1118.74	**S7**	-7.91	1871.77	354.91		72.17	80.08	157.44	55.69	4.24	3.45	28.06	595.88
D3	-83.92	14107.71	1985.35	991.09	21.33	105.25	879.60					3772.12	**D4**	-7.94	3224.93	860.45	372.07	72.41	80.35	285.66					1510.24
S11	-83.92	7372.40	1102.47		21.33	105.25	343.86	83.41	10.96	8.57	69.26	1534.61	**S12**	-7.94	2513.63	604.84		72.41	80.35	165.16	61.31	4.45	3.33	28.84	859.99

Source: Policy simulation results as stored in PhD Appendices 9C, 9D, 9E, and 9F.

1. Equivalent Full-time persons;

FC[2] – Final Consumption Expenditure Government

GG[3] – Gross Fixed Capital Formation for General Government;

PE[4] - Gross Fixed Capital Formation for Public Enterprises;

PR[5] - Gross Fixed Capital Formation for Private Sector Institutions

Table 3 Policy Simulation Multiplier Totals, $M AUD (Continued)

CONSUMPTION 2000/01													CONSUMPTION 2006/07											
Sim.	Net Exports	Employ[1]. (Persons)	Output	Value Added	Exports	Imports	Income	FC[2]	GG[3]	PE[4]	PR[5]	Total	Sim.	Net Exports	Employ[1]. (Persons)	Output	Value Added	Exports	Imports	Income	FC[2]	GG[3]	PE[4]	PR[5]	Total
D3	-81.11	11582.74	1501.75	876.17	6.54	87.65	788.52					3085.33	**D3**	-21.99	1767.63	295.00	220.43	19.30	41.29	179.09					672.53
S11	-81.11	4869.62	640.22		6.54	87.65	271.93	67.91	7.04	5.51	53.09	964.59	**S11**	-21.99	1434.00	248.27		19.30	41.29	129.67	51.71	3.28	2.60	21.98	435.52
S10	-81.75	4006.64	522.13		5.19	86.94	226.98	55.77	5.82	4.36	44.29	777.60	**D5**	-33.16	2575.15	438.37	295.96	18.16	51.32	244.68					945.85
S8	-81.75	4005.51	521.98		5.19	86.94	226.89	55.76	5.81	4.35	44.28	777.32	**S13**	-33.16	1669.65	290.89		18.16	51.32	160.33	59.79	3.84	2.97	28.15	512.81
S3	-81.75	4005.33	521.97		5.19	86.94	226.89	55.75	5.81	4.35	44.28	777.30	**S2**	-33.98	1167.72	200.25		15.10	49.08	113.02	42.02	2.74	2.02	20.14	346.21
S9	-81.75	3994.24	520.51		5.19	86.94	226.24	55.80	5.83	4.37	44.32	775.32	**S7**	-34.94	1200.74	205.92		15.53	50.47	116.21	43.22	2.84	2.10	20.73	356.08
D2	-81.91	11708.06	1513.36	863.32	5.20	87.11	776.27					3071.04	**S9**	-35.04	1207.98	207.18		15.63	50.67	116.90	43.47	2.85	2.11	20.85	358.32
S2	-81.91	4007.74	522.28		5.20	87.11	227.00	55.78	5.82	4.36	44.30	777.63	**D6**	-35.06	2304.02	383.46	267.16	15.64	50.70	216.38					831.94
S7	-81.91	4005.37	521.97		5.20	87.11	226.88	55.75	5.82	4.36	44.28	777.15	**S14**	-35.06	1210.01	207.50		15.64	50.70	117.11	43.54	2.85	2.10	20.86	358.90
D6	-81.92	11701.40	1512.36	863.21	5.18	87.10	775.37					3069.02	**D1**	-35.10	2304.02	383.46	267.16	15.60	50.70	216.38					831.90
S6	-81.92	3993.85	520.44		5.18	87.10	226.22	55.65	5.80	4.35	44.18	774.72	**S1**	-35.10	1207.22	206.90		15.60	50.70	116.77	43.41	2.84	2.10	20.81	357.73
S14	-81.92	3992.40	520.28		5.18	87.10	226.13	55.61	5.81	4.36	44.11	774.38	**D8**	-35.15	2304.01	383.45	267.12	15.55	50.70	216.38					831.80
D1	-81.99	11701.39	1512.36	863.21	5.11	87.10	775.37					3068.95	**S16**	-35.15	1203.70	206.44		15.55	50.70	116.51	43.33	2.83	2.87	20.75	357.58
D8	-82.03	11701.39	1512.36	863.21	5.07	87.10	775.37					3068.91	**S4**	-35.21	1210.61	207.61		15.65	50.86	117.16	43.57	2.84	2.11	20.88	358.96
S5	-82.08	4006.65	522.14		5.19	87.27	226.96	55.78	5.82	4.36	44.27	777.25	**S6**	-35.21	1208.67	207.31		15.65	50.86	116.98	43.50	2.85	2.11	20.85	358.39
D7	-82.09	11701.41	1512.36	863.21	5.01	87.10	775.37					3068.85	**S5**	-35.23	1211.40	207.76		15.66	50.89	117.24	43.59	2.84	2.11	20.89	359.20
S15	-82.09	3842.88	500.78		5.01	87.10	217.66	53.67	5.60	4.18	42.61	742.41	**S8**	-35.23	1211.32	207.75		15.66	50.89	117.23	43.59	2.84	2.11	20.89	359.18
S1	-82.15	3931.48	512.26		5.12	87.27	222.63	54.85	5.73	4.28	43.57	761.17	**S10**	-35.25	1211.72	207.82		15.67	50.92	117.28	43.59	2.85	2.11	20.89	359.29
S16	-82.86	4055.91	528.50		5.26	88.12	229.73	56.47	5.89	4.41	44.81	786.95	**D4**	-35.28	1938.05	520.38	264.30	19.25	54.53	209.73					959.13
S4	-82.86	4054.96	528.44		5.26	88.12	229.69	56.46	5.89	4.41	44.81	786.84	**S12**	-35.28	1283.79	325.46		19.25	54.53	120.76	45.54	2.95	2.25	20.02	481.70
D5	-82.87	12320.68	1593.48	893.93	5.68	88.55	805.33					3209.87	**S3**	-35.35	1211.24	207.73		15.71	51.06	117.28	43.59	2.84	2.11	20.89	359.09
S13	-82.87	4473.61	587.48		5.68	88.55	250.43	62.38	6.47	4.82	48.69	877.40	**D7**	-35.46	2304.02	383.45	267.16	15.24	50.70	216.38					831.53
D4	-83.20	12319.99	1520.00	889.95	5.99	89.19	800.79					3127.54	**S15**	-35.46	1178.09	202.03		15.24	50.70	114.01	42.40	2.75	2.02	20.30	348.05
S12	-83.20	4520.84	595.23		5.99	89.19	253.35	62.87	6.53	4.83	48.92	888.53	**D2**	-39.30	2304.81	383.64	267.20	11.42	50.72	216.46					828.00

Source: Policy simulation results as stored in PhD Appendices 9C, 9D, 9E, and 9F.

1. Equivalent Full-time persons;

FC[2] – Final Consumption Expenditure Government

GG[3] – Gross Fixed Capital Formation for General Government;

PE[4] - Gross Fixed Capital Formation for Public Enterprises;

PR[5] - Gross Fixed Capital Formation for Private Sector Institutions

Table 3 Policy Simulation Multiplier Totals, $M AUD (Continued)

INDUSTRY SUPPORT 2000/01													INDUSTRY SUPPORT 2006/07											
Sim.	**Net Exports**	**Employ[1]. (Persons)**	**Output**	**Value Added**	**Exports**	**Imports**	**Income**	**FC[2]**	**GG[3]**	**PE[4]**	**PR[5]**	**Total**	**Sim.**	**Net Exports**	**Employ[1]. (Persons)**	**Output**	**Value Added**	**Exports**	**Imports**	**Income**	**FC[2]**	**GG[3]**	**PE[4]**	**PR[5]**	**Total**
S12	-1.26	2545.53	325.21		5.66	6.92	34.60	7.90	1.12	0.89	7.94	376.40	**D3**	9.72	534.57	134.83	43.32	23.11	13.39	29.90					217.77
D4	-1.26	1984.01	190.22	56.26	5.66	6.92	49.47					294.69	**S11**	9.72	498.02	118.95		23.11	13.39	17.85	8.07	1.11	1.08	3.19	159.97
D3	-2.02	1492.70	278.51	72.70	9.38	11.40	60.83					410.02	**D5**	-1.36	1357.59	242.08	25.86	2.31	3.67	22.20					288.78
S11	-2.02	1480.50	262.94		9.38	11.40	45.02	9.74	2.14	1.92	10.45	330.19	**S13**	-1.36	1351.92	239.13		2.31	3.67	19.80	7.81	0.51	0.39	3.48	269.76
D5	-5.17	1984.21	265.11	50.24	1.26	6.43	43.74					353.92	**S2**	-2.90	40.10	8.47		0.71	3.61	4.40	1.39	0.00	0.00	0.88	12.24
S13	-5.17	1891.66	244.15		1.26	6.43	30.67	6.78	0.98	0.84	7.18	285.43	**S9**	-3.10	43.26	9.12		0.76	3.86	4.76	1.52	0.00	0.00	0.96	13.26
D2	-6.51	447.71	86.73	44.65	0.74	7.25	37.38					162.25	**D2**	-3.14	69.76	21.56	14.52	0.77	3.91	11.10					44.04
D6	-6.51	447.70	86.73	44.65	0.74	7.25	37.37					162.24	**D1**	-3.14	69.76	21.56	14.51	0.77	3.91	11.10					44.03
S9	-6.51	363.55	58.04		0.74	7.25	21.68	4.12	0.73	0.66	5.96	84.68	**D6**	-3.14	69.76	21.56	14.51	0.77	3.91	11.10					44.03
S6	-6.51	352.70	56.62		0.74	7.25	21.12	4.13	0.73	0.66	5.98	82.73	**S6**	-3.14	43.37	9.14		0.77	3.91	4.77	1.52	0.00	0.00	0.96	13.25
S2	-6.51	348.83	56.13		0.74	7.25	20.86	4.15	0.73	0.66	6.02	82.04	**S10**	-3.14	43.34	9.14		0.77	3.91	4.77	1.51	0.00	0.00	0.96	13.24
S5	-6.51	348.72	56.13		0.74	7.25	20.86	4.15	0.73	0.66	6.02	82.04	**S5**	-3.14	43.31	9.12		0.77	3.91	4.77	1.52	0.00	0.00	0.96	13.23
S10	-6.51	348.70	56.13		0.74	7.25	20.86	4.15	0.73	0.66	6.02	82.04	**S8**	-3.14	43.30	9.13		0.77	3.91	4.76	1.52	0.00	0.00	0.96	13.23
S8	-6.51	348.56	56.10		0.74	7.25	20.85	4.15	0.73	0.66	6.02	82.00	**S4**	-3.14	43.28	9.11		0.77	3.91	4.76	1.52	0.00	0.00	0.95	13.20
S7	-6.51	348.54	56.07		0.74	7.25	20.85	4.14	0.73	0.66	6.01	81.95	**S14**	-3.14	43.25	9.09		0.77	3.91	4.77	1.51	0.00	0.00	0.95	13.18
S3	-6.51	348.53	56.09		0.74	7.25	20.85	4.15	0.73	0.66	6.02	81.99	**S1**	-3.14	43.12	9.10		0.77	3.91	4.74	1.51	0.00	0.00	0.96	13.17
S14	-6.51	346.96	55.82		0.74	7.25	20.75	4.13	0.73	0.66	6.01	81.59	**D7**	-3.17	69.76	21.56	14.51	0.74	3.91	11.10					44.00
D8	-6.52	447.71	86.73	44.65	0.73	7.25	37.37					162.23	**D8**	-3.17	69.75	21.56	14.70	0.74	3.91	11.10					44.19
D1	-6.53	447.70	86.73	44.65	0.72	7.25	37.37					162.22	**S16**	-3.17	42.91	9.02		0.74	3.91	4.73	1.49	0.00	0.00	0.93	13.00
S1	-6.53	351.12	56.16		0.72	7.25	20.97	4.02	0.71	0.64	5.84	81.81	**S7**	-3.17	42.64	8.98		0.74	3.91	4.70	1.50	0.00	0.00	0.95	12.96
D7	-6.55	447.70	86.73	44.65	0.70	7.25	37.37					162.20	**S15**	-3.17	41.05	8.65		0.74	3.91	4.52	1.41	0.00	0.00	0.90	12.31
S15	-6.55	342.34	54.70		0.70	7.25	20.42	3.92	0.69	0.62	5.66	79.46	**S3**	-3.38	43.29	9.12		0.83	4.21	4.77	1.52	0.00	0.00	0.96	12.99
S16	-6.60	354.92	57.11		0.75	7.35	21.26	4.22	0.74	0.67	6.12	83.52	**S12**	-4.24	525.21	113.41		8.30	12.54	21.18	7.74	0.57	0.34	3.92	142.92
S4	-6.60	354.88	57.12		0.75	7.35	21.24	4.22	0.74	0.67	6.12	83.51	**D4**	-4.24	491.53	137.43	53.24	8.30	12.54	40.74					227.17

Source: Policy simulation results as stored in PhD Appendices 9C, 9D, 9E, and 9F.

1. Equivalent Full-time persons;

FC[2] – Final Consumption Expenditure Government

GG[3] – Gross Fixed Capital Formation for General Government;

PE[4] - Gross Fixed Capital Formation for Public Enterprises;

PR[5] - Gross Fixed Capital Formation for Private Sector Institutions

Table 4 Policy Simulation Multiplier Changes, $M AUD

Simulation Scenario	Simulation Code	2000/01 Values				2006/07 Values				Changes from 2000/01 to 2006/07	
		Net Exports	Exports	Imports	Export / Import Ratio	Net Exports	Exports	Imports	Export / Import Ratio	Exports Change	Imports Change
TOTAL CONTRIBUTIONS											
Sector specific	**S10**	-75.97	34.44	110.41	0.3119	-0.1	73.50	73.60	0.9986	39.0600	-36.8100
Sector specific	**S5**	-75.95	34.43	110.38	0.3119	-0.1	73.53	73.63	0.9986	39.1000	-36.7500
Sector specific	**S8**	-75.99	34.45	110.44	0.3119	-0.1	73.51	73.61	0.9986	39.0600	-36.8300
Sector specific	**S3**	-76.11	34.46	110.57	0.3117	-0.1	73.51	73.61	0.9986	39.0500	-36.9600
Regional information combined	**D6**	-71.25	34.32	105.57	0.3251	-0.1	73.08	73.18	0.9986	38.7600	-32.3900
Sector specific	**S4**	-76.28	34.58	110.86	0.3119	-0.1	73.52	73.62	0.9986	38.9400	-37.2400
Regional information combined	**S14**	-71.15	34.27	105.42	0.3251	-0.11	79.19	79.30	0.9986	44.9200	-26.1200
Sector specific	**S9**	-70.11	30.48	100.59	0.3030	-1.44	71.18	72.62	0.9802	40.7000	-27.9700
Small business	**D8**	-72.20	33.37	105.57	0.3161	-1.45	71.73	73.18	0.9802	38.3600	-32.3900
Small business	**S16**	-76.26	34.57	110.83	0.3119	-1.45	71.73	73.18	0.9802	37.1600	-37.6500
Innovative Milieu	**D3**	-83.92	21.33	105.25	0.2027	-1.59	69.22	70.81	0.9775	47.8900	-34.4400
Innovative Milieu	**S11**	-83.92	21.33	105.25	0.2027	-1.59	69.22	70.81	0.9775	47.8900	-34.4400
Sector specific	**S6**	-72.50	31.52	104.02	0.3030	-2.28	70.37	72.65	0.9686	38.8500	-31.3700
Sector specific	**S2**	-76.08	34.49	110.57	0.3119	-2.28	70.31	72.59	0.9686	35.8200	-37.9800
Equity	**D1**	-72.48	33.09	105.57	0.3134	-2.30	70.88	73.18	0.9686	37.7900	-32.3900
Equity	**S1**	-72.39	33.05	105.44	0.3134	-2.30	70.88	73.18	0.9686	37.8300	-32.2600
Sector information combined	**D7**	-73.58	31.99	105.57	0.3030	-3.16	70.02	73.18	0.9568	38.0300	-32.3900
Sector information combined	**S15**	-73.58	31.99	105.57	0.3030	-3.16	70.02	73.18	0.9568	38.0300	-32.3900
Equity	**D2**	-76.08	34.49	110.57	0.3119	-4.08	69.11	73.19	0.9443	34.6200	-37.3800
Information combined	**D5**	-75.82	28.95	104.77	0.2763	-5.81	62.51	68.32	0.9150	33.5600	-36.4500
Information combined	**S13**	-75.82	28.95	104.77	0.2763	-5.81	62.51	68.32	0.9150	33.5600	-36.4500
Sector specific	**S7**	-76.08	34.49	110.57	0.3119	-7.91	72.17	80.08	0.9012	37.6800	-30.4900
Information split	**D4**	-76.10	28.92	105.02	0.2754	-7.94	72.41	80.35	0.9012	43.4900	-24.6700
Information split	**S12**	-76.10	28.92	105.02	0.2754	-7.94	72.41	80.35	0.9012	43.4900	-24.6700

Source: Table 3 and the policy simulation results as stored in PhD appendices 9C, 9D, 9E, and 9F.

Table 4 Policy Simulation Multiplier Changes, $M AUD (Continued)

Simulation Scenario	Simulation Code	2000/01 Values				2006/07 Values				Changes from 2000/01 to 2006/07	
		Net Exports	Exports	Imports	Export / Import Ratio	Net Exports	Exports	Imports	Export / Import Ratio	Exports Change	Imports Change
CONSUMPTION-INDUCED CONTRIBUTIONS											
Innovative Milieu	**D3**	-81.11	6.54	87.65	0.0746	-21.99	19.30	41.29	0.4674	12.7600	-46.3600
Innovative Milieu	**S11**	-81.11	6.54	87.65	0.0746	-21.99	19.30	41.29	0.4674	12.7600	-46.3600
Information combined	**D5**	-82.87	5.68	88.55	0.0641	-33.16	18.16	51.32	0.3539	12.4800	-37.2300
Information combined	**S13**	-82.87	5.68	88.55	0.0641	-33.16	18.16	51.32	0.3539	12.4800	-37.2300
Sector specific	**S2**	-81.91	5.20	87.11	0.0597	-33.98	15.10	49.08	0.3077	9.9000	-38.0300
Sector specific	**S7**	-81.91	5.20	87.11	0.0597	-34.94	15.53	50.47	0.3077	10.3300	-36.6400
Sector specific	**S9**	-81.75	5.19	86.94	0.0597	-35.04	15.63	50.67	0.3085	10.4400	-36.2700
Regional information combined	**D6**	-81.92	5.18	87.10	0.0595	-35.06	15.64	50.70	0.3085	10.4600	-36.4000
Regional information combined	**S14**	-81.92	5.18	87.10	0.0595	-35.06	15.64	50.70	0.3085	10.4600	-36.4000
Equity	**D1**	-81.99	5.11	87.10	0.0587	-35.10	15.60	50.70	0.3077	10.4900	-36.4000
Equity	**S1**	-82.15	5.12	87.27	0.0587	-35.10	15.60	50.70	0.3077	10.4800	-36.5700
Small business	**D8**	-82.03	5.07	87.10	0.0582	-35.15	15.55	50.70	0.3067	10.4800	-36.4000
Small business	**S16**	-82.86	5.26	88.12	0.0597	-35.15	15.55	50.70	0.3067	10.2900	-37.4200
Sector specific	**S4**	-82.86	5.26	88.12	0.0597	-35.21	15.65	50.86	0.3077	10.3900	-37.2600
Sector specific	**S6**	-81.92	5.18	87.10	0.0595	-35.21	15.65	50.86	0.3077	10.4700	-36.2400
Sector specific	**S5**	-82.08	5.19	87.27	0.0595	-35.23	15.66	50.89	0.3077	10.4700	-36.3800
Sector specific	**S8**	-81.75	5.19	86.94	0.0597	-35.23	15.66	50.89	0.3077	10.4700	-36.0500
Sector specific	**S10**	-81.75	5.19	86.94	0.0597	-35.25	15.67	50.92	0.3077	10.4800	-36.0200
Information split	**D4**	-83.20	5.99	89.19	0.0672	-35.28	19.25	54.53	0.3530	13.2600	-34.6600
Information split	**S12**	-83.20	5.99	89.19	0.0672	-35.28	19.25	54.53	0.3530	13.2600	-34.6600
Sector specific	**S3**	-81.75	5.19	86.94	0.0597	-35.35	15.71	51.06	0.3077	10.5200	-35.8800
Sector information combined	**D7**	-82.09	5.01	87.10	0.0575	-35.46	15.24	50.70	0.3006	10.2300	-36.4000
Sector information combined	**S15**	-82.09	5.01	87.10	0.0575	-35.46	15.24	50.70	0.3006	10.2300	-36.4000
Equity	**D2**	-81.91	5.20	87.11	0.0597	-39.30	11.42	50.72	0.2252	6.2200	-36.3900

Source: Table 3 and the policy simulation results as stored in PhD appendices 9C, 9D, 9E, and 9F.

Table 4 Policy Simulation Multiplier Changes, $M AUD (Continued)

Simulation Scenario	Simulation Code	2000/01 Values				2006/07 Values				Changes from 2000/01 to 2006/07	
		Net Exports	Exports	Imports	Export / Import Ratio	Net Exports	Exports	Imports	Export / Import Ratio	Exports Change	Imports Change
INDUSTRY-SUPPORT INDUCED CONTRIBUTIONS											
Innovative Milieu	**D3**	-2.02	9.38	11.40	0.8228	9.72	23.11	13.39	1.7259	13.7300	1.9900
Innovative Milieu	**S11**	-2.02	9.38	11.40	0.8228	9.72	23.11	13.39	1.7259	13.7300	1.9900
Information combined	**D5**	-5.17	1.26	6.43	0.1960	-1.36	2.31	3.67	0.6294	1.0500	-2.7600
Information combined	**S13**	-5.17	1.26	6.43	0.1960	-1.36	2.31	3.67	0.6294	1.0500	-2.7600
Sector specific	**S2**	-6.51	0.74	7.25	0.1021	-2.90	0.71	3.61	0.1967	-0.0300	-3.6400
Sector specific	**S9**	-6.51	0.74	7.25	0.1021	-3.10	0.76	3.86	0.1969	0.0200	-3.3900
Equity	**D2**	-6.51	0.74	7.25	0.1021	-3.14	0.77	3.91	0.1969	0.0300	-3.3400
Equity	**D1**	-6.53	0.72	7.25	0.0993	-3.14	0.77	3.91	0.1969	0.0500	-3.3400
Regional information combined	**D6**	-6.51	0.74	7.25	0.1021	-3.14	0.77	3.91	0.1969	0.0300	-3.3400
Sector specific	**S6**	-6.51	0.74	7.25	0.1021	-3.14	0.77	3.91	0.1969	0.0300	-3.3400
Sector specific	**S10**	-6.51	0.74	7.25	0.1021	-3.14	0.77	3.91	0.1969	0.0300	-3.3400
Sector specific	**S5**	-6.51	0.74	7.25	0.1021	-3.14	0.77	3.91	0.1969	0.0300	-3.3400
Sector specific	**S8**	-6.51	0.74	7.25	0.1021	-3.14	0.77	3.91	0.1969	0.0300	-3.3400
Sector specific	**S4**	-6.60	0.75	7.35	0.1020	-3.14	0.77	3.91	0.1969	0.0200	-3.4400
Regional information combined	**S14**	-6.51	0.74	7.25	0.1021	-3.14	0.77	3.91	0.1969	0.0300	-3.3400
Equity	**S1**	-6.53	0.72	7.25	0.0993	-3.14	0.77	3.91	0.1969	0.0500	-3.3400
Sector information combined	**D7**	-6.55	0.70	7.25	0.0966	-3.17	0.74	3.91	0.1893	0.0400	-3.3400
Small business	**D8**	-6.52	0.73	7.25	0.1007	-3.17	0.74	3.91	0.1893	0.0100	-3.3400
Small business	**S16**	-6.60	0.75	7.35	0.1020	-3.17	0.74	3.91	0.1893	-0.0100	-3.4400
Sector specific	**S7**	-6.51	0.74	7.25	0.1021	-3.17	0.74	3.91	0.1893	0.0000	-3.3400
Sector information combined	**S15**	-6.55	0.70	7.25	0.0966	-3.17	0.74	3.91	0.1893	0.0400	-3.3400
Sector specific	**S3**	-6.51	0.74	7.25	0.1021	-3.38	0.83	4.21	0.1971	0.0900	-3.0400
Information split	**S12**	-1.26	5.66	6.92	0.8179	-4.24	8.30	12.54	0.6619	2.6400	5.6200
Information split	**D4**	-1.26	5.66	6.92	0.8179	-4.24	8.30	12.54	0.6619	2.6400	5.6200

Source: Table 3 and the policy simulation results as stored in PhD appendices 9C, 9D, 9E, and 9F.

Table 4 on the previous pages reproduces the simulation results data to perform the *combined multiplier-shift rank approach* analysis, which examines changes in the multipliers from 2000/01 to 2006/07. It lists the changes in the total impact, consumption-induced impact and the industry-support impact, in decreasing order of the net-exports multiplier changes. It shows S10 and S5, both of the sector-specific simulation group as having the largest beneficial net-export changes for the total impacts for both 2000/01 and 2006/07. It also shows D3 and S11of the innovative milieu scenario to be the consumption and industry-support induced simulation leaders for both 2000/01 and 2006/07. Simulations D3 and S11 for example are shown as both having the highest net-export consumption-induced changes of -$81.11M AUD and -$21.99M AUD for 2000/01 and 2006/07 respectively. These simulations are also shown as having the highest net-export industry-support induced changes of -$2.02M AUD and $9.72M AUD for 2000/01 and 2006/07 respectively and were associated with increases in the corresponding export to import ratios over the study period. For example the consumption-induced export to import ratio for D3 and S11 increased from 0.0746 to 0.4674 whilst the industry-support induced export to import ratio increased from 0.8228 to peak at 1.7259. These ratio increases were caused by export increases that were associated with import decreases or were far greater than any import increase. For example, consumption-induced net-exports have increased from -$81.19M to -$21.99M as consumption-induced exports increased from $6.54M to $19.30M while consumption-induced imports decreased from $87.65M to $41.29M. Over the same time period industry–support induced net exports increased from -$2.02M to $9.72M. This was caused by industry-support induced exports increasing from $9.38M to $23.11M while industry-support induced imports increased very slightly from $11.4M to $13.39M.

These changes indicate D3 and S11 to be the overall industry-support induced simulation leaders suggesting that government subsidies and tax deduction for scientific research leading to the improvement of export products or processes is the most successful of the simulated policies. For stimulating innovations in new products or production processes then, simulation D3 and S11 have advantages over simulation S10 which was the total impact leader for 2006/07 and were mainly consumption induced. Alternatively, a combination of both policies would stimulate net-exports through developments of new products and production processes plus consumption.

Table 5 presents a summary of the S10 and D3 simulation changes and indicates the overall leading net-export supply and demand induced performer as S10 (sector specific) and D3 (innovative milieu) at $75.87M and $82.33M as improvement to net-exports respectively. It also shows that simulation D3 delivers the highest ranking industry-support induced and consumption induced contributions, with both being allocated a ranking of one (1) for 2006/07 although S10 ranks above D3 at (1) for the overall 2006/07 contributions. The analysis using the *combined multiplier-shift rank method* therefore suggests that a compromise combination of simulations S10 and D3 may be employed to maximize net-export performance.

In contrast, Table 6 illustrates the *average rank method*. In this table, each component of each year's simulation is ranked from one to twenty-four with a score of one being for the highest achieving component. Component averages are listed in the three far-right columns and the policy that achieves the highest average rank for overall contributions is chosen. This method nominates simulations S9, S14 and D6 with average overall rankings of 4.5, 4.9 and 4 respectively. However, these are mainly consumption-induced rather than industry-support induced. Data in the far-right column indicates that simulations D3, S11 and D5 deliver the most industry support to net-exports at rankings of 2, 3 and 4 respectively. Simulation D3 provides consumption-induced leadership for both 2000/01 and 2006/07 and industry-support

for 2006/07 whilst S11 is the consumption-induced effects leader for both 2000/01 and 2006/07 and ranks second in industry-support effects for 2006/07. This is consistent with the *combined multiplier-shift rank method* findings and so once again D3 and S11 are the leaders with the industry-support induced effects ranking an average of 2 and 3 respectively.

Table 5 Relative Multiplier Movements for Policy Simulations S10 and D3

Policy Simulation	Simulation Scenario	Net-export Change	Export Change	Import Change	Rank in 2006/07	Component
S10	Sector specific	75.87	39.06	-36.81	1	Total
S10	Sector specific	46.50	10.48	-36.02	18	Consumption induced
S10	Sector specific	3.37	0.03	-3.34	11	Industry-Support Induced
D3	Innovative milieu	82.33	47.89	-34.44	11	Total
D3	Innovative milieu	59.12	12.76	-46.36	1	Consumption induced
D3	Innovative milieu	11.74	13.73	1.99	1	Industry-Support Induced

Source: Tables 3, 4 and the policy simulation results as stored in PhD Appendices 9C, 9D, 9E, and 9F.

Table 6 Policy Simulation Export Ranking by Export Multiplier Contribution

Policy Simulation	Policy Scenario	Total 2000/01	Cons. Induced 2000/01	Industry Support 2000/01	Total 2006/07	Cons. Induced 2006/07	Industry Support 2006/07	Total Average	Cons. Induced Average	Industry Support Average
S9	Sector Specific	1	6	9	8	7	6	4.5	6.5	7.5
S14	Reg. Inform. Comb.	2	12	17	7	9	15	4.9	10.5	16
D6	Reg. Inform. Comb.	3	10	8	5	8	9	4	9	8.5
D8	Small Business	4	14	18	9	12	18	6.5	13	18
S1	Equity	5	18	20	16	11	16	10.5	14.5	18
D1	Equity	6	13	19	15	10	8	10.5	11.5	13.5
S6	Sector Specific	7	11	10	13	15	10	10	13	10
D7	Sector. Inform. Comb.	8	16	21	17	22	17	12.5	19	19
S15	Sector. Inform. Comb.	9	17	22	18	23	21	13.5	20	21.5
D5	Inform. Combined	10	21	5	20	3	3	15	12	4
S13	Inform. Combined	11	22	6	21	4	4	16	13	5
S5	Sector Specific	12	15	12	2	16	12	7	15.5	12
S10	Sector Specific	13	3	13	1	18	11	7	10.5	12
S8	Sector Specific	14	4	14	3	17	13	8.5	10.5	13.5
D2	Equity	15	7	7	19	24	7	17	15.5	7
S2	Sector Specific	16	8	11	14	5	5	15	6.5	8
S7	Sector Specific	17	9	15	22	6	20	19.5	7.5	17.5
D4	Information Split	18	23	2	23	19	24	20.5	21	13
S12	Information Split	19	24	1	24	20	23	21.5	22	12
S3	Sector Specific	20	5	16	4	21	22	12	13	19
S16	Small Business	21	19	23	10	13	19	15.5	16	21
S4	Sector Specific	22	20	24	6	14	14	14	17	19
D3	Innovative Milieu	23	1	3	11	1	1	17	1	2
S11	Innovative Milieu	24	2	4	12	2	2	18	2	3

Source: The rankings are derived from data in Tables 3 and 4.

Over the time span from 2000/01 to 2006/07 the economic system changes structure due to changes in consumer demand and factor input contributions. The analysis presented below takes into account of the dynamic interaction between these structural changes and running the policies from 2000/01 to 2006/07. This means that policies that are the leaders in 2000/01 may not be the leaders by the end of 2006/07 because of this structural change. Table 7 below indicates how the leading policy for each simulation group has changed over the study period for the respective regions and sectors. It shows that the overall leading simulation became S10 (previously S9 and both of the sector specific group) with the Shoalhaven region increasing

its overall dominance with its other machinery and equipment sector remaining the main net-exports contributor despite its export multiplier falling slightly and representing mainly initial impacts with no industry support. By 2007, the performance of the Shoalhaven's other machinery and equipment sector was matched by the following sector-flows: forestry and fishing, fabricated metal products, and the Wingecarribee's education sector.

The overall leading consumption simulation remained D3 due to the continued dominance of the personal and other services sector and increased contributions from the other listed sectors. These export increases were accompanied by far larger decreases in imports of ownership of dwellings, education, health and community services, and electricity gas and water. However, the overall leading industry support simulation also became D3 (previously S12) due to increased importance of the Far North Coast region over the Wingecarribee region, whilst the secondary information and miscellaneous manufacturing sectors remained dominant even though decreases in contributions that were far greater than the property and business services and retail trade import decreases were experienced. Overall then, D3 remained the dominant strategy over the study period and this is consistent with the earlier analysis. Table 3 also indicates that in choosing between D3 and its supply-side counterpart S11, D3 has always delivered the larger employment increases.

Table 7 also provides details of simulation export multiplier changes for the regions and their sectors. It shows that increases for D3 are greater than all other policies within the simulation groups at 0.9 to 1.0 for basic metals and metal products within the Hunter region, 0.81 to 0.99 for meat and dairy products within the Western region, and 0.43 to 0.95 for meat and dairy products within the Northern region; and it also delivers the smallest offsetting multiplier decreases for the overall impact. In terms of the consumption-induced effects D3 (innovative milieu) delivers multiplier increases that are mid-way in the range of consumption-induced multiplier increases. Its offsetting consumption-induced multiplier decreases are also in the mid-range of all consumption-induced multiplier decreases. However, an examination of its industry-support effects show that it delivers the largest multiplier increases and these were 0.26 to the Wingecarribee region's transport equipment and miscellaneous manufacturing sectors and the Far North Coast region's petroleum and coal products sector and these were 0.26, 0.26 and 0.25 respectively. It also delivered multiplier increases in the offsetting multiplier changes and was the only policy to achieve this. All other policies recorded decreases or no change in their industry-support effects.

In summary, tax cuts and subsidies supporting scientific research (policy simulation D3) was the most successful policy in increasing the export related multiplier and this is consistent using both the static analysis as well as the more dynamic analysis that takes account of structural change occurring over the study period. This finding supports the innovative milieu approach to regional development as discussed further in the conclusion.

6. CONCLUSION AND RECOMMENDATION

This paper presents a comparative analysis of simulating 7 increases in final demand and 16 increases in final supply. These were designed to increase the sourcing, generation, transfer and sharing of information to benefit export product or production process development and increase associated employment; thereby facilitating export induced economic growth within the region whilst minimising regional divergence. The specific contributions of the method were that: policy design was based on identified and tested TVH strategy usage spatial distributions and these variations were stronger at the sector level rather than regional level with the exception of competitive advantage and innovation strategies. Hence policies must be based on sourcing from across a larger geography and not limited to the region.

Table 7 Details of Simulation Leadership Changes, 2000/01 to 2006/07

Simulation Scenario	Leadership Change	From Region	To Region	From Sector	To Sector	Net-Export Multiplier Change M AUD	Offsetting Regions		Offsetting Import Sectors		Offsetting Multiplier Change M AUD
							2001	2007	2001	2007	
TOTAL CONTRIBUTIONS											
Overall	S9 => S10 Change	Shoal. Shoal. West. Hunt.	Winge. Shoal. Shoal. Shoal.	Fabricated metal products; Forestry & fishing; Meat & dairy products; Basic metals & metal products.	Education. Forestry & fishing. Fabricated metal products. Other machinery & equipment.	1.02 to 0.98 0.99 to 0.98 0.97 to 0.98 0.93 to 0.98					
Equity	S1 = > D1 Change	Shoal. Shoal. FNC. North	Shoal. Shoal. FNC. North	Other machinery &equipment; Fabricated metal products; Paper, printing & paper prod. Wood & wood products.	Other machinery &equipment; Fabricated metal products. Paper, printing & paper prod. Wood & wood products.	1.16 to 1.16 1.02 to 1.02 1.00 to 1.00 1.00 to 1.00					
Information Combined	D5 = > D5 No Change	FNC. West. Hunt. West.	Hunt. Winge. West. North.	Paper, printing & paper prod. Chemicals. Basis metals & metal products. Meat & dairy products.	Basic metals and metal products; Miscellaneous manufacturing; Meat & dairy products; Meat & dairy products;	1.00 to 0.96 0.99 to 0.95 0.94 to 0.95 0.93 to 0.93				Transport equipment; Other machinery & equip.	0.98 to 0.83 0.98 to 0.85
Information Split	D4 = > D4 No Change	Winge. West. West.	Winge. West. West.	Secondary Information; Education; Chemicals; Meat & dairy products.	Secondary Information; Education; Chemicals; Meat & dairy products.	0.99 to 1.00 0.98 to 1.00 0.97 to 1.00 0.94 to 1.00				Chemicals. Transport equipment; Other machinery & equip.	0.98 to 0.86 0.98 to 0.87 0.98 to 0.91
Innovative Milieu	D3 = > D3 No change	Sec.Info. Hunt. West. North.	Sec.Info. Hunt. West. North.	Secondary Information. Basic metal & metal products; Meat & dairy products; Meat & dairy products.	Secondary Information; Basic metals and metal products; Meat & dairy products; Meat & dairy products;	1.00 to 1.00 0.90 to 1.00 0.81 to 0.99 0.43 to 0.95				Chemicals. Transport equipment; Other machinery & equipment.	0.98 to 0.90 0.98 to 0.90 0.98 to 0.94
Regional Information Combined	S14 = > D6 Change	Shoal. West. Shoal. FNC.	Winge. Shoal. Shoal. North.	Other machinery & equipment; Chemicals; Fabricated metal products; Paper, printing & paper products.	Education; Fabricated metal products; Other machinery & equipment; Wood & wood products.	1.16 to 0.98 1.09 to 0.98 1.02 to 0.98 1.00 to 0.98					
Sector Information Combined	D7 = > D7 No change	Shoal. FNC. North. Shoal.	Winge. Shoal. Shoal. North.	Fabricated metal products; Paper, printing & paper prod. Wood & wood products; Forestry & fishing.	Education. Forestry & fishing; Fabricated metal products; Wood & wood products.	1.02 to 0.98 1.00 to 0.98 1.00 to 0.98 0.99 to 0.98				Transport equipment; Other machinery & equipment.	0.98 to 0.67 0.98 to 0.65

Table 7 Details of Simulation Leadership Changes, 2000/01 to 2006/07 (Continued)

Simulation Scenario	Leadership Change	From Region	To Region	From Sector	To Sector	Net-Export Multiplier Change M AUD	Offsetting Regions		Offsetting Import Sectors		Offsetting Multiplier Change M AUD
							2001	2007	2001	2007	
TOTAL CONTRIBUTIONS											
Sector Specific	S9 = > S10 Change	Shoal. Shoal. West. Hunt.	Winge. Shoal. Shoal. Shoal.	Fabricated metal products; Forestry & fishing; Meat & dairy products; Basic metals & metal products.	Education; Forestry & fishing; Fabricated metal products; Other machinery & equipment;	1.02 to 0.98 0.99 to 0.98 0.97 to 0.98 0.93 to 0.98					
Small Business	D8 = > D8 No change	West. Shoal. FNC. North.	Winge. Shoal. Shoal. North.	Chemical. Fabricated metal products; Paper, printing & paper prod. Wood & wood products.	Education; Forestry & fishing; Fabricated metal products; Wood & wood products.	1.09 to 0.98 1.02 to 0.98 1.00 to 0.98 1.00 to 0.98	 Winge. Winge			Transport equipment Other machinery; Agriculture; Other food.	0.98 to 0.88 0.98 to 0.86 0.97 to 0.85 0.97 to 0.84
CONSUMPTION-INDUCED CONTRIBUTIONS											
Overall	D3 = > D3 No change			Personal & other services; Beverages & tobacco products; Clothing & footwear; Other food.	Personal & other services; Education; Government administration & defence.	0.09 to 0.40 0.09 to 0.41 0.09 to 0.41 0.09 to 0.41				Ownership of dwell; Education. Health & comm. Service; Electricity gas & water.	0.95 to 0.69 0.95 to 0.64 0.93 to 0.63 0.92 to 0.66
Equity	D2 = > D1 Change			Ownership of dwellings; Education; Transport & storage; Meat & dairy products.	Other machinery &equipment; Fabricated metal products; Paper, printing & paper products; Wood & wood products.	0.09 to 1.02 0.09 to 1.02 0.08 to 1.02 0.09 to 1.02				Education. Ownership of dwellings. Health & comm. Service; Personal & other serv.	0.95 to 0.60 0.94 to 0.58 0.92 to 0.59 0.91 to 0.57
Information Combined	D5 = > D5 No change			Ownership of dwellings; Education; Health & community services; Forestry & fishing.	Ownership of dwellings; Education; Health & community services; Forestry & fishing.	0.09 to 0.34 0.09 to 0.34 0.09 to 0.34 0.08 to 0.30				Ownership of dwellings; Education; Health & comm. Service; Electricity gas & water.	0.95 to 0.55 0.95 to 0.57 0.93 to 0.58 0.92 to 0.57

Table 7 Details of Simulation Leadership Changes, 2000/01 to 2006/07 (Continued)

Simulation Scenario	Leadership Change	From Region	To Region	From Sector	To Sector	Net-Export Multiplier Change M AUD	Offsetting Regions		Offsetting Import Sectors		Offsetting Multiplier Change M AUD
							2001	2007	2001	2007	
CONSUMPTION-INDUCED CONTRIBUTIONS											
Information Split	D4 = > D4 No change			Meat & dairy products; Beverages & tobacco; Clothing & footwear; Personal & other services.	Ownership of dwellings; Education; Health & community services; Government admin. & defence.	0.09 to 0.43 0.09 to 0.41 0.09 to 0.41 0.09 to 0.40				Ownership of dwelling; Education; Health & comm. serv; Personal & other serv;	0.95 to 0.69 0.95 to 0.68 0.93 to 0.65 0.93 to 0.63
Innovative Milieu	D3 = > D3 No change			Personal & other services; Beverages & tobacco; Clothing & footwear; Other food.	Personal & other services; Education; Government admin. & defence.	0.09 to 0.40 0.09 to 0.41 0.09 to 0.41 0.09 to 0.41				Ownership of dwell; Education; Health & comm. serv; Electricity gas & water.	0.95 to 0.69 0.95 to 0.64 0.93 to 0.63 0.92 to 0.66
Regional Information Combined	D6 = > D6 No change			Ownership of dwellings; Education; Transport & storage; Meat & dairy products.	Ownership of dwellings; Education; Other food; Government admin. & defence.	0.09 to 0.38 0.09 to 0.37 0.08 to 0.37 0.08 to 0.37				Education; Ownership of dwell; Health & comm. serv; Personal & other serv.	0.95 to 0.60 0.94 to 0.58 0.92 to 0.59 0.91 to 0.57
Sector Information Combined	D7 = > D7 No change			Ownership of dwellings; Education; Meat & dairy products; Beverages & tobacco products.	Ownership of dwellings; Education; Other food; Government admin. & defence.	0.09 to 0.38 0.09 to 0.37 0.08 to 0.37 0.08 to 0.37				Ownership of dwell; Education; Health & comm. serv; Personal & other serv.	0.95 to 0.60 0.94 to 0.58 0.92 to 0.59 0.91 to 0.57
Sector Specific	S10 = > S2 Change			Ownership of dwellings; Education; Meat & dairy products; Beverages & tobacco products.	Ownership of dwellings; Other food; Government admin. & defence.	0.09 to 0.38 0.09 to 0.38 0.08 to 0.38 0.08 to 0.38					
Small Business	D8 = > D8 No change			Ownership of dwellings; Education; Meat & dairy products; Beverages & tobacco products.	Ownership of dwellings; Other food; Government admin. & defence.	0.09 to 0.38 0.09 to 0.37 0.08 to 0.37 0.08 to 0.37				Ownership of dwell; Education; Health & comm. serv; Personal & other serv.	0.95 to 0.60 0.94 to 0.58 0.92 to 0.59 0.91 to 0.57

Table 7 Details of Simulation Leadership Changes, 2000/01 to 2006/07 (Continued)

Simulation Scenario	Leadership Change	From Region	To Region	From Sector	To Sector	Net-Export Multiplier Change M AUD	Offsetting Regions		Offsetting Import Sectors		Offsetting Multiplier Change M AUD
							2001	2007	2001	2007	
INDUSTRY-SUPPORT INDUCED CONTRIBUTIONS											
Overall	S12 = > D3 Change	Winge. Winge. FNC.	Winge. FNC. FNC.	Secondary information; Personal & other services; Miscellaneous manufacturing; Transport equipment.	Secondary information; Transport equipment; Miscellaneous manufacturing; Petroleum & coal products.	0.94 to 0.84 0.83 to 0.40 0.79 to 0.40 0.50 to 0.40	Winge. Winge.	Hunt. FNC. FNC. North.	Prop & buss. serv; Prop & buss. serv; Retail trade; Retail trade.	Prop & buss. Prop & buss. Retail trade. Retail trade.	0.23 to 0.19 0.23 to 0.19 0.23 to 0.19 0.23 to 0.19
Equity	D2 = > D2 No change		Shoal. FNC. Winge.	Transport & storage; Agriculture; Forestry & fishing; Textiles.	Finance & insurance; Paper, printing & paper products; Finance & insurance; Ownership of dwellings.	0.01 to 0.03 0.01 to 0.03 0.01 to 0.03 0.01 to 0.03	Winge. Winge. Winge.	Shoal. Shoal. Winge.	Agriculture; Other food; Bever. & tobacco; Bever. & tobbacco.	Agriculture. Textiles Other food. Bev. & tob.	0.08 to 0.05 0.08 to 0.05 0.08 to 0.05 0.08 to 0.05
Information Combined	D5 = > D5 No change	FNC. Hunt. West.	FNC. Winge. Shoal.	Retail trade; Property & business services; Property & business services; Information combined.	Retail trade; Personal & other services; Textiles, clothing & footwear; Information combined.	0.03 to 0.08 0.03 to 0.09 0.03 to 0.08 0.03 to 0.08	Winge. FNC. FNC.	FNC. Hunt. Winge.	Prop. & buss. serv; Transport equip; Retail trade; Information Comb.	Retail trade. Prop. & buss. Personal & other. Infor. Comb.	0.10 to 0.11 0.10 to 0.11 0.10 to 0.11 0.10 to 0.11
Information Split	S12 = > S12 No change	Winge. Winge. FNC.	Winge. FNC. FNC.	Secondary information; Personal & other services; Miscellaneous manufacturing; Transport equipment.	Secondary information; Transport equipment; Miscellaneous manufacturing; Petroleum & coal products	0.94 to 0.84 0.83 to 0.40 0.79 to 0.40 0.50 to 0.40					
Innovative Milieu	D3 = > D3 No change	Winge. Winge. FNC.	FNC. Winge. FNC.	Secondary information; Transport equipment; Miscellaneous manufacturing; Petroleum & coal products.	Secondary information; Transport equipment; Miscellaneous manufacturing; Petroleum & coal products.	0.95 to 0.84 0.14 to 0.40 0.14 to 0.40 0.14 to 0.39	Shoal. Shoal. Shoal. Shoal. & Others	Hunt. FNC. FNC. North.	Agriculture; Oth.Mach. & equip; Misscellaneous Man; Education.	Prop & buss. Prop & buss. Retail trade. Retail trade.	0.16 to 0.19 0.16 to 0.19 0.16 to 0.19 0.16 to 0.19
Regional Information Combined	D6 = > D6 No change		Winge. Shoal. FNC. FNC.	Transport & storage; Agriculture; Forestry & fishing; Textiles clothing & footwear.	Personal & other services; Textiles clothing & footwear; Petroleum & coal products; Retail trade.	0.01 to 0.03 0.01 to 0.03 0.01 to 0.03 0.01 to 0.03	Winge. Winge. Winge.	Shoal. Winge. Winge.	Agriculture; Other food; Bev. & tobacco; Bev. & tobacco.	Agriculture; Other food; Bev. & tobacco; Bev. & tobacco.	0.08 to 0.05 0.08 to 0.05 0.08 to 0.05 0.08 to 0.05

Table 7 Details of Simulation Leadership Changes, 2000/01 to 2006/07 (Continued)

Simulation Scenario	Leadership Change	From Region	To Region	From Sector	To Sector	Net-Export Multiplier Change M AUD	Offsetting Regions		Offsetting Import Sectors		Offsetting Multiplier Change M AUD
							2001	2007	2001	2007	
INDUSTRY-SUPPORT INDUCED CONTRIBUTIONS											
Sector Information Combined	D7 = >D7 No change		Winge. Shoal. FNC. FNC.	Transport & storage; Agriculture; Forestry & fishing; Textiles.	Personal & other services; Textiles clothing & footwear; Petroleum & coal products; Property & business services.	0.01 to 0.03 0.01 to 0.03 0.01 to 0.03 0.01 to 0.03	Winge. Winge. Winge.	Shoal. Winge. Winge.	Agriculture; Other food; Bev. & tobacco; Bev. & tobacco;	Agriculture; Other food. Bev. & tobacco; Bev. & tobacco;	0.08 to 0.05 0.08 to 0.05 0.08 to 0.05 0.08 to 0.05
Sector Specific	S9 = > S2 Change	Winge. FNC. North. Winge.	Winge. FNC. North. Winge.	Agriculture; Non-metallic mineral products; Meat & dairy products; Miscellaneous manufacturing.	Personal & other services; Retail trade; Property & business services; Non-metallic mineral products.	0.01 to 0.03 0.01 to 0.03 0.01 to 0.03 0.01 to 0.03		Shoal. Shoal. Winge		Agriculture; Bev. & tobacco; Textiles,cloth/footwear; Other food.	0.08 to 0.05 0.08 to 0.05 0.08 to 0.05 0.08 to 0.05
Small Business	D8 = > D8 No change		Winge. Shoal. FNC. FNC.	Transport & storage; Agriculture; Forestry & fishing; Textiles clothing & footwear.	Personal & other services; Textiles, clothing & footwear; Petroleum & coal products; Retail trade.	0.01 to 0.03 0.01 to 0.03 0.01 to 0.03 0.01 to 0.03	Winge. Winge. Winge.	Shoal. Winge. Winge.	Agriculture; Other food; Bev. & tobacco;	Agriculture; Other food; Bever. & tobacco.	0.08 to 0.05 0.08 to 0.05 0.08 to 0.05 0.08 to 0.05

Source: Tables 3, 4 and the policy simulation results as stored in PhD Appendices 9C, 9D, 9E, and 9F.

The demand-side followed by the supply-side innovative milieu simulation identified as D3 and S11 respectively were identified as best for export and associated employment stimulation. Both generated the highest industry-support spillover and associated employment contributions with D3 slightly ahead of S11 with the employment creation. The D3 demand-side policies would comprise tax-cuts and subsidies to encourage the use of new research and technologies by developing exporters whilst the S11 supply-side policies would comprise providing tax cuts and subsidies for those performing such scientific research. This is consistent with the innovative milieu theory in that milieu network participation provided information spillovers through cooperative learning and product or production process design and developments (Maillat *et al*, 1994, Maillat, 1998; Capello, 1999a) and views expressed by Nelson and Winter (1982) and Dosi *et al*. (1988) who have argued that the milieu network serves to reduce decision making uncertainty during innovation developments. Theoretically the innovative milieu approach considers not just the control over given technologies or stocks of complementary assets at a point in time, but considers long-term control over the development of these technologies. Fundamentally the milieu network has a collective intention to focus these scientific developments towards specific applications that usually benefit exporting industries.

Consistent and supporting evidence for this is found in the analysis of section and Table 7. It shows D3 delivering the largest growth in exports associated with the largest import declines, accompanied by evidence of beneficial networks and linkages via very supportive export multiplier changes for the regional sector-flows. For example, D3 delivered the largest increases for regional sector-flows compared to other policies, delivered the smallest offsetting multiplier decreases for the overall impact, and also delivered multiplier increases in the offsetting multiplier changes and was the only policy simulation to achieve this; as all the other policies recorded decreases or no change in their industry-support effects.

It should also be noted that two complementary but slightly different methods of analysis were used to choose the best policies. The *combined multiplier shift rank method* examines multiplier changes over the whole study period, while the *average rank method* uses a system of determining an average rank after each component change has been ranked. Both methods account for any market induced structural change that takes place while the assistance is provided over the six year period thereby adding some dynamics to the system.

In concluding this paper the demand-side followed by the supply-side innovative milieu stimulations are the recommended policy. Their results are consistent the theoretical expectations and make sense in light of the findings reported by Hodgkinson (2004, 2008) and McPhee (2010).

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Adaptive Regions, Deliberative Power Spaces and the Sustainable Development Platform Method

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ABSTRACT

Neo-liberal ideologies continue to pervade the regional sciences and Australian regional and economic development policy. But is neo-liberalism still our sharpest tool for creating adaptive regions in this post-globalised age of the 'me' individual? A paradigm shift is needed – one that takes us beyond neo-liberalism and social capitalism and towards a renewed social liberalism. Such a transformation, it is argued, would better suit emerging policy needs in an unstable world. In this paper, the Sustainable Development Platform Method's (SDPM) institutional governance design, core processes and knowledge sharing phases are explored to reveal their capacities for organising power structures and relationships. Using the SDPM, regional development agents can create Deliberative Power Spaces where relational and structural power transparency is increased and subjected to social scrutiny and community interaction. Increased community ownership of power within regional development praxis can facilitate regional adaptability whilst fostering increased social responsibility and re-embedded social economies.

INTRODUCTION

> "Life is risky, certainty is not on offer."[1]

The global financial crisis (GFC) and subsequent economic crises have contributed to economic decline in Northwest Tasmania, as well as many other regions throughout the world. Under neo-liberalist policies, regional economic growth has not occurred within a stable global environment and as such, conditions for growth have been anomalous (Olson, 1982). Recent economic crises have been exacerbated by natural phenomena such as droughts and floods, leading to further impacts on regions. These events have resulted in a political call for a policy shift away from neo-liberalism, further opening the socio-political space for a new policy paradigm. For regional science to meaningfully contribute to this policy milieu, regional scientists need to move away from a predominantly positivist paradigm and embrace Isard's (1951, cited in Isard, 2003, p. 41) early vision for a field of research capable of understanding 'the complex of society itself', and his later hope that regional science would incorporate political and social subsystems into regional science studies, 'namely – the analysis of the interaction of decision makers' (Isard, 2003, p. 189). In this paper, notions of *power-over* and *power-to* are contextualised within a socio-regional science discourse to argue the case for regional development policy and praxis to embrace social liberalism and notions of social responsibility as a means to build regional adaptability. The Sustainable

[1] Professor Lord Nicholas Stern in his address to the National Press Club, Canberra, Australia, on the 1st September 2010.

Development Platform Method (SDPM) developed by Campbell-Ellis (2009) and Campbell-Ellis and McCall (2010), and its newly developed Deliberative Power Spaces (DPS) are presented as tools capable of increasing regional adaptability within a relational and evolutionary regional science paradigm.

CRISES AND REGIONAL DECLINE IN NORTHWEST TASMANIA

The Circular Head municipality in Northwest Tasmania has been described as containing a resilient community (R. Forrest, pers. comm. 4/10/2011; T. McCall, pers. comm. 12/10/2011) that has faced a barrage of emotional, natural and economic crises in recent years. It can be argued that the Circular Head community features high levels of social capital but low levels of human capital, particularly university educated individuals (Nelson, 2008). The municipality has a population of approximately 8,000 people, made up of many tight knit sub-communities which are known to come together under crisis circumstances (Hine, 2006 in Grace and Allan, 2006). The Circular Head community has also been described by many as parochial and isolated (pers. obs.), characteristics that may be both values and barriers. In 2009/10 the latent peripheral impacts of the GFC contributed to the downsizing of the McCain Foods vegetable processing facility in the town of Smithton, resulting in the loss of 150 jobs. Following the McCain Foods downsizing event, flooding caused widespread damage to vegetable crops throughout the region. In 2011, an announcement was made by Gunns Ltd, a major timber company, that it would sell its Smithton Mill; all 60 jobs are expected to be lost (ABC News, 2011).

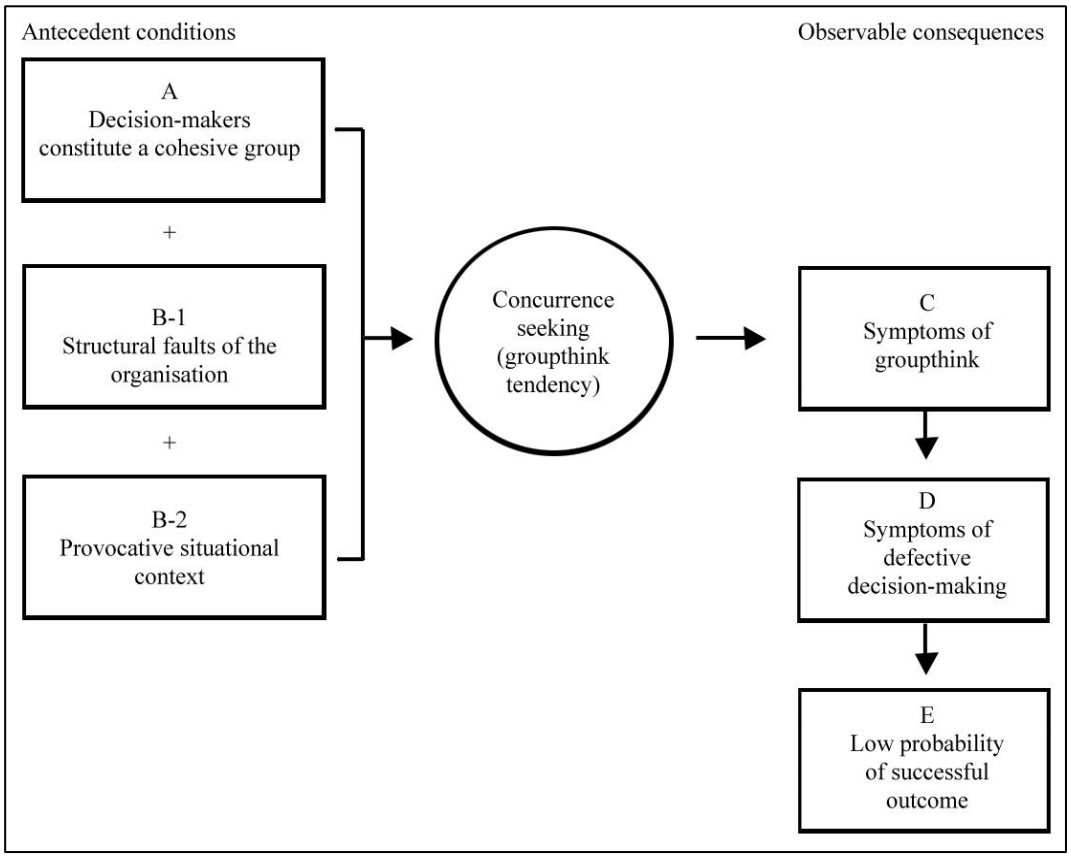
The region has experienced multiple rise and decline trends but recent events have been described as the areas 'first major economic shock' (M. Buckby, pers. comm. 12/10/11). Early rise periods resulted from endogenous innovation and industry development. Endogenous activities, however, soon began to attract exogenous investments and subsequent exogenous ownership. Exogenous companies such as McCain Foods, Ta Ann, Gunns Ltd, and Murray-Goulburn have in recent history, provided investment capital for local enterprise activities. Exogenous ownership has placed regional actors, particularly those in the agri-foods sector, as price takers rather than price makers (Wells, 2011).

The policy problem within the Circular Head municipality is not one of labour shortages or access to markets and, it is questionable if it is one of innovation capacity or entrepreneurship, both of which have featured strongly in Circular Head's history. The policy problem may well be more akin to notions of complacency, coupled with exogenous ownership and a sense of local powerlessness; but also one of 'groupthink', whereby the local community acts as a cohesive group that will seek consensus and avoid critical evaluation of alternatives to avoid group conflict (Janis, 1982, in Parsons, 1995). First, exogenous ownership brings with it issues of relational network embeddedness and firm-scale decision making processes, particularly those relating to location and operating costs. In essence, Circular Head has become less competitive when compared with other comparable regions around the world, due in part to complacency resulting from a reliance on comparative natural advantages. In response to this diminished competitiveness, some local farmers are trialling the SDPM as a tool to identify and exploit regional innovation systems and associated regional development opportunities.

Secondly, the geographical isolation of the Circular Head region in far Northwest Tasmania, may have contributed to Janis' (1982, in Parsons, 1995) groupthink conditions and the creation of what Etzioni (1968, cited in Parsons, 1995, p. 380) described as a 'community-of-assumptions'. The Circular Head municipality arguably features parochial decision-making and leadership characteristics that manifest as Janis' (1982, in Parsons, 1995) blind consensus

to realities held by a highly cohesive community with many shared assumptions. This blind consensus, as Janis (1982, in Parsons, 1995) argued, results from groupthink viewpoints, non-critical appraisal and an irrational fear of exogenous influence. Janis' (1982, in Parsons, 1995) simplified model of groupthink is presented in Figure 1 below.

Figure 1 Groupthink



Source: Janis and Mann (1977) and Janis (1982) cited in Parsons (1995, p. 345).

Janis's (1982, cited in Parsons, 1995) notion of groupthink is contextually significant, and policy and praxis relevant. Groupthink provides a framework for understanding local values, discourse and power relations in the Circular Head municipality. According to Janis, groupthink impacts on decision-making processes and results in the suppression of independent and alternative thinking. As a regional policy problem, groupthink attitudes construct barriers to regional development initiatives and constrain the interpretation and inclusion of decision alternatives. Although groupthink contributes to community cohesiveness and, therefore, resilience, it impacts on the availability of human capital contributions and, hence, regional adaptive capacities. Again, the SDPM contains mechanisms capable of overcoming groupthink symptoms by providing an analysis framework for the systematic appraisal of alternative development platforms.

A region's ability to adapt and engage competitively within a post-globalised market economy can affect rise and decline trends that have significant impacts on regional communities such as those within Circular Head. The emergence of post-globalism results not from market failures but, according to Saul (2005, pp. 222-224), as a result of fragmenting political relationships and alliances and a return to nation-state sovereignty – as demonstrated

in the post-GFC period. The emergence of the region as central to post-global economies has significant repercussions for regional development policy and praxis as well as for regional science.

THE POST-GFC POLICY MILIEU

The Australian response to the GFC focused on 'restoring the stability of national financial systems' (Sherry, 2009). Political responses to the GFC have attempted to re-establish the role of government as Keynesianesque 'big' government and social capitalism has emerged as the dominant policy rhetoric with then Prime Minister Kevin Rudd claiming that neo-liberalism was nothing more than 'personal greed dressed up as economic policy' (Rudd, 2009, cited in R. Taylor, 2009).

In this post-GFC period, the search for a new approach to fiscal management is in play, one which features systemic and stable economic controls (Konings, 2010). Shifting societal trajectories continue to move away from neo-liberal ideals of free and rational actors. Recent trends have featured a reduction in individual motives for economic success and an increased focus on well-being (Giddens, 1998). Questions about productivity and ageing populations, increasing socio-economic disparities and of tree-changing and downshifting workforces (Giddens, 1998) are proving difficult for neo-liberal approaches whether old or new.

To declare neo-liberalism dead, however, is far from accurate (Janda, 2010, Ergas, 2010). Neo-liberalism sought to free markets from government intervention, rendering government as passive and powerless (Porter, 1990, in Parsons, 1995), whilst neo-liberal policy increasingly turned to interventionist social policy approaches (Peck and Tickell, 2002) that encouraged government influence on societal values and norms (Giddens, 1998, p. 12). A balance to socio-economic management that provides opportunities for collaboration within market economies and that can deliver community well-being benefits may better suit emerging policy needs. Such an approach that better equalises relations between public and private sectors, could 'create spheres of freedom' (Polanyi, 1944, p. 255) capable of re-embedding the economy as a social and institutional process as advocated by Polanyi (1957, in Cahill, 2010).

Polanyi (1944, p. 163) claimed that the 'laws of the market' severed organic transactions from social economies and resulted in disembedded economies that failed to maintain the social fabric of society, replacing it with market institutionalism (Polanyi, 1944, p. 179). Polanyi was optimistic that social economies would, through protectionist mechanisms, reassert their dominance as the guiding social object and that self-regulating market economies would slip away into history (Polanyi, 1944, p. 250).

Neo-liberalism and the market society, however, did not fade away (Marginson, 1997) and the pursuit of individual commodity rewards, expressed through increasing consumer spending rates, is arguably stronger than ever in this age of the 'me' individual (Bureau of Economic Analysis, 2009). This does not place Polanyi's call for re-embedded social economies in the ideological waste basket. Neo-liberalism has been and continues to be, fraught with implementation difficulties among which are market and system failures surrounding Polanyi's social consequences and increasingly problematic risk management complications. According to Eddy (2009) neo-liberalism failed as it focuses on wealth creation for elites rather than broad scale advantages for society.

Achieving the social outcomes that Polanyi called for, which could underpin a reframing of regional development policies, requires a rethinking of community engagement and participation approaches, the institutionalisation of socially embedded markets and, the

emergence of a renewed social liberalism better suited to current regional development needs. Social liberalism seeks to place democratic freedoms before market freedoms (Howarth, 2007) whilst arguing that markets featuring minimal government intervention have a significant role to play in managing market failures and ensuring a fair provision and distribution of wealth and power (Howarth, 2007). Social liberals believe that decentralised decision-making and minimised market controls encourage innovation but that market failures (especially asymmetries of information and transaction costs) must be addressed through democratically legitimate government interventions (Howarth, 2007).

According to social liberal theory, inequitable power concentrations can result from a lack of legitimate democratic processes as well as from concentrated wealth inequities which together, threaten individual political freedoms (Howarth, 2007). Social liberals advocate the principle of equal opportunity (Sawer, 2003) and participatory and deliberative democracy notions within a 'fair' and minimally controlled market and political system. These ideals combine with non-market pursuits such as community well-being, standing in stark contrast to the emphasis of neo-liberalism on free markets over political freedoms and, the social capitalist ideal of government-centred macroeconomic control and government sponsored market interventions, stimulation and regulation.

Novel socio-regional methods and regional development policies and tools are needed to provide regional outcomes capable of establishing and developing conditions for local socio-economic responsibility which support regional sustainability and adaptability. Policies can better suit regional community needs if they are able to provide sustainable development outcomes that are locally constructed and maintained by individual socio-economic agents. Such an approach can be located within a socio-regional discourse, whereby collaborative innovation processes provide social returns that assist build regional adaptability, construct new and dynamic regional advantages and promote regional development that is based on endogenous and nested collective action and social responsibility principles. For regional scientists to participate in the post-GFC policy space, a return to the very roots of regional science and Isard's (2003) vision for the future of regional science is required. This shift entails an expansion from the economic and geographical dominance of regional science (Plane, 1994) that goes beyond the 'new regional science' and into a free-thinking amalgamation of Cooke, Uranga and Etxebarria's (1998) evolutionary regional science and Bathelt and Gluckler's (2003) relational economic geography.

CAN REGIONAL SCIENCE ADAPT TO REGIONAL NEEDS?

The early history of regional science is presented in Isard (2003), whilst a less detailed but broader chronological history is offered in Boyce (2004). In addition there are various accounts of the history of regional science, or at least components of this history, with a notable critical overview provided by Isserman (1995). Within these accounts, regional science emerged in 1950's from an interest by regional researchers in input-output analysis and its affects on industrial and population location and regional development matters (Isard, 2003). From its earliest days, regional science sought to understand not only location and regional matters (Isard, 2003), but 'the complex of society itself' (Isard 1951, cited in Isard, 2003, p. 41). As a participant at the Interdisciplinary Regional Research Meeting held in Chicago on the 6th September 1951, Firey (1951, cited in Isard, 2003, p. 38) stated that he was 'interested in social organisation and control as it pertains to spatial patterns of land use and regional resource management'. Firey (1951, in Isard, 2003) brought a sociological perspective and interest in power, society and regional resource exploitation, to the emerging economically dominated regional studies field. From the outset, it was asserted that regional

research should be multidisciplinary, with a particular emphasis on economics and the social sciences.

In an early newsletter to interested regional researchers, now referred to as regional scientists, Isard (1954, cited in Isard, 2003, pp. 74-75) wrote that the interests of members of the regional research group included, amongst other things, 'the interaction of cultural, social, political, economic and geographic factors'. According to Isard (2003, p. 118), the Regional Science Research Institute sought to conduct 'multidisciplinary studies of the spatial and locational interaction and interdependence of economic, social, political and environmental phenomena associated with urban development and regional growth', from which the Institute was, amongst other aims, to provide 'advice to government and academic institutions on policy and research issues'. A core focus of regional science research was to be the development of new understandings of 'regional structure and function' as well as developing a better understanding of the 'possibilities for economic and social development' (Isard, 2003, pp. 119 and 121).

Isard (2003, p. 188) further asserted that regional science 'is concerned with the study of man and the spatial forms which his continuous interaction with, and adaptation to, physical environment take. Regional science concentrates its attention upon human behaviour and institutions'. Isard (2003, pp. 188-189) argued that regional science can progress regional studies to expand on the sociological interests of communication processes and mechanisms, to include 'all interregional bonds… and exchange[s] of all kinds' to develop an 'interregional model which expresses all kinds of linkages in proper relation to one another'. Isard (2003, p. 189) sought to incorporate political and social subsystems into regional science studies, 'namely – the analysis of the interaction of decision makers (individuals, organisations and institutions) and their interdependent decision making in situations of conflict over policy and other joint actions'.

Mera's (2004) search of regional science journals (see Table 1 below), however, indicates that the contribution from disciplines other than economics and geography is lacking – particularly the policy and social science (including qualitative research) contributions that were identified as desirable in the early days of regional science research. According to Quigley (2001), regional scientists began to vocalise concerns for the future of the field as early as 1991 whilst Mera (2004) claimed that concerns were expressed as early as 1959 by Rodwin. It was not until 1994, however, that a diagnosis of regional science as being 'in a state of crisis' was delivered by Bailly and Coffey (1994, p. 3). Bailly and Coffey's (1994) diagnosis asserted that regional science lacked relevance, being unable to address real world problems and was fraught with a 'narrowness of perspective'. The field of regional science today appears to remain constrained within a positivist paradigm, unable to embrace the sociological aspirations of some of its founding members, called for again by Domanski (1983), who has argued for greater inclusion of social values and social context in regional science inquiries. As Bailly and Coffey (1994) noted, a paradigm shift is required, one that embraces post-positivism, critical realism and constructivism amongst other approaches.

According to Holland (1976, p. 29 and 274) attests that regional science has entered 'an intellectual cul-de-sac', arguing that orthodox regional science methods are unrealistic and require 'a more divergent approach' that is inclusive of a 'social and political context'. Barnes (2003, p. 21) has added that the field of regional science is too focused on the '"S" science part of regional science… effectively arrest[ing] regional science's development' and resulting in an 'unreflective' discipline 'inured to change'. Barnes (2003, 2004) further argued that regional science has failed to adequately emphasise the region and the socio dimensions of places. Barnes (2003, p. 20) also claimed that regional scientists have failed to move away

from 'rationalist, formal, and universal explanations' to embrace 'relativistic, eclectic, and local' explanations of regional matters, thus ignoring the contributions to regionalism provided by 'post-structuralism, feminism, post-Marxism, and post colonialism'. Massey (1985, cited in Bathelt and Gluckler, 2003, p. 122) has further criticised regional science for its 'obsession' with spatial regularities, arguing that 'there are no such things as purely spatial processes; there are only particular social processes operating over space'. Additional commentary on the rise, decline and future of regional science can be found in two volumes of the journal International Regional Science Review published in 1995 where 32 authors debated the relevance of the field, as well as further analyses in the works of important contributors including Hägerstrand (1989), Gibson (1994), Plane (1994), Anas (1994), Bailly, Coffey and Gibson (1996), Cooke, Uranga and Etxebarria (1998), Rees (1999), Markusen (2002), Bathelt and Gluckler (2003), Mera (2004), M. Taylor (2009) and Lahr (2009).

Table 1 Percentage Distribution of Papers by Discipline

Meetings/Journal	Economic	Spatial	Social	Other
Papers and Proceedings of RSA 1958/1959	59.4	40.6	0.0	0.0
Papers of RSA 1970/1971/1972	46.2	41.0	10.3	2.5
North Am RSA Meetings 2000	62.3	23.2	13.2	1.3
WRSA Meetings 2002	54.2	29.2	14.2	2.5
Papers in Regional Science 2001/2002	55.6	25.0	19.4	0.0
Annals of RS 2001/2002	62.5	31.3	3.1	3.1
RURDS 2001/2002	67.7	25.8	6.4	0.0

Source: Mera (2004, p. 354).

The paucity of research on the sociological dimensions of power in regions is further evidenced by the lack of attention placed on sociological forms of power in the regional science literature. A search for the term "power" in the Regional Science Association International's journals *Papers in Regional Science* and *Regional Science Policy and Practice*, for example, resulted in three uses of the term power in titles with only one of these referring to power in a sociological sense. An abstract search of these two journals resulted in 13 uses of the term power in a sociological sense. With *Papers in Regional Science* being the Regional Science Association International's oldest journal, having published articles since 1955, these results indicate a lack of inclusion of notions of power-over and power-to within the regional science field. If regional scientists are to work towards developing Isard's (2003, p. 189) vision of an interregional model that 'expresses all kinds of linkages in proper relation to one another', then studies of relational power and the structures they are framed within, as well as the spatial and locational factors that influence power relations, are necessary.

The failure of regional science and regional research in general, to embrace a sociological power discourse as advocated by Firey (1951, in Isard, 2003) and more recently by Domanski (1983), Markusen (2002), Hudson (2007) and M. Taylor (2009), amongst others, has resulted in a significant gap in the regional science literature and an inadequate understanding of regions. By moving regional research away from 'pure' geography and into an economic sphere, regional scientists placed regions into a sociological framework whereby the study of regions became the study of regions through a societal lens, albeit a mostly quantitative and positivist lens. Questions that regional scientists have shied away from, such as those pertaining to institutional power structures and power relations, as well as the impact of

geographical and spatial factors on sociological notions such as groupthink, amongst others, are central to a more complex understanding of regional matters and in particular, regional development and its associated sociological dimensions (Hudson, 2007). Such inquiries take shape as contextual phronetic research in a Lasswellian sense, asking questions such as 'who gets what, when [and] how' (Laswell, 1936, cited in Parsons, 1995, p. 246) or, as Flyvbjerg has suggested, '[w]here are we going with [regional development in Circular Head]? Who gains, and who loses, and by which mechanisms of power? Is it desirable? What should be done?' (Flyvbjerg, 2001, p. 145). This approach involves a study of values and power, with an emphasis on political, economic and socio-cultural inquiry within a spatial context.

Regional science, in spite of early ambitions and ideals, has left itself exposed to criticism based on its failure to adequately include non-quantitative methods in its modelling of regional processes that, since the 1970s, have been increasingly recognised as socially and politically complex (Aoyama *et al*, 2011). One of regional science's greatest critics has been Harvey (2009 (1973)) who attempts to include notions of power in regional analysis. Harvey (2009 (1973)) has argued that capitalism shapes the elements and relational spaces within itself to ensure its own permanently revolutionising reproduction, and that power lies at the centre of this iterating force. According to Harvey (2009 (1973), p. 215), new modes of economic integration and market institutionalisation are perpetuated through legitimising processes based on violence and the 'power to coerce'. The ideological superstructure of society, he adds (idem, p. 215), contains correlative features of status and class which are projected into 'patterns of political power, definite supportive institutions and states of social consciousness'. These factors can be unravelled to reveal social and economic organisation, through investigations into the reciprocal, redistributive and market exchange factors (Harvey, 2009 (1973)). This delving into sociological power discourses is missing in the regional sciences that have remained constrained by the positivist paradigm previously described.

Although terms such as 'control', 'inequality' and 'influence' are frequently featured in the literature of regional research, and 'power' to a lesser extent, direct inquiries into power relations are largely lacking. Aoyama *et al*. (2011, p. 11), recently stated that 'socio-cultural contexts structuring economies can be viewed as compilations of Networks which are horizontal, flexible and infused with power relations'. Peck (2005, p. 162) has called for increasing dialogue between social-constructivists and economic geographers, amongst others to foster a better understanding the 'non-economic parameters of the economy', particularly institutional phenomena, socio-economic relationships and their effects. According to Peck (2005, p. 166), a valuable shift in economic geography would be to 'engage more seriously with theoretical and substantive issues around the social construction of markets and of economies more generally'. Economic geographers, according to Aoyama *et al*. (2011, p. 183), have gone some way towards achieving this through extended economic sociology and organisational theory inquiries into 'understand[ing] how social networks influence small enterprise and regional development processes, how network structures reflect social inequalities and how networks evolve through social interactions between individuals'.

Bathelt and Gluckler (2003, p. 118), have argued that the 'economic and the social are fundamentally intertwined'; drawing on the work of Stark (2000, in Bathelt and Gluckler, 2003, p. 118) they add that these intertwined factors are 'dimensions of the same empirical reality which should be studied in a dialogue of perspectives rather than in mutual exclusion and reductionist prioritization'. Bathelt and Gluckler (2003) have also argued for a relational re-conceptualisation of economic geography and by default, regional science. Bathelt and Gluckler (2003, p. 123) proposed that this transitional re-conceptualisation of regional science and economic geography into a relational economic geography, would focus on 'economic

actors and their action and interaction', seeing economic action as a 'process, situated in time and place' (Bathelt and Gluckler, 2003, p. 126). Through the lens, albeit modified, of Storper's (1997, in Bathelt and Gluckler, 2003) 'holy trinity' of *technologies, organisations and territories*, Bathelt and Gluckler (2003, p. 130) suggested that 'economic and social processes and their interactions and power relations can be analysed'. Bathelt and Gluckler (2003, pp. 129-131) propose, as an adaptation of Storper's holy trinity, their four 'ions' of relational economic geography, being 'organization, evolution, innovation, and interaction' which are subject to contextuality, contingency of economic action and path-dependence.

Although Bathelt and Gluckler (2003, p. 129) propose that an analysis of structures, interactions and power relations is needed, and that the 'strategies and objectives of economic agents and their relations with other agents and institutions' would become 'the core of the analysis' in relational economic geography; a geographical Storperesque lens is useful and valuable but insufficiently suited to understanding the predominantly sociological dimensions of power relations. It remains, therefore, that economic geographers and regional scientists, have not adequately investigated notions of 'why' agents participate in regional development and economic activities, nor have they adequately investigated the structural forms of power within network relationships (Peck, 2005, in Aoyama *et al*, 2011).

Through an actor/network theory perspective, some sociologists and economic geographers have incorporated an anthropological and sociological dimension to regional studies whereby it is argued that economic agents cannot be separated from their actions as their actions are 'embedded in multiform and multiscalar relationships' (Murdoch, 1998, in Aoyama *et al*, 2011, p. 184). Power is expressed in these relationships through 'micro-social interactions and negotiations [that] construct economic spaces, interconnections and interdependencies' (Murdoch, 1998, in Aoyama *et al*, 2011, p. 184).

Although regional science has provided a valuable geo-spatial and locational analysis framework to regional research, it lacks the complexity and 'messiness' that current regional policy approaches can benefit from. Regional science can contribute to this policy void by adding a qualitative socio-relational and spatial-relational approach to regional research that fits within the evolutionary regional science approach called for by Cooke, Uranga and Etxebarria (1998). In particular, regional science research is needed that is more attuned to understanding the interdependence of economic, social, political and environmental phenomena and associated power relations in decision making processes; which as Isard (2003, p. 118) hoped, regional scientists could then provide as 'advice to government and academic institutions on policy and research issues'.

Cooke, Uranga and Etxebarria's (1998, p. 1563) evolutionary regional science is linked to social and evolutionary economics and takes account of 'processes of agglomeration, trust building, innovation, institutions, and learning in regional systems' as well as 'hard and soft infrastructures, and the cultural superstructure'. They claim (idem, p. 1564) that 'innovation', for which social interactions are critical, 'accounts for a very large amount, perhaps 80-90% of the growth in productivity in advanced economies'. They argue (idem, p. 1580) that:

> the systemic dimension of innovation at regional level relies upon a combination of a well-endowed organisational infrastructure and an associative superstructure composed of an embedded civil society capable of activating social capital. Institutionally speaking, embeddedness will reside in the collective social order which evolves according to an informal microconstitution composed of microregulatory conventions, habits, routines, and rules of the game. Systemic innovation is facilitated by the constructive interaction of the institutional order and the organisational infrastructure.

The transformative capacity of these social interactions, which are capable of shaping the cultural superstructure of society and which, according to Cooke, Uranga and Etxebarria (1998), are geographically concentrated, should not be underestimated in a regional development context. Socio-cultural interactions and the agents involved in them should, therefore, be considered central to future regional research (Bathelt and Gluckler, 2003) and should be explored in a free-thinking evolutionary regional science.

Notions of power contained within the power discourses, are capable of providing an analysis framework for regional development policy and praxis that can compliment socio-regional research and add richness and depth to evolutionary regional science. Of particular interest for future research are the notions of social and human capitals, embeddedness, and trust in institutional networks as well as what role power plays within social relationships.

POWER AND ADAPTIVE REGIONS

To understand the power relations aspect of the above call for a transformation of regional science into a free-thinking form of evolutionary regional science, an understanding of power, particularly 'how people are affected by the outcomes of issues' pertaining to power is essential (Lukes, 1986, p.9). An understanding of power 'is usually thought to be indispensable for moral or ethical appraisals of political systems' (Dahl, 1986, p. 38). Through an understanding of power, power relations may be modified (Dahl, 1986) to increase opportunities for human benefits that result from the (re)distribution of power. Given the federal government's provision of much regional development funding in Australia and associated policy domination, the benefits that can accrue to regions are arguably biased by political motives and decision-making processes that may further entrench regional disparities. Benefits and political bias, however, are not the only factor of concern for studies of regional disparity. Within the context of the Circular Head municipality, the role of endogenous political influence and the role of groupthink as a social phenomenon are arguably significant.

In a Foucaldian sense (see Foucault, 1978), regional development as a power-based social activity is systemically affected by social structures comprised of individual agents (although individual agents may be affected by group psychology conformity pressures) that shape and are shaped by agent-based iterative processes. The extent to which individual agents are capable of influencing and changing socio-economic structures is complex, unstable and contextual but it is through the actions of individuals that social action occurs (Weber, in Giddens, 1984). Increasing the (re)distribution of power and equality between individuals and within regional development structures can break down the institutionalised power enclosures that shape time space power relations, organising power values and compliance (Hägerstrand, 1975, in Giddens, 1984, p. 147).

Adding a Bourdieuesque conceptualisation of power (see Bourdieu, 1972) and its effects, Giddens (1984, p. xxv) argued that the situational context of social encounters are not only structurally influenced but are framed within regionalised settings that 'sustain meaning in [agent-based] communicative acts'. These social settings, however, are 'intersocietal' and are not constrained by 'time-space edges' (Giddens, 1984, p. xxvii) – in other words, as with Foucault's (1986 (1976), pp. 233-234) conceptualisation of power as being web-like and everywhere, the social location within which structuration occurs is not clearly defined. This cross-regional setting of social encounters suggests that power relations within regional development are not only net-like but may also be hierarchically non-linear and somewhat chaotic, crossing socio-boundaries between the macro and micro frames. Giddens (1984, p. 2) argued that social activities, such as those within a regional development context, are 'self-

reproducing' and are not 'brought into being by social actors but continually recreated by them via the very means whereby they express themselves as actors'. It is through such structured iterating activities that agents 'reproduce the conditions that make these activities possible' (Giddens, 1984, p. 2).

The desirability for increased community-based involvement and control of regional development socio-processes is supported by calls for the continued devolution of power in public governance (Hilder, 2006) and increased public ownership of outcomes (Rankine *et al*, 2005). The devolution of powers within a groupthink dominated socialscape, however, may require that regional development practitioners and theorists apply a cautious approach to discourse language and a deep understanding of community beliefs, values, assumptions and ideologies. Gaventa (1980, p. 15) argued that understanding the third dimension of power requires 'locating the power processes behind the social construction of meanings and patterns', and it is through such an understanding that the design of devolutionary and participatory processes can occur. According to Gaventa and Valderrama (1999, p. 7), 'participation is about power and its exercise by different social actors in the spaces created for the interaction' but that the 'control of the structure and processes for participation – defining spaces, actors, agendas, procedures – is usually in the hands [of] governmental institutions [and professional development agents] and can become a barrier for effective involvement of citizens'.

Traditional development approaches too often fail to achieve participation that is free of power inequities, reinforcing top-down, elitist policy agendas through project and programme-based activity resourcing (Eversole, 2010). Rather than implement participation-based theories and development models aimed at empowering regional communities, many professional development agents are disempowered by resource constraints – particularly staffing and funding limitations, funding and organisational vulnerability to politically driven restructuring and policy priorities and, a lack of public interest or understanding of development activities and objectives (Beer *et al*, 2003).

According to Eversole (2010, p. 2) '[p]articipation is ultimately a discourse' that under current policy trajectories, seeks to facilitate increased involvement of 'communities of people as key agents of development'. The participatory nature of development, however, is a contested theory with Taylor and Mayo (2008, cited in Eversole, 2010, p. 3) having suggested that participation is an unattainable 'elusive goal' due to the top-down dominance of policy and resourcing constraints. Craig and Porter (1997, cited in Eversole, 2010, p. 7), however, asserted that development 'professionals and organisations' utilise 'practices and processes which are primarily instruments of control, rather than of participation'. Eversole (2010, p. 9) has posited that the 'problem of participation is not that participation is impossible to achieve; but rather, that it is impossible to achieve for others'. Eversole (2010, p. 10) further adds that:

> the challenge of participation is about how to become participants in our own right: choosing to move across institutional and knowledge terrains to create new spaces for communities and organisations to 'participate' together.

Eversole (2010) calls for the remaking of participation, 'reframing the interactions among communities, professionals, and institutions into a truly 'participatory space''. To achieve this participatory space, Eversole (2010) has suggested that: (1) expert and experience-based knowledge must both be viewed as valid and legitimate and that for participation to be community oriented, community knowledge must be included; (2) that institutionalised participatory spaces are the result of community driven processes that become the 'institutions through which communities work' rather than top-down initiatives. These processes can frame participatory spaces according to the interests of those newly created institutional

power bases. Development practitioners are, therefore, transformed into 'participants in other people's processes' (Eversole, 2010, p. 9), and; (3) that community embedded development practitioners, or rather 'translation agents', transform knowledge and institutional spaces to be more inclusive and accessible to all participants (Eversole, 2010, p. 11).

The SDPM provides a community oriented development tool through which power can be (re)distributed to create DPS that aim to increase community participation and process ownership whilst being inclusive of public sector agents.

THE SDPM AS A TOOL FOR CREATING ADAPTIVE REGIONS

Lukes (1986, p.5) posited that 'to have power is to be able to make a difference to the world'. As a policy and praxis tool designed to achieve community-based sustainable development outcomes, the SDPM aims to facilitate such a difference. This difference manifests through collective processes built on deliberation that promote collaboration, networked knowledge sharing and, innovation outcomes. The SDPM aims to increase community ownership of relational and structural power within regional development praxis to facilitate regional adaptability. Through power relations that are enabling and collaborative, the SDPM encourages a return to socially and institutionally embedded economies and increased social responsibility. In its principal form, the SDPM aims to network and embed institutional relationships to overcome unique regional dilemmas and innovation inhibitors whilst developing inimitable and non-substitutable resource configurations. The SDPM involves nine phases and is summarised in Table 2 below.

The application of the SDPM suits situations where the exploitation of resources are sub-optimal due to: a failure by local entrepreneurs and others to instigate and develop successful networks of cooperative innovation; a lack of effective knowledge management systems, and; a lack of path dependant organisational and governance capabilities (Campbell-Ellis and McCall, 2010).

The SDPM provides a mechanism whereby resources can be optimally exploited to provide a source of revenue (through levies) for resources management and community development initiatives (Campbell-Ellis and McCall, 2010). It is through the institutional governance design, core processes and knowledge sharing phases that the SDPM provides mechanisms for the (re)distribution of power and the creation of DPS.

DELIBERATIVE POWER SPACES

Within a relational and structuralist regional development context, power can be conceived as both an enabler and as a coercive/domineering mechanism. Such a definition adopts Arendt's (1970, cited in Lukes, 2005, p. 32) conceptualisation of power as a social construct that is 'never the property of an individual; it belongs to a group and remains in existence only so long as the group keeps together'. According to Arendt (1970, cited in Lukes, 2005, pp. 32-33) and importantly for regional development, power 'springs up whenever people get together and act in concert' and 'far from being the means to an end, is actually the very condition enabling a group of people to think and act in terms of the means-end category'.

Arendt's conceptualisation of power as socially constructed and empowering, as with the feminist view of power as being 'transformative' (Wartenberg, 1990, cited in Lukes, 2005, p. 84), lies at the core of the SDPM which seeks to enable and empower regional development agents through endogenous resourcing and collaborative action. Pitkin (1972, cited in Allen, 2011, p. 3), supported the argument that power is enabling, having suggested that 'power is a something – anything – which makes or renders somebody able to do, capable of doing

something. Power is capacity, potential, ability, or wherewithal'. Although Arendt and Pitkin isolate power as being empowering and not domineering, power within the Australian regional development context exists within a complex web, manifesting itself in multiple ways that are empowering and domineering.

Table 2 Sustainable Development Platform Method Phases

SDPM PHASE	ACTIONS
(1) Sustainability Audit	• Independent assessment of resources sustainability • Audit of resource conditions (socio-cultural, economic and environmental) • Identify resource condition indicators and action triggers • Identify environmental management actions
(2) Comparative Analysis	• Inter-regional comparison of natural and human resource conditions against sustainable development and RIS theories • Detailed background study of regional assets, industries, communities, academic institutions and government participation
(3) Community / Network Analysis	• Exploration of potential network(s) that could participate in and contribute to the SDPM approach • Detailed stakeholder analysis and SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis
(4) Institutionalised Governance Design	• Networking of self-identified and research identified stakeholders and leaders • Nesting within local, regional and institutional settings • Defining governance structure and associated working rules • Defining rewards and penalty systems
(5) Futurescaping	• Statistical and tacit identification of future megatrends • Analysis of existing and possible trajectories based on network and regional capabilities
(6) Platforms Identification	• Identification of platform opportunities inherent within regional resource constraints and associated capacity and interest of network participants to explore individual platform opportunities
(7) RIS Conceptualisation	• Identification of likely network participants and associated institutional resource configurations to pursue a specific RIS platform • Creation of a shared individual platform vision to support and guide the identification and definition of core processes associated with a particular RIS platform
(8) Core Process Identification	• Identification of processes that deliver a unique RIS platform • Definition of individual responsibilities and tasks to achieve the RIS platform • Definition of how sustainability indicators will be reported against monitoring criteria • Definition of individual property rights and how they will be assigned and enforced (aligned with the broader working rules) • Definition of levy duties to fund socio-cultural, economic and environmental management actions identified in the first phase
(9) Knowledge Management	• Encourages new learning and knowledge creation and knowledge dissemination • Feeds into phases one and six to ensure that knowledge is distributed at critical phases of the SDPM process

Source: Adapted from Campbell-Ellis and McCall (2010).

The ways in which power is manifested, Saar (2010, cited in Allen, 2011, p. 5) recently argued, 'remains individualistic' whereby 'power operates on individuals as individuals, in the form of a 'bringing to action' or external determination'. Saar's individualist notion of power exists within the relational structures where power affected agents operate. By contextualising Saar's claim within a relational and structural framework, power as power-to and power-over can be integrated with each other to provide a more holistic view of power and how it manifests within the regional development context as well as under groupthink conditions.

Understanding how groupthink and power enclosures affect regional development is critical to understanding how power, in whatever forms it may take, can be (re)distributed and applied within the regional development setting using the SDPM. French and Raven's schema for power analysis provides a useful lens to reveal power-over relations and affects. They identify five common and important bases of domineering power which include (French and Raven, 1959, pp. 155-156):

> (1) reward power, based on P's [person affected by power-over agent, O] perception that O has the ability to mediate rewards for him; (2) coercive power, based on P's perception that O has the ability to mediate punishments for him; (3) legitimate power, based on the perception by P that O has a legitimate right to prescribe behaviour for him; (4) referent power, based on P's identification with O; (5) expert power, based on the perception that O has some special knowledge or expertness.

French and Raven define power in terms of influence that results in 'changes in behaviour, opinions, attitudes, goals, needs, values and all other aspects of the person's psychological field' and that these changes can result from inducement by another agent, 'a restraining force corresponding to anchorage in a group opinion, and an own force stemming from the person's needs' (idem, pp. 150-151). These forces of power-over are limited to those influences which are produced by the actions of a particular social agent or agents that affect the subject and result in a directly related change (p. 153). This paper rests on the hypothesis that regional development agents both shape and are shaped by power relations and structures that manifest in regional development praxis.

French and Raven's bases of power, however, do not account adequately for phenomena such as false compliance in the case of reward power or non-compliance when punishment may be avoided in the case of coercive power; nevertheless these five bases of power-over emphasise the scope of limitations for these power types, particularly the bounded nature of applied power-over. The five bases of power were expanded upon by Morgan (1997, p. 171) who identified 14 sources of power as being 'among the most important':

1. Formal authority
2. Control of scarce resources
3. Use of organizational structure, rules and regulations
4. Control of decision processes
5. Control of knowledge and information
6. Control of boundaries
7. Ability to cope with uncertainty
8. Control of technology
9. Interpersonal alliances, networks, and control of "informal organisation"
10. Control of counterorganisations
11. Symbolism and the management of meaning
12. Gender and the management of gender relations
13. Structural factors that define the stage of action
14. The power one already has

According to Morgan (1997, p. 171), these 'sources of power provide organizational members with a variety of means for enhancing their interests and resolving or perpetuating organizational conflict'.

French and Raven's five power bases and Morgan's 14 sources of power provide a valuable critical theorist schema for investigating power-over and developing mechanisms that support power-to. The relationship between these categories of power and the SDPM is that through such a schematic lens one can identify which forms of power may be present within the relational and structural dimensions and confines of a given regional development issue. By identifying, mapping and incorporating power structures and relations into the SDPM at the Institutional Governance Design, Core Processes and Knowledge Management phases, power structures and relations can be revealed and power can be (re)distributed to facilitate increased community control of regional development praxis. In addition, this inclusion of power and its analysis into the SDPM, enables the breaking down of the antecedent conditions for groupthink to occur as well as the minimisation of impacts resulting from groupthink symptoms where they continue to affect development outcomes. Specifically, this results from the critical analysis of alternatives that the SDPM facilitates combined with the deliberative exposure and (re)distribution of power that DPS enable. This (re)distribution of power into deliberative spaces within the regional development context endeavours to achieve a social liberalist outcome rather than a neo-liberal outcome more common to regions engaged in globalised markets (Aoyama *et al*, 2011; Giddens, 1998).

The SDPM was designed to be inclusive of deliberative democracy principles that facilitate discussion-based decision-making and polity free governance processes (Campbell-Ellis, 2009) that contribute to the realisation of what Lindblom (1990, in Parsons, 1995, p. 439) described as a 'self-guiding society'. Lindblom's (1990, in Parsons, 1995) self-guiding society is a problem solving society whereby problem solving is based on deliberation, communication, participation and democracy as well as the redistribution of power. Hartz-Karp (2004) asserted that cycles of trust must be created for deliberation to work in a democracy. These cycles of trust can be created by including participants that: are 'representative of the population;… focus on thoroughly understanding the issues and their implications;… [provide] serious consideration of differing viewpoints and values;… search for consensus or common ground; and [have] the capacity to influence policy and decision-making' (Hartz-Karp, 2004, p. 16). These design components aim to build positive cycles of learning, understanding and decision-making for the collective good and are a firm foundation for power-to outcomes. According to Pettit (2001) deliberative democracy concepts imply inclusiveness, deliberative judgement, and open and unforced dialogue that can best be achieved with the depoliticisation of discourse, deliberation and governance. Cohen (1989, pp. 3-4) posits that deliberative democracy features five main elements:

> D1 A deliberative democracy is an ongoing and independent association, whose members expect it to continue into the indefinite future.
>
> D2 The members of the association share (and it is common knowledge that they share) the view that the appropriate terms of association provide a framework for or are the results of their deliberation. They share, that is, a commitment to co-ordinating their activities within institutions that make deliberation possible and according to norms that they arrive at through their deliberation. For them, free deliberation among equals is the basis of legitimacy.
>
> D3 A deliberative democracy is a pluralistic association. The members have diverse preferences, convictions and ideals concerning the conduct of their own lives. While sharing a commitment to the deliberative resolution of problems of collective choice (D2), they also have divergent aims, and do not think that some particular set of preferences, convictions or ideals is mandatory.

D4 Because the members of a democratic association regard deliberative procedures as the source of legitimacy, it is important to them that the terms of their association not merely be the results of their deliberation, but also be manifest to them as such. They prefer institutions in which the connections between deliberation and outcomes are evident to ones in which the connections are less clear.

D5 The members recognize one another as having deliberative capacities i.e. the capacities required for entering into a public exchange of reasons and for acting on the result of such public reasoning.

These idealistic attributes of deliberative democracy are fraught with challenges when exposed to groupthink affected communities, individual interests and free rider dilemmas. Cohen's (1989) principles of deliberative democracy, combined with French and Raven's (1959) five bases of power and Morgan's (1997) 14 sources of power influence the design of the below DPS framework. In addition to these theorists and models is Janis' (1982, in Parsons, 1995) measures to counter the groupthink process, which include: leader encouragement of critical evaluation of alternatives and open objection, leaders refrain from stating policy preferences, decisions should be evaluated, external participation and policy challenge should be included, and additional meetings should be held to enable the expression of outstanding doubts.

The (re)distribution of decision making power into a deliberative democracy arena can provide institutional power equities that are legitimising and trust building (Carson and Hart, 2006). In order to incorporate constructive and empowering power relations into the SDPM and thereby establish DPS, a feminist orientation to power has been applied. According to Allen (2011, p. 1) feminists have conceptualised power in three main ways, 'as a resource to be (re)distributed, as domination, and as empowerment'. Through the liberal feminist conceptualising of power as a resource, 'the goal is to redistribute this resource' in a more equitable way (Allen, 2011, p. 7).

From this feminist perspective, dominating dimensions of power relations are transformed into positive outcomes capable of creating and sustaining spaces where power is equitably distributed to provide beneficial outcomes. Such outcomes can be achieved through discursive mechanisms where power, in a Bourdieuian sense, is always present. As Bourdieu (1972) argued, the control of language and discourse is central to notions of power-over. Through the transformation of power-over into power-to, discourse becomes deliberative and democratic and groupthink antecedent conditions can be overcome. The SDPM seeks to achieve this through establishing and maintaining DPS. The SDPM's DPS do not aim to, nor can they, transform and (re)distribute all forms and manifestations of power but limit their focus on relational and structural power typologies.

The discourse of power theory and deliberative democracy suggests that the construction of workable DPS within a regional development context requires that the SDPM's deliberative processes be (1) participant owned, accessible and embedded; (2) mutually supportive, empowering and resourced; (3) dialogically reason-giving, transparent and decision-challenging, and; (4) contextually binding. These four deliberative process constrain the design of institutionalised working rules that guide agent behaviour (as per Ostrom, 2005, p. 18) and generate 'a commitment to co-ordinating their activities within the institutions that make deliberation possible and according to norms that they arrive at through their deliberation' (Cohen, 1989, p. 3). The four deliberative processes listed above, are comprised of the following characteristics:

(1) **Participant owned, accessible and embedded**, whereby the forms of collective behaviour are networked within pluralistic relationships that are constructive and participatory and are

accessible to all interested public and private agents who are empowered to take ownership of the process. The embedded nature of collective relationships supports legitimacy which in turn promotes process influence and outcomes attainment (Cavaye, 2004). According to Prager (2006), participants should have an interest in and be relevant to the issue and should have scope to work within a range of decision alternatives. Accessibility, however, is an entitlement that is subject to positive and negative social sanctions. Non-compliance will result in non-participation in the SDPM and a forfeiture of any rights (outside of what an agent is legally entitled to) to beneficial outcomes that may be derived from the SDPM's collaborative processes that take the form of regional innovation systems (see Campbell-Ellis, 2009), risk sharing and, as processes that strategise and action collective priorities (McCall, 2011).

(2) **Mutually supportive, empowering and resourced**, whereby participating agents can act individually within a pluralist environment that sees power as a resource that can be equitably (re)distributed to empower all entitled participants. Through cooperation and collaboration, innovation based on trust and mutual support is fostered in a creative environment that seeks to see multiple individual benefits achieved through collective behaviours (McCall, 2011). The resourcing of the collectivity is accomplished through individual inputs that are power transforming as well as mobile. Fiscal resources are critical and support the pre-investment components of the SDPM and to some degree, the actionability of the collective's non-innovation phases. These inputs are secured through redistribution and reallocation levy components built into the SDPM's Core Processes phase (see Campbell-Ellis, 2009). The SDPM also includes the sustainable development provision that levies will be used to support community development and environmental management outcomes (Campbell-Ellis, 2009) and as such further support and empower participating agents, the broader community and future generations.

(3) **Dialogically reason-giving, transparent and decision-challenging**, based on deliberative and analytical discourse that is open, transparent, and accountable, and where process transparency generates trust and understanding. Dialogical processes should not be forced or restricted to closed timeframes. Open timeframes, however, are not intended to become barriers to innovation processes but are seen as providing pathways to collaboration and creative tensions. Decisions should be open to questioning and outstanding doubts should be provided sufficient opportunities to be heard. External participation and professional input should be included and open to challenge.

(4) **Contextually binding**, in so far that decisions made by the collective group or sub-groups are expected to be carried out by those members of the group that accept the contextual responsibilities, obligations and, therefore, the associated benefit rights to development platform outputs. Compliance results from incentive and coercive mechanisms that are the result of participation entitlements as per these four deliberative processes and in the collaborative innovation-based processes that are capable of providing market benefits through the outputs of the SDPM.

The current application of the SDPM in Northwest Tasmania has not yet tested the effectiveness of DPS. Elements of the DPS concept, however, have been in place since the SDPM has been applied within the region. The theoretical basis of the DPS as a tool for (re)distributing and equalising power within regional development policy and praxis aims to assist develop regional adaptability based on collaborative and participatory processes capable of overcoming groupthink barriers. The role of a DPS, therefore, is to support and enable collaboration featuring equitable power relations and to assist with the application of the SDPM.

CONCLUSION

As a socio-regional science tool existing within a relational and evolutionary regional science paradigm, the SDPM and its DPS aim to achieve the realisation of increased regional

adaptability and community well-being by equalising agent-based power in participatory development processes. The SDPMs deliberative and participatory processes support inclusive access, critical analysis, collaboration and innovation as well as the attainment of social responsibilities within regional communities. The SDPM and DPS aim to shift regional development policy and praxis away from external government domination and towards community driven agendas. This approach seeks to balance local social responsibility with private sector profit seeking activities, thus supporting a social liberal policy approach. To achieve this, the careful devolution of government and regional development organisational powers is required to transform and (re)distribute those powers into community driven participatory processes. The SDPM and its DPS facilitate such outcomes, endogenously resourcing development agents and actions to provide regional self-determination, adaptability and resilience. The SDPM and DPS are newly applied tools that support a paradigm shift for regional science into a free-thinking evolutionary paradigm, a shift that involves a somewhat chaotic and non-linear socio-regional approach that is inter-disciplinary and capable of expanding Bourdieu's (1972, pp. 169-170) 'universe of possible discourse'.

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Well-being Economics and Regional Science

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ABSTRACT

In this Presidential Address delivered to the 35th ANZRSAI conference, the author recalls his introduction to regional science during his 1981 Masters' studies. He recalls New Zealand's economic reforms (1984-1994), using Census data to illustrate how central government policies caused considerable hardship in all of New Zealand's regions. He reflects on changes since 1999, especially after the introduction of the regional partnerships programme in 2000 and the passing of the Local Government Act in 2002. In that context, he comments on what is termed here as the McCann critique, which cautions against the policy use of constructs not amenable to formal empirical evaluation. The paper finishes with a recent contribution by the author on 'well-being economics'. It shows how the '*market* value-added' created by providers of goods and services in New Zealand's sport and outdoor recreation sector is outweighed by the '*personal* value-added' that New Zealanders create *for themselves* by participating in sport and outdoor recreation activities.

INTRODUCTION

I am honoured to deliver this address at the end of my term as ANZRSAI President. I recently attended the North American meetings of Regional Science Association International where the 2011 NARSC President, Professor Gilles Duranton, explained that the only duty of NARSC Presidents during their year of service is to deliver a Presidential Address! We do things differently 'Down Under'. ANZRSAI offers many more opportunities for its President to make contributions to the well-being of the Association over twice as long a period. Nevertheless, I think it is valuable for a knowledge community like ours to ask its President at the end of his or her tenure to reflect on some important theme in our discipline.

The theme I have chosen is *well-being economics and regional science*. Well-being economics has been a unifying strand in my own research and I think will be one of the cornerstones of our discipline's future. The following section recalls my introduction to regional science during my Masters' study in 1981, exactly thirty years ago. I then recall how my research was strongly influenced by New Zealand's 1984-1994 decade of economic reforms, since those reforms caused considerable hardship in all of New Zealand's regions. There was a marked change in New Zealand's regional policy approach after 1999, especially with the introduction of the regional partnerships programme in 2000 and then the passing of the Local Government Act in 2002. I use that change as an opportunity to comment on what I have termed the McCann critique, which cautions against the use for policy of constructs not amenable to formal empirical evaluation (McCann, 2007). I finish with an illustration of the importance of well-being economics, drawing on a recent study that shows how the '*market* value-added' created by providers of goods and services in New Zealand's sport and outdoor

recreation sector is outweighed by the '*personal* value-added' that New Zealanders create *for themselves* by participating in sport and outdoor recreation activities.

ECONOMICS OF LOCATION AT THE UNIVERSITY OF CANTERBURY IN 1981

In 1981 I enrolled as a Masters of Commerce candidate in the Department of Economics at the University of Canterbury. The programme at that time consisted of six papers, among which I included *ECON 610: Economics of Location*. I still have my lecture notes. Using exclusive language that was still commonplace in the Department at that time (the first female lecturer with tenure was not appointed until 1990; Tay, 2007, p. 69), the subject outline explained that the course was "designed to cover certain aspects of the relationship between man and his environment, with consideration being given to some of the more important topics in the fields of location theory and urban and regional economics." Adopting as the textbook the second edition of Edgar Hoover's (1975) *An Introduction to Regional Economics*, the syllabus was in five parts:

- An introduction motivating the study of regional economics, covering multivariate tools for separating regions;
- Regional growth, introducing shift-share analysis, input-output analysis, probabilistic models (e.g. Markoff processes);
- Domestic trade, including empirical evidence on the determinants of inter-regional trade (e.g. agglomeration economics), growth centres and central place theory;
- Regional (including urban) policy, covering policy objectives, market versus planning solutions, outcome evaluation and linear programming; and
- The frictions of distance, including gravity models, human migration and transport costs.

We know the old joke of a lecturer who goes in for the first lecture, says "good morning" and a student in the front row puts up a hand and asks "Will we need to know for the final exam that the morning is good?" I was that student! Thus, when the lecturer began by asking "what is a region?" I wrote down the first part of his answer without any hint of the intended irony: "A region is any area for which the research can get a grant."

The lecturer was Peter Hampton, who had been in the Department since 1963 after completing his PhD at the University of Ottawa under Professor Jack Firestone (Tay, 2007, pp. 34-35). More than a decade before I met him, Hampton had published a broad ranging analysis of regional economic development in New Zealand in the *Journal of Regional Science*. He introduced his article with a comment that reflected his wider sense of humour but also tells us something about the debates in regional science in New Zealand at that time (Hampton, 1968, p. 41):

> Interest has recently been aroused in the pattern and cause of locational changes in New Zealand industry. This is partly because of a recent suggestion by the leader of the national opposition political party that the whole of the South Island, which comprises 56 per cent of the total land area, and has 30 per cent of the total population, may be regarded as a "depressed area" suitable for subsidy and other development incentives.

That interest had been sufficient for the Minister of Industries and Commerce to commission the New Zealand Institute of Economic Research to prepare a report on *Regional Development in New Zealand*. The report's conclusions were clear-cut (McDonald, 1969, p. 8):

> There does not appear to be a case at present for direct Government intervention to change the pattern of regional development. This pattern results largely from assessments by firms and individuals of their location preference, which cannot allow fully for the effect of their decisions on the community as a whole. However this pattern of development does not appear to be giving rise to excessive public authority or social costs.

In contrast, Hampton (1968, pp. 48-49) argued that the government was already involved in regional economic development policies in ways that were not necessarily benign:

> Successive governments, through the use of such devices as the issuance of import licences for producer goods and raw materials only to already locationally established industries, variations in roading and building expenditures on a regional basis, and subsidies to mining industries have pursued a policy of stabilizing industrial movement.
>
> … As suggested earlier, the government has the means to continue the implementation of a policy of counterbalancing the effects of deeper, underlying economic forces because of both the relatively easy transmission from area to area of the chief power source, hydro-electricity, and their complete control over the disbursement of foreign exchange. Both main political parties have pledged the continuance of such a policy.

In a prescient footnote, Peter pointed out that as a result of government policy "in 1963 seventeen motor vehicle assembly plants existed to serve a population of less than three million persons" (Hampton, 1968, fn. 3, p. 48). Unwinding this and other poor policy would eventually have brutal impacts on the regions, but this was still two decades away.

By the time I was Peter's student in 1981, regional economic development policy of this type had reached a peak. The government led by Sir Robert Muldoon was returned to power by a single seat in that year's general election on a promise that it would "Thing Big". Think Big was a programme of large construction projects in the energy sector: in particular the Petrocorp ammonia-urea plant at Kapuni, the synthetic fuel plant at Motonui, the expansion of the oil refinery at Marsden Point, the methanol plant at Waitara, the expansion of the steel mill at Glenbrook and the promise of an aluminium smelter at Aramoana (although this did not proceed). These projects were typically in marginal electorates and came to be regarded as exemplars of the cynical use of taxpayer funds to subsidise uneconomic investments in the name of regional development but motivated by political influence.

NEW ZEALAND'S PROGRAMME OF ECONOMIC REFORMS 1984-1994

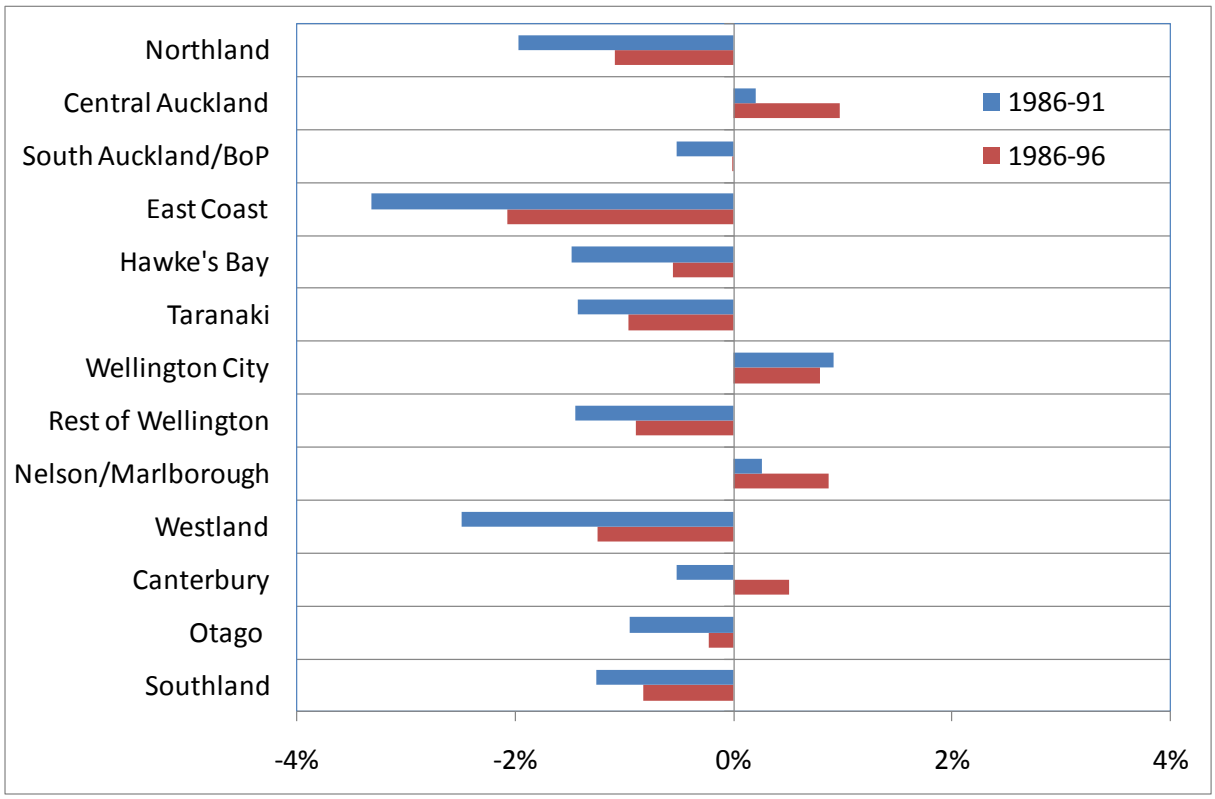
After completing my Masters degree, I returned to the University of Canterbury to enrol in PhD thesis research on the economics of water storage (still one of the most pressing issues for economic development in Canterbury; see Whitehouse *et al*, 2008; Dalziel and Saunders, 2009). Accidents of timing and my location turned that research into a University of Otago degree awarded in 1985, but in the meantime there was a landslide change of government in the snap general election held in July 1984.

The reforming Labour government had no time for regional policies after the debacle of the Think Big projects. That antipathy was reinforced when it discovered that the costs of guarantees and loans made to implement Thing Big, plus other loans extended to the meat and dairy producer boards, the Rural Bank and the Shipping Corporation, had resulted in an unfunded Crown liability of $7.2 billion (in 1986/87 prices) or 13 per cent of gross domestic product that year (Dalziel, 1999a, p. 125). Consequently, governments over the next decade focused on economic reforms to stabilise macroeconomic policies, to increase competition in domestic industries and to open up the economy to international market forces (Dalziel and Lattimore, 1996; Silverstone et al, 1996; Dalziel, 1998, 2002).

These reforms were comprehensive. In short order, interest rates were deregulated, international capital restrictions were removed, the currency was floated, most tax incentives and agricultural subsidies were phased out, import quotas were eliminated, and a timetable was set for reducing tariffs to zero by 2006. Price stability was made the sole objective of monetary policy and the government began privatising or commercialising its state-owned enterprises. In 1991, labour legislation moved from a union-based awards framework to an individual-based contracts system while social welfare income support entitlements were cut back. In 1994, the Fiscal Responsibility Act introduced a statutory requirement for a balanced or surplus budget 'on average, over a reasonable period of time'.

Policy advisors recognised that the short-term impact of these reforms would be a rise in unemployment, something that under previous governments would have been regarded as intolerable (EMG, 1989; Higgins, 1997). Figure 1 presents regional data showing Census employment trends for five and ten years after 1986. In the five years between 1986 and 1991, only Central Auckland, Wellington City and the Nelson and Marlborough regions experienced any employment growth; the remaining ten regions in Figure 1 all experienced falls in the number of people employed. Five years later, nine of these ten regions still had not caught up to their employment levels of 1986 (the exception was Canterbury).

Figure 1 Annual Percentage Change in Census Employment Levels by Statistical Area, 1986-1991 and 1986-1996



Notes: The Statistical Areas were defined by Statistics New Zealand, except that the graph separates Wellington City from the Wellington Statistical Area and it combines Nelson and Marlborough. BoP stands for Bay of Plenty.

Source: New Zealand Census of Population and Dwellings, 1986, 1991, 1996.

I have recently described the impact of the reforms on workers and communities as 'brutal' (Dalziel, 2011b). Figure 1 is one of the key reasons I hold this view. A decade is a long time to have no job creation in a region. In the East Coast of the North Island, employment was

still almost *20 per cent lower* in 1996 than it had been *ten years earlier* in 1986. The reforms left scars across some of New Zealand's poorest urban and rural communities, with negative implications that continue to the present day (see also Morrison, 2001).

But what does a regional economist do when government policy has such negative impacts on the economic well-being of regions right across the country? In my case, it produced a research programme on macroeconomics (see, for example, Dalziel, 1990, 1991a, 1993, 1996, 2000 and 2001a) and a series of publications documenting the reform's consequences for economic well-being (Dalziel, 1991b, 1999b, 2001b, 2002; Boston and Dalziel, 1992; Boston, Dalziel and St. John, 1999).

Following the end of the reforms in 1994, the government over the next five years sought to consolidate the benefits (middle income tax rates, for example, were reduced in 1996 and again in 1998) but still with no room for regional development policies. Instead, the aim was "to create an environment in which New Zealand firms, as well as the ordinary New Zealander, make the best decisions for themselves" (Peters, 1998, p. 5).

COMMUNITIES-LED REGIONAL POLICIES

Another change of government in November 1999 saw a marked change in this approach (Schöllmann and Dalziel, 2002; Dalziel, Greer and Saunders, 2003; Dalziel and Saunders, 2003 and 2005; Schöllmann and Nischalke, 2005; Dalziel, 2007). The Ministry of Commerce was rebranded as the Ministry of Economic Development and a new Crown entity was created to deliver industry and regional development programmes. The flagship of the new approach was the Regional Partnerships Programme (RPP), which was designed using principles of "endogenous regional development" highlighted in the OECD's Local Economic and Employment Development (LEED) programme (see especially OECD, 2001, summarised at www.oecd.org/dataoecd/51/42/1962067.pdf).

The Regional Partnerships Programme divided New Zealand into 26 regions, defined by officials after an open invitation for local organisations to nominate a suitable partnership for their region. Each RPP region was eligible to receive government funding to build up regional development capability, to prepare a regional economic development strategy and to have $2 million co-invested by the Crown in a major regional initiative every three years.

There was some arbitrariness in the definitions of the 26 RPP regions, as illustrated in Table 1. The territory of the Bay of Plenty Regional Council was divided into three RPP regions, for example, whereas the Canterbury Regional Council (with four times the land area and twice the population) was kept as one. Thus it came to pass that Peter Hampton was more accurate in 1981 than he had realised: in 2001 the definition of a RPP region was any area for which the government would give a grant!

Table 1 Comparison of the Bay of Plenty and Canterbury Regional Council Areas

Regional Council	Land Area	Population in 2001	No. of RPP Regions
Bay of Plenty	12,000 km^2	239,412	3
Canterbury	48,000 km^2	481,431	1

Sources: Dalziel (2007, p. 20); Dalziel and Saunders (2009, p. 1); Statistics New Zealand 2001 Census.

The Regional Partnerships Programme was replaced in 2007/08 by a Regional Strategy Fund, which was itself phased out after another change of government in November 2009. A more enduring change was reform of the Local Government Act in 2002. Previous legislation had defined nine specific purposes for local government; in contrast, Section 10 of the new Act defines just two purposes, which are both very broad (Saunders and Dalziel, 2004 and 2010):

(a) to enable democratic local decision-making and action by, and on behalf of, communities; and

(b) to promote the social, economic, environmental, and cultural well-being of communities, in the present and for the future.

The communities-led approach in the Local Government Act 2001, which was also reflected in the former Regional Partnerships Programme, takes us a long way from the accepted framework for regional science I studied in 1981. It is no longer a question of assisting a well-resourced central government make sound decisions for the country's regions based on comprehensive data collection and sophisticated empirical analysis. Instead the engaged regional scientist is now asked to interact with regional bodies directly, to help them take democratically supported decisions that might reasonably be expected to promote the well-being of the region's communities.

All the plenary speakers at this conference will address the formidable challenges associated with this task and many of the contributed papers also report projects where regional scientists are aiming to help local communities, which vary enormously in size and capability. Let me list the names of some of these communities to give you an idea of the diversity involved: King Island (population 1,700 in the middle of Bass Strait); the town of Rochester in Victoria (population 1,849); the City of Onkaparinga in the south of Adelaide; the Wandiwandian aboriginal people of the Yuin nation; the Cairns region in the far north of Queensland; Emerald, Dalby and St George in Queensland; Moree, Wee Waa and Warren in New South Wales; the south-west region of Victoria; the Northern Territory; Latrobe Valley; the Murray Darling Basin; the Surat Basin; the Flinders Ranges and Eyre Peninsula; Metropolitan Beijing in China; and the central areas of Kyoto, Seoul, and Florence.

It is not only the communities that are diverse; so too are the methods being used to generate ideas for improvements. The contributed papers at this conference include: a carbon neutral investment model for local government; the sustainable development platform model; the NEXIS model of urban adaptation; the community report card for building sustainable regional communities; the economic gardening entrepreneurial approach to economic development; the charette approach for addressing climate change; innovation indicator matrices used within a modified input-output approach; and the social entrepreneurship 4.0 model.

THE MCCANN CRITIQUE

In this context of this great diversity of communities and methods, I want to discuss what I term the McCann critique. Professor Philip McCann is Professor of Economic Geography at the University of Groningen in the Netherlands, Professor of Economics at the University of Waikato in New Zealand and Special Adviser to the European Commissioner for Regional Policy. He is a recognised international leader in regional science; in 2002, for example, the North American Regional Science Association honoured him with the Hewings Award for outstanding scholarship.

In a recent special issue of *Regional Studies*, Professor McCann contributed an article on regional studies and regional science that deserves careful attention (an early discussion in a

New Zealand context was by Perry, 2010). The article begins with the following summary statement (McCann, 2007, p. 1210):

> This paper will examine various issues relating to the identification, measurement and policy evaluation of urban and regional phenomena, which can lead to problems of analysis and interpretation. In particular, in many environments the importance of evidence-based policy design, analysis, and evaluation is increasing, and this paper will argue that, in such environments, there is no substitute for empirical work based on formal models. At the same time, the paper also argues that much of the current thinking regarding urban and regional issues is increasingly driven by concepts and constructs that do not lend themselves to empirical evaluation or evidence-based analysis.

McCann's article considers three major themes in regional policy over the last two decades: (i) clusters and industrial districts; (ii) social, cultural and creative capital; and (iii) regional innovation systems and learning regions. McCann provides persuasive evidence that (idem, p. 1215):

> … in none of these three cases has the nature of the relations within the systems ever been formally specified by the regional studies tradition. As such, while one hears of many anecdotal and case study examples of the types of relations that may operate in specific examples of each of these different characterizations, what has never been provided is a blueprint for which types of relations ought to be generally observable in all cases, and what types of relations will only operate in specific cases.

McCann treats the three themes with respect; indeed he argues that this type of conceptual thinking (which he calls "regional studies") has an important role to play, complementing the essential role for empirical work based on formal models (which he calls "regional science"). Nevertheless, the McCann critique is that "one cannot generalize on the basis of a few limited case-study observations, which themselves are not rigorously defined" so that "without any internal methodological consistency there is no real mechanism for moving from stylized discussions to specifically-targeted policies, or from policy-implementation to policy-evaluation" (idem, p. 1218). He concludes (ibid):

> As a consequence of this, unless one carefully considers the origins of different constructs, the outcome is all too likely to be both poor ex ante policy prescriptions and poor ex post policy evaluations.

I should acknowledge that my own work on regional development has made liberal use of McCann's three exemplar themes: cluster analysis (Saunders and Dalziel, 2003; Dalziel, Saunders and Taylor, 2005; Dalziel, Saunders and Zellman, 2006); social and cultural capital (Dalziel, Matunga and Saunders, 2006; Dalziel, Maclean and Saunders, 2009; Dalziel and Saunders, 2009); and regional innovation systems (Saunders and Dalziel, 2006; Dalziel, Saunders and Kaye-Blake, 2009). Faced with this personal history, how should I respond to McCann's thoughtful critique that "designing policies which are based on constructs amenable to formal empirical evaluation is *always required* for ensuring good policy" (McCann, 2007, p. 1209, emphasis added)?

Before I give my answer, let me state the obvious – this is not simply a personal issue. As I have just described, this conference is replete with invited and contributed papers that either advocate for changes to regional policies or report on research carried out with some regional community. I take for granted that the aim of the work in these papers is to help improve well-being, but in the absence of empirical testing, how do we know that the analysis and advice we offer will genuinely advance this goal?

History confirms this is a highly practical question. I have argued that regional policies in New Zealand during the 1960s and 1970s were poor and that the way those policies were

unwound during the reforms of the 1980s and 1990s led to enduring distress in regional communities. Whether one thinks this was primarily due to the recklessness of the policies before 1984 or to the recklessness of the policies after 1984, the issue raised is the same – as a discipline how do we take care to ensure our policy advice, however well intentioned, does not end up harming the well-being of communities?

My answer to this question has two dimensions to it.

The first dimension focuses on what counts as evidence for the validity or invalidity of any concept or theory. I agree wholeheartedly with Professor McCann that where scholars are able to draw strong conclusions based on sophisticated empirical work using rigorous formal models, that evidence carries enormous weight. No conceptual metaphor, no matter how clever, can survive decisive empirical tests demonstrating its invalidity.

I am also persuaded, however, by scholars such as Deirdre McCloskey (1994, 2002), Victoria Chick (1995, 1998), Sheila Dow (1996, 2007) and Tony Lawson (1997, 2009) that while empirical formalism is a powerful method that should be used when appropriate, there are other methods available for testing validity when a theory is not susceptible to empirical formalism. Dow (1996, p. 12), for example, refers to what she terms the Babylonian tradition (following Feynman, 1965) as an alternative:

> The alternative approach is to employ several strands of argument which have different starting points and which, in a successful theory, reinforce each other; any argument, therefore, does not stand or fall on the acceptability of any one set of axioms. Knowledge is generated by practical applications of theories as examples, using a variety of methods.

This is a close description of what often happens in regional scholarship. A new theory or concept begins to gain attention. At meetings like this one and in the pages of academic journals, researchers engage in reasoned debates about the evidence accumulating for and against the concept. This does not typically produce consensus, but validity is judged to be strong if the implications are generally supported by arguments produced from diverse starting points, while each study of a practical application helps to advance our knowledge about possible limitations on the extent of the concept's validity.

Note that this alternative test of validity places a heavy burden on individual scholars, who are required to exercise judgement about the weight of accumulating evidence across many available concepts to determine which concepts are most applicable to the situation of a community being studied or advised. In the absence of decisive empirical tests, there is no getting away from this burden; it can only be shared by participating in events like this one and by weighing up the arguments put forward by different points of views using different methods.

The second dimension of my answer returns to the main theme of my address: well-being economics and regional science. At the heart of well-being economics is the principle that the best judge of an individual's well-being is generally the individual himself or herself. In this, I am influenced by Professor Amartya Sen's scholarship on *Development as Freedom* (see, for example, Schischka, Dalziel and Saunders, 2008). Sen (1999, p. 11) argues that "with adequate social opportunities, individuals can effectively shape their own destiny and help each other [and] need not be seen primarily as passive recipients of the benefits of cunning development programs" (see also Alkire, 2002, and Nussbaum, 2011). Consequently, in Sen's famous formulation, the goal of development is "the expansion of the 'capabilities' of persons to lead the kinds of lives they value – and have reason to value'' (Sen, 1999, p. 18).

Within this framework, the work of regional studies scholars in developing conceptual metaphors and interpreting regional data can be very powerful in helping communities to

imagine new possibilities for how they might lead the kinds of lives they value and have reason to value. In saying this, I am not thinking just of international figures such as Michael Porter or Richard Florida, but any scholar in any locality who prepares any report that helps decision-makers and community leaders "see" their region in a new way.

In 2003, for example, a colleague and I were commissioned to prepare a study on the "high tech sector" in Canterbury (Saunders and Dalziel, 2003). We interviewed 34 senior managers drawn from the region's largest electronics and software firms as well as from key public and private sector support agencies. Participants in those interviews spoke about why they were based in Canterbury, including many comments about the presence of other similar firms, the quality of their lifestyle in the region and the value of graduates and researchers from the region's tertiary institutions.

Thus when it came time to analyse the interview material, it made complete sense to use the metaphors of industry clusters, cultural capital and regional innovation systems, not because we were wedded to those concepts from overseas evidence, but because they resonated with the views expressed to us by leaders in our community. Further, in a good illustration of Sheila Dow's Babylonian approach, the different concepts and the different viewpoints reinforced each other in a way that not only built confidence in the sector but also helped key stakeholders see how their individual viewpoints were placed in a much larger picture. This had two consequences.

First, the report recommended that the region's universities and high tech enterprises collaborate to prepare a proposal for capital investment from the private sector and from the government's Partnerships for Excellence programme that would create a new facility for fostering better linkages between tertiary education institutions, industry, and business. This was done and the purpose-built state-of-the-art National ICT Innovation Institute was opened at the University of Canterbury on 23 April 2009.

Second, in the planning to rebuild the central business district after the 22 February 2011 earthquake, the Christchurch City Council has included provision for a new high-technology Enterprise Precinct and Innovation Campus (EPIC) in the south-east quarter. The Draft Central City Plan explains (Christchurch City Council, 2011, p. 112):

> The benefits of this development are twofold: in the first phase it protects existing businesses and employment and allows high-tech sectors to continue to grow. In the second phase it acts as a catalyst for high-growth potential businesses and presents an opportunity for Christchurch to position itself as the key high-tech employer in New Zealand.

Thus the high tech sector is now part of the Christchurch identity in a way that was not true ten years ago. Caroline Saunders and I did not *cause* that change, but we did make an important contribution. Our use of concepts and theories drawn from the regional studies discipline to express the views held by leaders in the community helped to shape the shared imaginative landscape of the sector. This illustrates the power of good regional analysis.

In summary the second dimension to my answer to the McCann critique is that validity is supported when concepts resonate with the experience and views of community decision-makers about how to promote well-being. This second dimension is supported by the recent emphasis in regional science on the importance of leadership and effective institutions in regional communities (see for example Stimson, Stough and Salazar, 2009, and Kroehn, Maude and Beer, 2010) and on the importance of creating and analysing measures of subjective well-being (see for example Kahneman and Krueger, 2006, and Morrison, 2011).

Bringing both dimensions together, the common element is "reasoned discussion": reasoned discussion with our peers in the community of regional scholars and reasoned discussion with

the representatives of the communities who must ultimately decide where to invest their time and other resources. This is enormously challenging work, but for scholars who want to make a difference for regional communities it can also be enormously rewarding.

WELL-BEING ECONOMICS: AN ILLUSTRATION

I have suggested that at the heart of well-being economics is the principle that the best judge of an individual's well-being is generally the individual himself or herself. I want to finish this address with an illustration of the importance of this principle.

As commented in the previous section, the purposes of local government are very broad. They sanction, for example, the involvement of Councils in providing facilities for sport and recreation of their communities, including maintaining lakes, rivers, beaches, parks, camping grounds, sports fields, stadiums, swimming pools, recreation centres, gymnasiums, cycle ways, walkways, playgrounds, picnic areas and botanic gardens. Earlier this year, I was asked by Sport and Recreation New Zealand (SPARC) to analyse the economic and social benefits of the sport and recreation sector at the national level and at the level of regional councils.

At its simplest level, the economic value of any industrial sector is easily estimated. The boundaries of the sector must be defined, and then the System of National Accounts can be used to estimate the total "value added" by enterprises providing goods and services within the defined boundaries. Applying this technique for this project (the details are explained in Dalziel, 2011a), 17 sport and recreation industries were identified, which in 2008/09 were estimated to have contributed $3.8 billion or 2.1 per cent of New Zealand's gross domestic product (GDP).

A broader analysis recognises that there are important economic activities strongly related to sport and recreation not included within the 17 identified industries. The report for SPARC measured the value added by (i) people working in sport and recreation occupations outside the 17 industries; (ii) investment by central government in sport and recreation education in schools; (iii) local government expenditure on new sport and recreation facilities; and (iv) the market value of volunteers working in sport and recreation clubs. These items raised the market value of the sector to $5.2 billion or 2.8 per cent of GDP (extended to include the market value of volunteered work).

That estimate of 2.8 per cent of GDP indicates the importance of sport and recreation to the economic well-being of communities in New Zealand. But the report then went on to ask another question: what is the value *to the participants' personal well-being* to justify the time they spend in sport and recreation activities?

This question was answered using 'revealed preference' to value the opportunity cost of time spent in sport and recreation. Survey data suggests that an average New Zealand adult aged 25 to 34 spends about 146 hours per year engaged in sport and recreation. Assuming 8 hours per working day, this is equivalent to just over 18 working days. At the beginning of the year, such a person *could* have chosen to spend this time in a secondary job (or in a primary job if not currently employed). The fact that the person did not make that feasible choice, but chose instead to participate in sport and recreation, reveals that the person obtains more value from the sport and recreation than would have been obtained from the secondary job.

As well as time spent actively participating in sport and recreation activities, New Zealanders also spend time as volunteers for sports and recreation clubs and watching their children participate in organised sport. The same argument applies to this use of time; the person must obtain more value from these activities than would have been obtained from working in paid employment. Further, items such as transport costs, clothing costs and equipment costs are

likely, on average, to be not significantly greater participating in sport than participating in employment. Thus it is reasonable to take the potential income earned in employment as a measure of the opportunity cost of time. To be conservative, the study used the statutory minimum wage ($12.75) to measure this potential income, even though most people earn a higher hourly rate than this figure.

The results are shown in Table 2, which summarises the total number of hours spent in sport and recreation in 2009, amounting to 544.9 million hours. The final column uses the statutory minimum wage to calculate the value of time associated with those activities. The largest value is the active participation of adults, calculated at $5.3 billion, followed by the watching of young people's active participation at $1.0 billion. The total value is $6.9 billion.

Table 2 Value of Time Spent in Sport Participation and Volunteering for Adults, 2009

Activity	**Total Hours (millions)**	**Total Value ($ millions)**
Adult participation in sport and recreation	418.7	$5,338
Watching young people in organised sport	75.0	$956
Volunteering for sport and recreation clubs	51.3	$654
TOTAL	**544.9**	**$6,948**

Source: Dalziel (2011a, p. 96).

The total of $6.9 billion is a substantial figure. Recall that the study's estimate of the market value-added was $5.2 billion. Thus the 'market value-added' created by providers of goods and services in New Zealand's sport and outdoor recreation sector is outweighed by the 'personal value-added' that New Zealanders create for themselves by participating in sport and outdoor recreation activities.

I think Professor McCann is correct when he says we do not understand this feature well. Participation in sport and recreation is an example of what we might term "social capital" and watching our children play sport may be part of what we consider "cultural capital". Scholars include indicators such as these as explanatory variables in models of regional economic development. The SPARC study, however, suggests that they are valued aspects of personal well-being in their own right; a major part of how regional communities create lives they collectively value and have reason to value.

Kia ora tātou katoa; may we all enjoy well-being.

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Building Regional Adaptive Capability through a Local Government Insider-Researcher Network

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ABSTRACT

This paper reports on the development and early deployment stages of an on-going local government 'insider-researcher' network. This represents a *new model for research engagement and development* between regional universities and local councils. It serves as an infrastructure to generate multi-level benefits to the parties involved. That is: the development of knowledge and skills for the individual council employee participant; research and action on strategic projects for the councils involved; and, collaboration, knowledge development and exchange between councils and local tertiary institutions. This model may provide impetus to other councils seeking ways to build their internal capabilities and capacities to be able to respond effectively to the diverse challenges faced in the regional government sector. Over time, the numerous and multidisciplinary research outputs generated from such an initiative contribute to sector knowledge and councils' abilities to initiate and lead effective changes in policy settings and sector practices.

1. INTRODUCTION

Regional centres not only need to build adaptive capability to survive and recover from traumatic events but also the capabilities to deal successfully with strategic and environmental challenges that persist and which require effective and more often than not, proactive and systematic attention. Like many other regional authorities worldwide, local councils in Australia and New Zealand are under continual pressure to lift performance in response to their constituents' needs and expectations of efficiency, sustainability, participation and social equity. Regional councils are thus at the forefront of dealing with a raft of complex local social and economic issues, higher level government impositions concerning new policy development and deployment and fiscal income constraints, while managing challenges from multiple community groups to their decision-making activities. An example of this is the decreasing funding support from State or Federal governments and increasing restrictions on local government capacity to raise revenues from ratepayers e.g. the NSW State Government cap on yearly rates increases. Within this contextual fabric the work of government and associated agencies has thus become more knowledge oriented which relies heavily on the human capital involved to exchange knowledge, learn and solve issues and become performance focused (Agranoff, 2008). To state that local government is a difficult and challenging proposition when confronted with such complex and diverse matters is perhaps an understatement.

In dealing with such issues, local government authorities seek to source and engage appropriate technologies, establish structures and processes to aid efficient and ethical decision-making and recruit and develop the necessary skilled human resources. These actions, whilst intended to always be appropriate and successful are often less so. As seen by specific events in the local government area, sometimes technologies don't work effectively in their context, organizational structures and processes do not always support efficient decision-making or detect unethical activities and training and development of employees is frequently limited to generic coursework programs provided by educational institutions and consultant bodies. Such typical cognitive learning focused training and development programs are most often quite valuable but do not provide a means to deeply develop the in-house investigative and critical management knowledge and skills so important for people at the forefront of leading activities in the local government sector. With such higher-level skills employees are able to exhibit a better capability to adapt to new situations and indeed, be able to embrace those new situations in a formative way rather than simply remaining reactive or subject to them. Moreover, despite the multifaceted activities that councils are involved in, there is a significant lack of research about many issues specific to or as applied to the sector. Perhaps by introducing a research program that jointly focuses on the development of critical staff within councils and the development of knowledge and actions on important strategic projects for each council, one might effectively achieve two outcomes. These involve the growth of an individual's knowledge and skills and council's knowledge, and the capability for both to confidently and competently act. Critically, this may be underpinned by a coupling to the research expertise of a local tertiary institution to guide and inform such activities. Thereby, adaptive capabilities of the individuals and their employer are enhanced directly through research. Added to this, if a number of local government authorities interlinked their various researchers' efforts in a knowledge creation and knowledge sharing situation over time, participants may develop a communal capacity for handling change and also provide a series of knowledge inputs to the sector more generally, that will help the sector to progressively become more adaptive. Thus, such a network [to be considered as an embedded network substructure as opposed to a freestanding cluster (Isett *et al*, 2011) in this paper] would provide a venue to develop and harness the social capital within and between participant councils and in positively deviant ways, enhance sustained organizational and intraorganizational learning (Casebeer *et al*, 2009). Hence, as Agranoff (2008) indicates, such networks become important platforms for activating individuals and for deepening and broadening the knowledge pool through facilitating formal and informal social exchange (Isett *et al*, 2011). In large part also, such an approach aligns with Hagen and Liddle's (2007) call for more and improved attention to the executive development and education needs of public sector management.

Consequently, the purpose of this paper is to simply report on the development and early deployment processes of a new and formal network of local government 'insider-researchers' supported by a local tertiary institution, and to articulate the core structural elements of such an innovation. This network commenced operation in August 2011 and given its primary aim, the paper does not present a deep theoretical elaboration on such a development. In essence, it provides an initial insight into a revelatory case study (Yin, 1994) of such a research network and thereby furnishes one account of how local government authorities may develop their human and technical systems capabilities and performance through leading-edge applied research activities professionally undertaken by council staff. It also indicates an alternative way for local government authorities to connect with local tertiary institutions and with each other in order to generate collective knowledge and build communal adaptive capabilities at the local level in the first instance, and then through dissemination practices across the sector.

Beyond the immediate case study, the insights/outcomes generated likely represent untapped opportunities and value in many other regional centres.

To achieve its aims the following section of this paper will elaborate on the opportunity and the context in which the network and its development is embedded and thereafter, articulate some specific features of the reported case. The section that follows will then identify the core structural aspects of the case study model. Following this, the paper will articulate the practical implications of this new model for local government practice and then provide some concluding remarks and outline opportunities for further research.

2. THE OPPORTUNITY AND THE CONTEXT

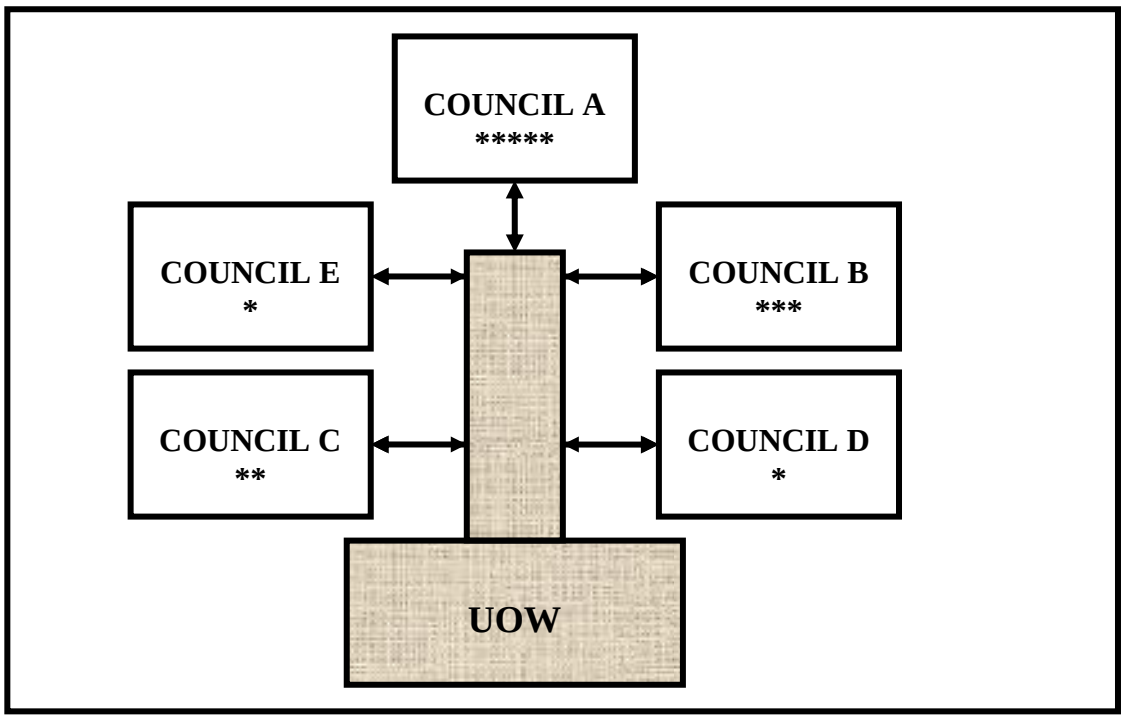
The author of this paper had previously been involved with a local council in undertaking some small contract research projects and in jointly developing a major research grant application. Through those activities a number of further collaborative projects within that local council were jointly identified. The author recognised that some of those possible research projects may have utility in or at least some interest for other councils and started to speculate that perhaps there was a larger opportunity here. He further conjectured that quality 'in-house' research skills and well supported applied research projects more generally in the sector appeared to be somewhat lacking – despite the potential practical benefits to the sector and to knowledge development within and beyond it. Hence, the genesis of this research network initially was the relationship the researcher had developed with one council and thereafter, the further investigation and creative development of a proposal and subsequent discussions held with other councils. In pursuing this opportunity, the researcher was made aware by senior management people from across seventeen councils that: councils' acknowledged they had difficulties freely sharing information between them; their internal capability retention and development was deeply important to them; and, most councils genuinely sought to improve their lot and equally also, inform and improve the sector and its reputation. The research network (as proposed to them) offered an alternative and exciting way to help address those issues. The participant councils subsequently indicated that they considered this innovation as: highly beneficial to council and their employees and the university; providing opportunities to genuinely engage and share knowledge with each other to everyone's mutual benefit i.e. to enhance the knowledge quotient of those involved and to learn how to span the boundaries between agencies (Agranoff, 2008); and beneficial to the sector and its progressive development over time. Of course there were alternate views expressed by some councils which, while genuinely supportive of the program, highlighted some constraints they had about participating themselves. These included: small council size and thereby not having the resources available to cover those doing the research projects; no-one or too few employees interested in pursuing post-graduate research degrees; no employees possessing the minimal qualifications to enter the research program; major cost reduction pressures (e.g. not replacing staff as they leave and rate hikes) acting as a curb on discretionary expenditure on these perceived 'nice to do if you can afford it' opportunities; and a perception that they currently support enough staff training and development activities. These perceived constraints are reflected in what Krueathep *et al*. (2010), refer to as the dimensions of network formation i.e. local government networks may emerge [or not] as a result of the institutional settings (organizational size, years of existence and community complexity), tasks difficulty (resource dependency, task complexity), management capacity to act (managerial experiences and responsibilities and attitudes), local political climate and the socioeconomic context in which they operate.

In broad terms then, the local government (LG) context [of the participant councils] in which this program is located is one consisting of diverse and challenging pressures [from within and from without] continually confronting and impacting councils operations. These conditions encourage these councils to either seek out or be receptive to new potential ways to manage their 'empire of operations' and to change – whilst remaining highly cognisant of fiscal responsibilities to their constituencies. The LG context in this story perhaps at a foundation level, underpins the enthusiastic reception of participant councils to this initiative and also their active engagement.

3. Description of a New Model for 'Applied Research' Engagement between Councils and a Tertiary Institution

This case study model for research engagement with regional councils has two principal formative elements. The first being the development of councils' own staff as qualified researchers and the second being the University of Wollongong (UOW) acting as an independent facilitative hub for the research projects and candidates and for knowledge exchange between the participants. This model offers a fresh and engaging way to build local innovation capacity and capability which is significantly beneficial to all the stakeholders involved. Figure 1 depicts this rather simple network model.

Figure 1 The Case Study Consortium Research Network



As shown, UOW is acting as a significant foundation hub for the communication and organization of the network and its research activities. Given this consortium has recently formed and commenced operation, this degree of influence is not surprising. In time the necessity or expectation of UOW to serve as a principal means of communicating between the councils on research may shift as research relationships between those participants consolidate and grow. However, given the research emphasis inherent in building these relationships and its fundamental capabilities in research and research skills development, UOW will always be at the core of the facilitation of the research projects and knowledge

sharing and dissemination practices for the consortium. The stars depicted in each council box represent the number of first cohort research candidates from that council now engaged in research projects through the consortium.

Features of the Case Study Model

(a) Five councils are committed to participation in the consortium with UOW.

As intended, these councils are a mix of Sydney city based and regional councils (approximately within a 120 km radius of Wollongong or 1.5 hours travel time to the main campus) that would bring to the table a raft of different and also related issues for research and practice development. This expected diversity-similarity issues dialectic was considered very valuable for the consortium as it would add to the richness of the exchanges and the learning and knowledge development of the participants. Two of the councils involved can be classified as Sydney urban based, another is urban based but also a major regional centre outside of Sydney, and two others demonstrate both rural and also urban characteristics and are undergoing significant urban growth. These councils and 12 others that were approached were within that catchment zone which was determined to be logistically practical for the face-to-face connections and exchanges desired in the consortium's activities. In approaching those other councils who did not initially partake of the program, it has opened up the potential for them to become passive participants in the program through the provision of additional and accessible research sites for the research candidates' to use.

(b) Initial cohort of twelve research students consisting of senior council staff.

The councils had the freedom to nominate strategic projects across any discipline area and potential candidates to UOW to join the program. This however was not done in isolation to UOW expectations and minimal entry requirements for research degrees. The Director of the consortium worked with each council in briefing, supplying and preparing material to publicize and recruit participants (which each council adapted to their own internal processes), in auditing the proposed projects and discussing and clarifying them with each candidate, and in aligning potential supervisors with candidates and their projects. Hence, identification and confirmation of the individual projects and candidates to undertake them, while driven by a council's expressed needs/desires, was also a collaborative activity with UOW. Moreover, the fact that research degrees are HECS free and the flexibility in time afforded in undertaking a research degree were indicated as a strong incentive for these candidates to engage with this program – as opposed to coursework degrees that require regular attendance at lectures often at inconvenient times and at a financial cost to the individual.

As shown in Figure 1 above, the number of candidates and projects at each council varied considerably. The guideline initially provided to each council was a desire to see at least one or two candidates per annum from each council, but in the first year of the consortium that guideline would be relaxed on the basis of how many councils' ultimately joined. Consequently, some councils made a determination that they only wanted one or two key projects commencing in the first year and others more than that. In future years of the consortium, and in recognition of the supervisory resources at UOW and council resources, this number from each council will be prudently capped to a maximum of two per council. That way, the quality of the processes and the outcomes to be realised will be maintained. Even at that capped level, over the initial 3 year period, 24-30 research students from across the 5 councils are expected to have commenced their research degrees through the program. As an example of the diversity of these projects and the candidates, three are Doctoral level projects and the remaining nine are Masters by Research level – with some of those capable of being converted to a Doctoral study at a later time. The discipline areas involved range from

management, human resources, asset management, social science, marketing to urban planning. Some example project foci include: 'Developing a new model for infrastructure planning in new urban growth areas: A systems thinking approach', and, 'Measuring the success of cultural precincts: The development of key performance indicators'. Thus the program also fosters cross disciplinary knowledge generation and sharing between participants. All projects pursued have received the full endorsement and active support of the senior leadership in each council. That being, councils have agreed they will provide the necessary time to their employees involved in a consortium project to successfully complete it, to attend showcase seminars and conferences and any other situations that assist their project and, as appropriate, provide financial assistance or resources to do so. Since these projects are considered of significant importance to councils, it is not surprising that councils clearly demonstrate a substantial commitment of in-kind and direct support to their candidates.

(c) The consortium is intended to be an ongoing and increasingly more expansive collaboration between the parties involved.

This feature whilst appearing to simply reflect the general aspirations of any tertiary institution that wishes to connect with industry organizations is actually quite important to the direction and functioning of the consortium. That being, decisions made by the Director such as the timing of review committees, allocations of funds, and many other operational aspects, take a medium to long term view, particularly since the research projects are not short term i.e. they are completed over 3 to 6 years. Over the initial three years of the program, as the research relationships further develop between the councils and between the councils and UOW, there will be opportunities identified to generate new projects that may require funding from external bodies such as the Australian Research Council. In addition, there are possibilities to also utilise other full time research students or academic staff from UOW to address specific operational problems a council may be confronting. In these different but research focused ways, the consortium will underpin an expansion of relationships between the participants that otherwise may not have evolved.

(d) The Consortium has a Director who conceived, developed and is now managing it.

The author of this paper is the Director of the consortium. The continuity of his participation from conception to delivery has meant that he has considerable ownership invested in its success and in developing it further. Consequently, it has his ongoing purposeful attention rather than it being a cursory or assigned administrative academic role. His intimate exposure and knowledge of preceding formative actions assists him in being an effective leader of the program. The implication here clearly suggesting, that having ownership and knowledge of such a developmental process may be one key to successfully forming and launching such a network. To further support the Director in his work in this case study, a Review Committee consisting of a senior representative from each participating council and a similar number of senior academic researchers from UOW, including the Director, will regularly review the functioning of the full consortium program and seek to initiate the development of further collaborations and future projects that generate mutual benefits.

(e) Involves regular forums for networking, knowledge exchange and relationship building based on research activities

This feature is crucial in assisting the consortium members to build their relationships and their collective knowledge over time on research related matters. One early example of such actions, involves the operation of a customised research methods development program for the researcher candidates at the start of their candidature. This nine session long program runs on Saturday mornings over five months and provides the candidates a good exposure to

essential research methods skills. Much of the student work involved is performed outside of the actual sessions. At the end they are required to present a coherent research plan based on the knowledge gained through the coursework program and on their deliberations with their supervisors. This course is primarily intended to inform and guide their development as researchers while recognizing their skills as competent industry practitioners. It also serves to provide the initial impetus to build their relationships as all parties involved are moved beyond their traditional comfort zones as practitioners. In the near future, regular showcase events will be held that highlight these candidates projects and also some university lead research that may have utility in the sector. The invited guests to those events will be all the researchers in the consortium, appropriate council representatives and the supervisors involved. It is intended that these events involve an intimate expose of the projects where exchanges between guests and researchers are encouraged.

(f) All direct costs associated with the program are funded through small annual contributions from participant councils

This feature of the case model recognizes the fiscally constrained context that councils are forced to work within but also that there are expenses involved in running a high quality targeted program that will appropriately support their staff's research skills development and the development of research collaborations with other councils. It also reflects a financial critical mass to adequately support those consortium activities and an orientation of the Director to astutely manage consortium expenses – reflected in the provision of administration support for only one day per week. It is intended that there will be sufficient funding available each year to also support the dissemination of research outcomes at international or national conferences by a number of candidate researchers. In addition to managing direct costs, the parties also make substantial in-kind contributions. UOW makes a large indirect contribution to the program through research supervision, endorsements, Director representations and visitations to participant councils and other bodies, organization of and participation in forums, provision of venues for forums and meetings, provision of research facilities/tools for the candidates and other administration support for items such as conference and journal paper preparations. The councils make similar in-kind contributions through endorsements, representations, staff released for research and forums participation, staff attendance at conferences and support facilities for their staff researchers. In all, each council makes a minimal cash contribution to the consortium each year which is prudently managed to ensure the quality of the program and that stakeholder expectations are met.

4. CORE STRUCTURAL ASPECTS OF THIS NEW MODEL

Solely based on the development and recent deployment of the case study reported on here (as discussed above), and in its rawest terms, the core structural aspects of this model relevant to other settings include the following:

A critical mass of councils – Identify a critical mass of target councils for funding capabilities and knowledge exchange potential.

The staff insider-researcher is at the core – All parties involved require a continued focus and commitment and undertake clear and supportive actions towards developing nominated council staff to achieve Doctoral or Masters by Research degrees.

Projects must be relevant and valued – Research projects must be concerned with important issues facing councils' operations.

Communal knowledge management processes are essential – Establish communal knowledge generation and sharing processes throughout the network life cycle.

Research supervision capabilities and capacities – progressively confirm the availability of research expertise in the tertiary institution to guide research projects and the development of council staff as researchers.

Long-term and collaborative perspectives – Take a long term collaborative relationship view for the program and treat that as a core value.

Establish a champion early to own the process – Embed a Director early to facilitate and guide such a program's actions and relationship building with councils.

Share the financial costs involved – Fund the program through equitable and small cash contributions from participant councils with all parties contributing in-kind support.

Notably these eight structural aspects are interacting and complementary and therefore if any one structural aspect is overlooked then the success of the initiative may be less than desired. Overall, this model promotes industry based and context relevant insider-research which generates empirically grounded knowledge and tools to assist council employees and their organizations to adapt and change. Therein, UOW as the participating tertiary institution in this case, is a very important and very active participant in the functioning of the consortium and in generating and disseminating outputs from it.

5. IMPLICATIONS FOR THE LOCAL GOVERNMENT SECTOR

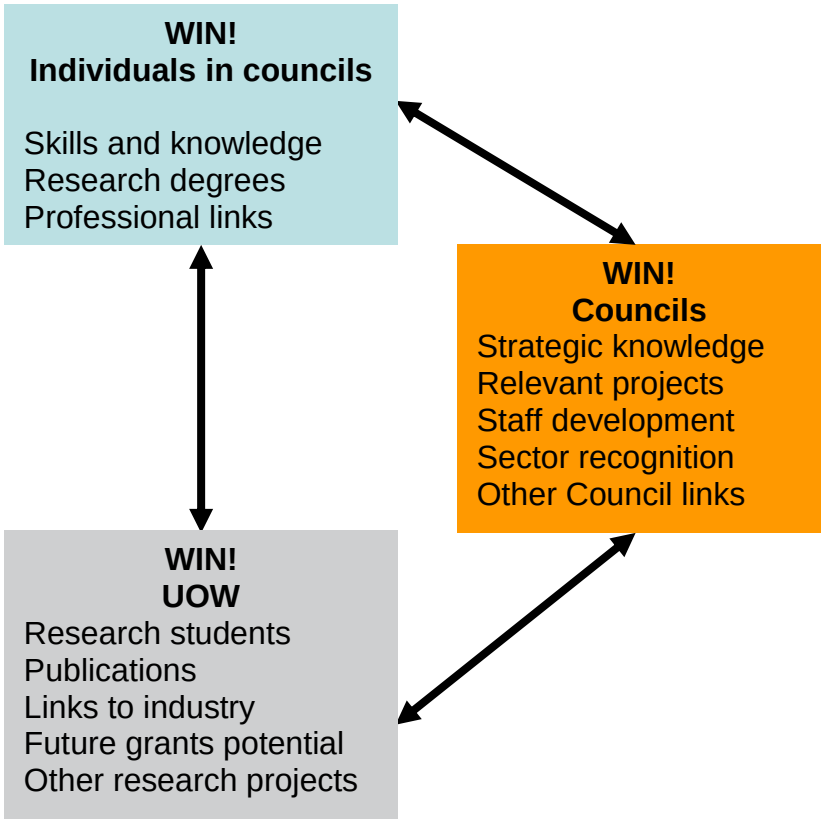
The practical implications of this model of research engagement between local councils and tertiary institutions, for the local government sector are quite significant. The first concerns councils' investment in developing their own people through a research channel. This approach is clearly different to the standard training and development packages which arguably deliver more immediate and normative outcomes. A research orientation places a sharper focus on the longer term and progressive development of individuals which may not produce immediate results and may be comparatively more chaotic and challenging in process for the individual and the council involved. Hence, councils will need to be receptive to such deviations and differential expectations. A second implication concerns councils becoming more actively and directly involved in the generation of new knowledge for the sector. As their 'insider-researchers' undertake their research on important issues confronting their council employer, their council and indeed additional councils necessarily provide the sites and the access to information sources to help better understand phenomena in their contexts. This means they will need to be explicitly and implicitly supportive and tolerant of their researchers probing their organizations and at times, revealing and reporting on matters that may be uncomfortable but necessary if one is to address issues appropriately. In being such active players in the research process, councils can become the generators or exporters of new knowledge to the sector rather than remain as just recipients of knowledge from other research external to their regional contexts or even the sector itself. A third implication concerns councils' purposeful research engagement with local tertiary institutions and other councils. Whilst there are many examples of engagement processes between such entities across the sector, this model specifically opens up new relationship opportunities for councils and their staff to regularly access or 'tap into' knowledge and research expertise residing in our tertiary institutions and to access knowledge in other councils. The challenge for councils (and also the tertiary institutions and their staff) is to build and maintain such externally focused relational activities so as to ensure the highest quality of any research project outcomes and to stimulate new projects/possibilities that may benefit all. A final implication for councils involves their preparedness to more broadly expose matters relating to their operations through the research projects and through the dissemination of the research findings across the sector. In participating in such a network, councils need to accept that

information on their functioning may be explicated and shared (in sensitive and aggregated ways) with other councils, and also to the sector and beyond through academic publications. Hence, any high sensitivity to such matters may be problematic for their successful engagement in such a program.

6. CONCLUDING REMARKS

The relevance of research to practitioners' real problems is highly desired in the public administration sector internationally (Isett *et al*, 2011). The model presented in this paper is an excellent example of one way to systematically achieve such an outcome where the research projects and the candidates pursuing them are intimately related to strategically important operational matters for the organizations concerned. In one sense, who better to investigate a real practitioner problem than the practitioner themself, provided they are equipped with the research and analytical skills and the academic guidance and support necessary to ensure both theoretical and practical robustness. The network to-date has spawned twelve new, diverse and applied research projects in the sector that will generate new knowledge across a number of discipline areas and whose findings will have relevance across the sector and beyond. This research network is clearly one that is highly approachable and practically oriented for those involved. Through their human and social capital invested in the network operation over time, it will facilitate and promote the building of local government internal capabilities and capacities to be able to adapt and lead change in their practices.

Figure 2 Benefits to the Stakeholders Involved



In essence, as shown in Figure 2 above, the reported network presents a win-win-win situation for the participants involved. For example, UOW will benefit from additional research students and publications. Councils will benefit from new research linkages with other

councils and from having work performed on strategic projects of value to them with the development of new methods or tools to address those challenges. Individual researchers will benefit from obtaining new skills and knowledge and links to others in the sector as well as achieving a formal high-level research degree. Consequently, little wonder the model presented in this paper has received such strong support from the sector. Drawing on this case alone, some core structural aspects of the network have been postulated. These structural keys may have utility and relevance for other regional councils that seek to improve their adaptive capabilities through an emphasis on research.

Limitations of this Paper and Further Research

As stated previously the purpose of this paper was to report on one case study of a new and formal network of local government 'insider-researchers' supported by a local tertiary institution, and to articulate the core structural elements of such an innovation. Subsequently, the paper did not attempt to provide a deep theoretical analysis on such a development. Any deeper theoretical and more expansive evaluation of this singular case will be the subject of further research and publication activity. Also, the core structural aspects proffered in this paper are not intended to be viewed as always universally applicable to any research network in the local government sector as this is an exemplar study of a unique singular case. Thus, the possible applicability of those outcomes in other contexts should be interpreted wisely from that perspective.

In respect to further research building on this study, there are a couple of more apparent options to progress. Firstly, this original network will be under ongoing research scrutiny by the author over the next three years. As such, a process study which captures the intimate perspectives of all the players involved may offer further and deeper insights into the functioning of the human actors in such a network organization and how that relates to or impacts its success. Furthermore, assessing the uptake and impact of the findings generated from potentially some 30 research projects across the participant council organizations may also prove informative for the industry organizations and the academic institution involved.

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Regional Development Before and After an Earthquake: The Canterbury New Zealand Experience

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ABSTRACT

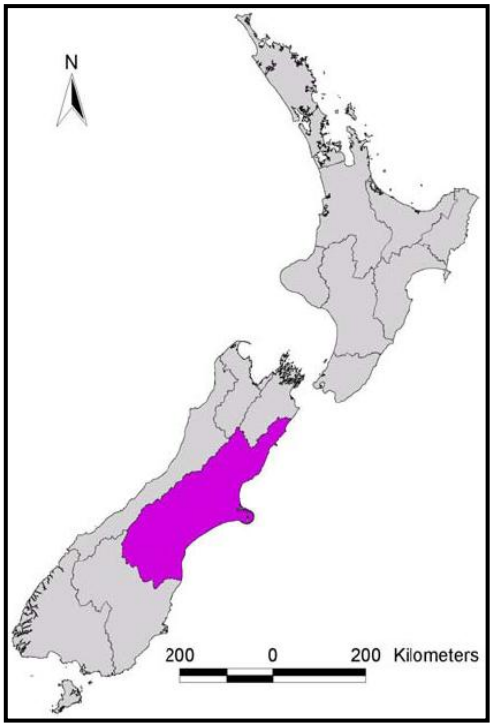
The authors were responsible for leading the preparation of the Canterbury Regional Economic Development Strategy (CREDS) in September 2009, twelve months before a series of three devastating earthquakes destroyed large parts of the central business district of the region's largest city, Christchurch. The authors were commissioned to prepare an evaluation of the impact of the first earthquake and to write a report on opportunities for one of the region's two universities in the post-earthquake environment. They have acted as advisors to planners before and after the earthquakes. Drawing on these experiences, the paper presents the analytical model that was used in 2009 to identify key sectors for regional economic development and reflects on the implications of that analysis for planning after the natural disaster.

1. INTRODUCTION

The Canterbury region covers 4.8 million hectares in the middle of the South Island of New Zealand (see Figure 1). To the east, the Canterbury coastline extends along the Pacific Ocean, from Kekerengu Point in the north to the Waitaki River in the south. The Canterbury Plains extend westwards to the Southern Alps, overseen by Aoraki/Mt Cook, the tallest mountain in Australasia (3,754 metres).

Eighteen major rivers flow across the plains to the sea: Clarence (Waiau-Toa), Conway (Tūtae Putaputa), Waiau, Hurunui, Waipara, Kowai, Ashley (Rakahuri), Waimakariri, Selwyn (Waikirikiri), Rakaia, Ashburton (Hakatere), Hinds (Hekeato), Rangitata, Orari, Opihi, Pareora, Waihao and Waitaki. Nearly 90 per cent of the Canterbury area is covered by pastoral grasses, tussock, scrub or bare land, with another 8 per cent devoted to forests.

Figure 1 The Canterbury Region



Source: Morgan *et al*. (2002, p. 8).

The first settlers in the region were Māori, beginning with the Waitaha tribes, followed by Ngāti Māmoe and then Ngāi Tahu. As successive migrations arrived, they defeated or intermingled with their predecessors, so that today Ngāi Tahu describe themselves as 'the iwi comprised of Ngāi Tahu whānui; that is, the collective of the individuals who descend from the five primary hapū of Ngāi Tahu, Ngāti Māmoe and Waitaha, namely Kāti Kurī, Ngāti Irakehu, Kāti Huirapa, Ngāi Tūāhuriri and Ngāi Te Ruahikihiki' (see the Ngāi Tahu website at www.ngaitahu.iwi.nz/About-Ngai-Tahu/).

The first wave of organised European migrations began in England with the formation of the Canterbury Association by John Godley and Edward Wakefield in 1848 and the arrival at Lyttelton of the Association's first four ships in December 1850. Further vessels brought the number of European settlers in Canterbury to 3,000 by the end of 1851. In 1852, New Zealand was divided into six self-governing provinces, including Canterbury. These were replaced by a national government on 1 November 1876, with local government devolved to 64 counties. The system of local government has continued to change over the decades. Canterbury now has a Regional Council, known as Environment Canterbury, which covers territories governed by nine District Councils and the Christchurch City Council.

Figure 2 comes from Environment Canterbury's (2008) Regional Land Transport Strategy. It shows the region's strategic land transport network, and is a good representation of the integrated province. There are five main points of entry by land. From the north, State Highway One brings traffic from the top of the South Island through Marlborough into Canterbury and towards Kaikoura. To the west, three mountain passes provide access from the north-west (Lewis Pass), the west (Arthur's Pass) and the south-west (Lindis Pass). From the south, State Highway One brings traffic from Oamaru in North Otago towards Timaru in South Canterbury.

The city of Christchurch lies at the centre of the network. In the 2006 census, two-thirds of Canterbury's normally resident population (521,832 people, which was 12.9 per cent of the national population) lived in Christchurch City (348,435 people). Christchurch International Airport is the point of arrival into the province for many visitors from overseas and the rest of New Zealand; it recorded three million passenger arrivals in 2010 (www.christchurchairport.co.nz). The Lyttelton Port of Christchurch is the largest port in the South Island and the third largest port in New Zealand. Total volumes through the port are approximately 10 million tonnes per annum (www.lpc.co.nz).

On 4 September 2010, Canterbury experienced a large and reasonably shallow earthquake (magnitude 7.1 at a depth of 10 km), centred 40 km west of Christchurch city. At the time, this was the most damaging earthquake in New Zealand since the Hawke's Bay earthquake in 1931, but fortunately there was no loss of life, in part because of the timing of the earthquake (4.35am on a Saturday morning) and its distance from the main population centre of Christchurch.

On 22 February 2011, a second and more devastating earthquake occurred. It was smaller (magnitude 6.3), but took place at 12.51pm on a working day and was centred in Lyttelton Harbour, much closer to Christchurch city. It is regarded as one of the most significant disasters in New Zealand history, causing 181 fatalities. The Reserve Bank has estimated that out of approximately 220,000 homes in the city, around 165,000 were affected, including many made uninhabitable (Bollard and Ranchhod, 2011). The Christchurch central city business district was effectively closed down, and the Reserve Bank estimates the total cost of the damage to be in excess of $20 billion (around 10 per cent of the country's gross domestic product).

Figure 2 Canterbury Regional Strategic Land Transport Network

Source: Environment Canterbury (2008, p. 98).

A third large earthquake occurred on 13 June 2011, at 2:20pm. It was another magnitude 6.3 shock, again centred close to Christchurch. It followed a magnitude 5.6 shock just 80 minutes earlier. There were no fatalities, but there were 46 serious injuries and further damage to property, including in parts of the city that had not been so badly affected by earlier shocks.

By the end of October 2011, the Canterbury region around Christchurch had experienced 33 seismic shocks measuring above 5.0 on the Richter scale, and more than 2,750 shocks greater than 3.0 (www.geonet.org.nz/canterbury-quakes/aftershocks/). The Canterbury Earthquake Recovery Authority summarised some of the property damage as follows (CERA, 2011, p. 9):

> More than 100,000 houses have been damaged requiring repair or rebuilding. A significant number of properties will not be able to be redeveloped in the short to medium term due to serious land damage. Many homeowners and occupants will move to new locations. More than 60% of the 5,000 businesses in the CBD and their 50,000 employees were displaced, although overall unemployment levels were largely unaffected. More than one third of central city businesses are unable to operate, with another third operating from makeshift premises. The earthquakes closed many swimming pools, historic buildings, museums, churches and sports clubs, with many facing demolition or extensive restoration work. Organisations and community services have been dislocated and the large volunteer networks that run activities and organisations have been disrupted.

Before the earthquakes, the authors of this paper had been involved in the development of two major regional economic development strategies: the Canterbury Regional Economic Development Strategy (CREDS, final document completed 25 September 2009) and the Christchurch Economic Development Strategy (CEDS; consultation document completed 3 August 2010). The authors were also involved in an initial assessment of the economic impact of the earthquake of 4 September 2010, which became out-dated once the more devastating earthquake of 22 February 2011 had occurred.

The purpose of this paper is to summarise those initiatives and to begin to ask the question: what changes, if any, need to be made to the analysis in the previous regional economic development strategies as a result of the damage caused by the Canterbury earthquakes?

The structure is as follows. Section 2 summarises the main results of the CREDS exercise. Section 3 explains the Canterbury Economic Development Model, which was created as a joint venture between the AERU and the Canterbury Development Corporation as part of the work to produce the CEDS consultation document. Section 4 summarises the evaluation completed by the AERU after the first earthquake. Section 5 concludes with a discussion of the above research question. There is a brief conclusion in section 6.

2 THE CANTERBURY REGIONAL ECONOMIC DEVELOPMENT STRATEGY

The Canterbury Regional Economic Development Strategy (CREDS) was prepared by a research team appointed at the end of November 2008, comprised of the AERU research unit at Lincoln University and the region's five economic development agencies: Enterprise North Canterbury, Canterbury Development Corporation, the economic and community development officers in the Selwyn District Council, Enterprise Ashburton and the Aoraki Development Trust. The exercise followed a template produced by the Ministry of Economic Development and published its final reports in September 2009.

Following that template, the AERU produced a report on the Canterbury regional profile and economic outlook in March 2009 (Dalziel and Saunders, 2009). That report collected and analysed statistical data on the province under a variety of headings. This was supplemented with a series of consultations with business leaders and key stakeholders, carried out by the project's economic development agencies. Strategic themes were identified from these two sources, and then drafted into pairs of strengths and constraints as listed in Table 1.

Table 1: Strengths and constraints in the Canterbury Economy, 2009

Strengths	Constraints
Canterbury is a great place for people to live.	The region is not promoted well, nationally or internationally.
The Canterbury economy has long been built on export growth.	Access to international marketing expertise is not always easy.
There is a wealth of experienced business people in Canterbury.	Access to capital, especially venture capital, can be difficult.
Canterbury businesses are responsive to market signals.	Volatility from overseas and demand seasonality can be issues.
Canterbury has abundant land, water and other natural resources.	Water storage has not been planned well for economic development.
There is a solid skill base in the Canterbury labour force.	Skill shortages, and workers with low skill levels, have been issues.
Canterbury has strong public and private research institutions.	Linkages between researchers and businesses are often weak.
Canterbury offers visitors a range of national iconic attractions.	Planning and marketing of tourism are not well integrated regionally.
Canterbury has good infrastructure, including the airport and seaports.	Infrastructure planning is disjointed, and rural broadband is expensive.
Canterbury is well-connected, with effective working relationships.	Regulations and compliance costs can hinder business growth.

Source: Dalziel and Saunders (2009, p. 9).

The strengths and constraints were paired, based on the view that the key constraints to be addressed in an economic strategy were those that were limiting the region's ability to build on its identified strengths. That view was used to define the strategic objectives, as set out in Table 2. The table repeats in the left-hand column the constraints from Table 1, and shows how these were translated into objectives on the right-hand column. Note that two of the constraints had two elements each, and so this produced twelve strategic objectives.

The twelve strategic objectives in Table 2 were presented in CREDS as a broad framework for the economic development of Canterbury as a region. In order to develop priorities from these the objectives, the research team identified key themes based on considerations such as time sensitivity, reinforcing nationally important regional strengths, promoting stepwise changes in regional development capability, producing large returns for small outlays, addressing equity and inclusiveness, and capturing engagement.

This analysis paid particular attention to: the evidence gathered for the Canterbury Regional Profile and Economic Outlook; the importance of avoiding duplication of work being carried out under existing Canterbury strategies; and feedback from public meetings across the region that reported findings from the consultations that had carried out by the region's economic development agencies. There was also a further round of consultation with key regional-level stakeholders.

Table 2: Constraints and Objectives in the Canterbury Economy, 2009

Constraints	Objectives
The region is not promoted well, nationally or internationally.	Potential migrants and investors are easily able to obtain reliable information about the quality of life in Canterbury.
Access to international marketing expertise is not always easy.	Canterbury businesses with export potential are easily able to access expertise in international marketing.
Access to capital, especially venture capital, can be difficult.	Effective systems support Canterbury firms obtaining access to capital, especially venture capital.
Volatility from overseas and demand seasonality can be issues.	Canterbury businesses are able to manage commercial volatility from overseas and seasonality of demand.
Water storage has not been planned well for economic development.	Canterbury producers are able to increase yields as a result of well planned investment in water storage.
Skill shortages, and workers with low skill levels, have been issues.	Firms in Canterbury are able to employ all the skilled and unskilled labour they need to grow.
	All Canterbury citizens are able to participate in quality education, training or employment.
Linkages between researchers and businesses are often weak.	Regional innovation systems include strong linkages between Canterbury researchers and businesses.
Planning and marketing of tourism are not well integrated regionally.	The planning and marketing of Canterbury tourism is integrated regionally.
Infrastructure planning is disjointed, and rural broadband is expensive.	Planning for infrastructure investment in Canterbury is integrated across the different types of investment.
	Canterbury citizens in rural districts are able to access quality services such as affordable broadband.
Regulations and compliance costs can hinder business growth.	Central, regional and local governments do not impose unjustified regulations and compliance costs on Canterbury businesses.

Source: Dalziel and Saunders (2009, p. 18).

This led to eight priority themes being identified by the research team. The governance structure for the CREDS exercise further refined the eight themes to focus on five key areas where enterprise and innovation were required to address fundamental issues in the Canterbury economy. The five key areas were:

- Canterbury Water
- Canterbury Intellectual Property
- Canterbury Trade Alliance
- Canterbury Connectivity (especially Broadband)
- Canterbury Tourism

Following the Canterbury earthquakes in 2010/11, two questions about the CREDS exercise arise. The first is whether the broad framework set out in Tables 1 and 2 is still applicable, or is it necessary to revisit the strengths, constraints and objectives in the light of the devastation caused by the earthquakes? The second question is whether the priorities identified in 2009 are still relevant in 2011, again given the devastation caused by the earthquakes? These questions are discussed in section 5 below.

3 THE CANTERBURY ECONOMIC DEVELOPMENT MODEL

In 2009, the AERU began working with the Canterbury Development Corporation (the economic development agency of the Christchurch City Council) to produce the Canterbury Economic Development Model (CEDM). The purpose of the model was to provide economic planners a tool for evaluating the strengths of industry sectors in the regional economy and for performing economic impact assessments of positive and negative economic shocks to sectors in Canterbury. The economic impact assessment module is a standard input-output model and will not be discussed any further in this paper. The sector selection module sought to integrate international market opportunities with local industry capabilities. This produced some surprising results and so will be explained in more detail.

The theoretical structure of the CEDM sector selection module (and its planning context) is shown in Figure 3. It begins with a definition of sectors. This is based on standard Statistics New Zealand classifications, but there is scope for user-defined sectors to be incorporated. For this exercise, 48 sectors are analysed. This is followed by an analysis of the international opportunities for each sector and its economic contribution to the region, as shown in the figure. Before the selection is made, consideration is given to the profile and history of the sector in the region and the sources of competitive advantage. The final row in the figure shows how a strategy can be designed by analysing the drivers for growth of each selected sector, focusing on industry inputs (labour, capital and natural resources) and on infrastructure, enabling industries and business conditions.

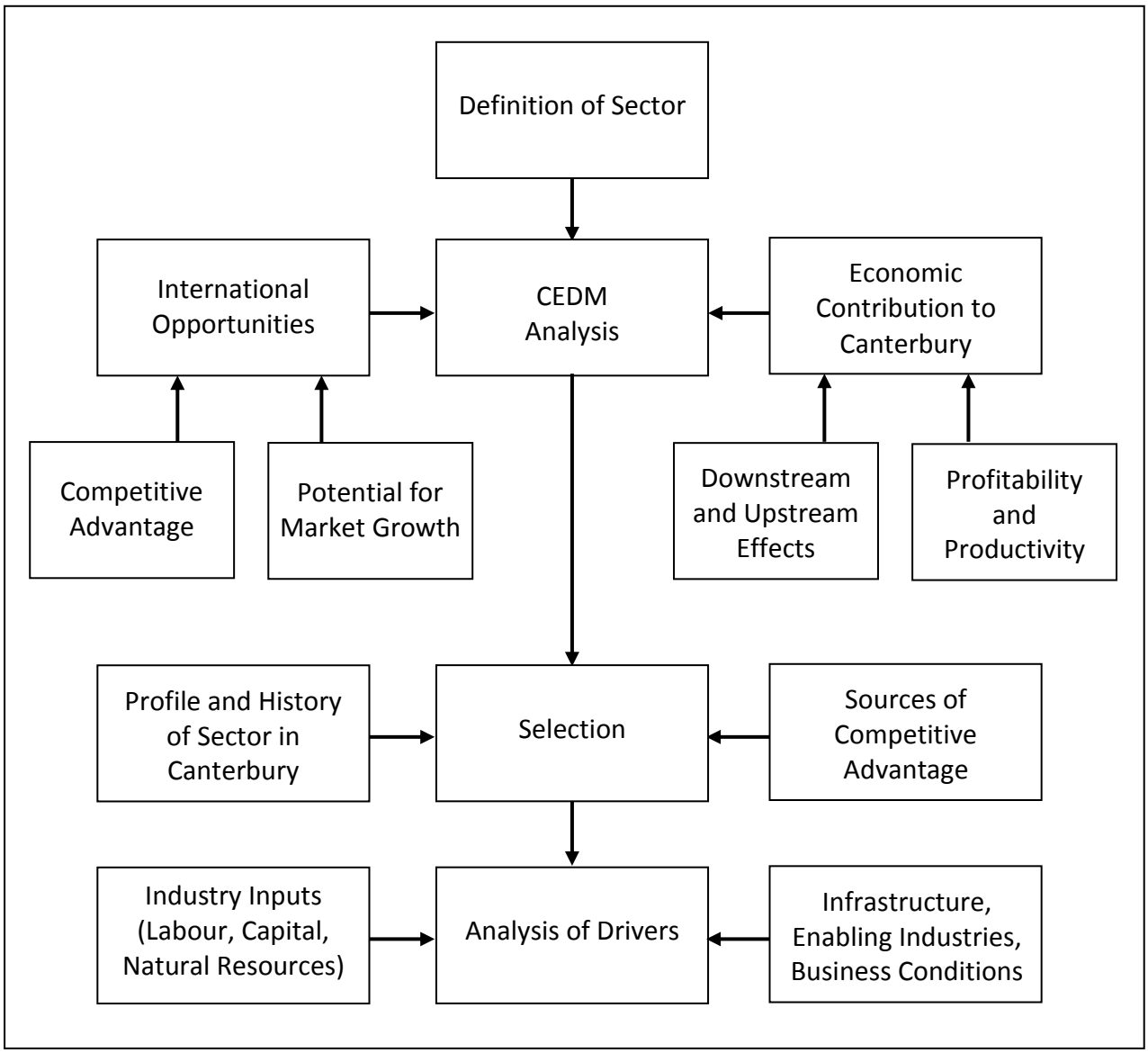
Thus there are six contributors to the selection of key sectors using the CEDM. For all but the last of these contributors (which relied on a qualitative assessment of government policies and trade barriers), the AERU research team identified one or two statistical time series that could be used as indicators. Descriptions of the data series are provided in Table 3. In total nine indicators are used in the CEDM.

The model allows sectors to be ranked from 1 (the strongest sector) to 48 on each indicator. An overall ranking is then obtained by ranking the unweighted sums of the nine indicators for each sector. It is important, of course, not to apply the model mechanistically without considering what drives the overall ranking of each sector. The strength of the model is that it provides a strong discipline to sector selection by requiring the planner to consider all of the pre-identified factors contributing to the region's economic development.

The model can be used to analyse either Christchurch city or the wider Canterbury region. The model's results for Christchurch city revealed that "business and finance services" was

the first ranked sector. Its strong points were: it had the second highest potential for market growth (expenditure in this sector increased by two per cent per annum between 1975 and 2005 in the UK and US); it had the second highest productivity with each worker contributing around $90,000 in value added; and it was the second highest contributor to the city's GDP, at around 17.1 per cent. It is also a sector with highly qualified employees, with 53 per cent having a qualification at level 4 or above. New Zealand has competitive advantage in this sector and Christchurch a competitive advantage to the rest of New Zealand.

Figure 3: Structure of the CEDM Sector Selection Module



This identification of business services as a key sector in Canterbury was surprising; it had not been a sector often mentioned in policy advice about regional economic development. Yet the evidence seems clear; this sector (when including property) had the largest increase in employment between 2001 and 2006, was the third largest employer in Canterbury, and grew much more strongly in Canterbury than would be expected from national trends. If the Canterbury region is to prosper economically, this analysis concluded that it is important that this sector develops in a way that enhances its own productivity growth and the productivity of the businesses it serves.

Table 3: Indicators Used in the CEDM

Contributor	Indicators
Competitive Advantage	Value-added per person engaged in the sector compared to equivalent sectors in Australia, Germany, Japan, UK and US.
	Value-Added per person-engaged comparing the region to the rest of New Zealand.
Potential for Market Growth	Historical trend of personal consumption expenditure in the UK and the US.
Downstream and Upstream Effects	Value-added effects using standard input-output multipliers.
	Employment effects using standard input-output multipliers.
Profitability and Productivity	Value-added per person engaged in the sector.
	Percentage of employees in the sector with Level 4 qualifications or higher.
Profile and History in Canterbury	Historic share of exports in the sector's production in Canterbury.
	Proportion of the region's gross domestic product contributed by the industry.

"Health and Community Services and Education" was identified as the second sector most likely to facilitate growth. It recorded the highest potential for market growth with average proportion of expenditure in the UK and US increasing by 3.2 per cent per year between 1975 and 2005. It also had a relatively strong impact on total employment and value added in the region. It is also a sector with the highest percentage of qualified employees (71 per cent having level 4 or above qualifications) and was a strong contributor to the city's GDP.

The third highest ranked sector was "Information and Communications Technology". This was the third highest potential for market growth with proportion of expenditure increasing by 1.3 per cent per year between 1975 and 2005 as well as having the third highest productivity at an average of $90,000 per employee. It had 41 per cent of employees with high qualifications and had a high value added impact with $1.06 million in increased GDP to the region from a $1 million increase in output. Christchurch also has a strong competitive advantage in this sector (4th) with employees on average producing 2.7 per cent more than New Zealand on average.

The next highest ranked sector was "Specialised Manufacturing". Its strengths included being Christchurch's largest exporter in the city, accounting for around 24 per cent of exports from the two ports and having a strong competitive advantage for the city (second highest), around 5.9 per cent more productive than New Zealand on average. It is also a sector with highly

qualified workers (fourth highest), with 41 per cent of workers having a high qualification and a highly productive sector (fourth highest), with around $90,000 in value added per worker.

The fifth ranked export sector was "Tourism". This had the second highest employment effect with 17.5 additional people employed for a $1 million increase in output. It was the fourth highest potential for market growth with expenditure increasing by 1.12 per year per person on average between 1975 and 2005 in the UK and US.

"Food and Beverage Manufacturing" was also highly rated as a potential sector. It was the city's second biggest exporter, accounting for around 19.1% of exports. New Zealand has a strong competitive advantage (4th highest) in this sector with Christchurch having a competitive advantage when compared to New Zealand (5th highest), being on average 2.6% more productive per worker.

The above analysis was for the city of Christchurch. A key sector for the wider region of Canterbury is "Agriculture, Forestry and Fishing". This is key sector for the region and has potential for growth especially given the opportunity for increased irrigation. Approximately 41 per cent of the Canterbury land area is grassland, for example, and another 41 per cent is tussock, with arable 6 per cent. Sheep, dairy cattle and beef cattle are the main livestock in the Canterbury region: 18.6 per cent of sheep in New Zealand are located in the Canterbury region, 14.4 per cent of dairy cattle and 13.3 per cent of beef cattle. There is a range of arable crops produced in the Canterbury region, accounting for 72 per cent of the arable area in New Zealand. Wheat and barley are the dominant crops in terms of tonnes harvested and hectares planted although specialist seeds are also important especially in terms of value added. Canterbury is also a significant producer of horticultural crops in particular potatoes and onions although their importance has fallen. Canterbury is the fourth largest wine region in New Zealand behind Marlborough, Hawke's Bay and Gisborne.

These considerations have been important for regional economic development planning in Christchurch. At the time of writing, for example, the Canterbury Development Corporation identifies five key sectors for its strategy (see www.cdc.org.nz/key-sectors/):

- Professional services;
- Manufacturing (especially specialised manufacturing);
- Information and communications technology (ICT);
- Food and beverage; and
- Agribusiness.

Following the Canterbury earthquakes in 2010/11, the question must be asked whether these key sectors are still relevant given the devastation caused by the earthquakes? This question is also discussed in section 5 below.

4 EVALUATING THE 4 SEPTEMBER EARTHQUAKE

Three months after the earthquake of 4 September 2010, the AERU was commissioned by the Canterbury Development Corporation and New Zealand Trade and Enterprise to review from an economic perspective the short and long-run implications of the earthquake for the Christchurch and Canterbury economies, and to test whether Council and central Government need to reconsider existing policy on development of the region. The analysis was out of date even before it was published as a result of the more devastating earthquake of 22 February 2011. Nevertheless, the report provided some empirical results on the impact of the initial earthquake that offer lessons for the discussion in section 5 to follow.

In particular, the AERU research team did not find anything in its study to suggest that the initial earthquake had had an impact that would warrant radical change to existing planning documents. Instead, the underlying comparative advantages of different areas of the region, and of the region within the national economy, appeared to have remained intact.

The report did find that some areas had been disproportionately affected, notably the central business districts of Christchurch and of Kaiapoi (a small town north of the city), and the sectors most affected tended to be in secondary retail, education, and tourism. Overall retail spending began to recover during the period, but consumer preferences moved to other centres, leaving a potentially long-term issue for the Christchurch CBD and Kaiapoi. The research noted that the earthquake did not create the issue for both CBDs, but rather seemed to have exacerbated a longer-term trend. Some specific findings from the research were:

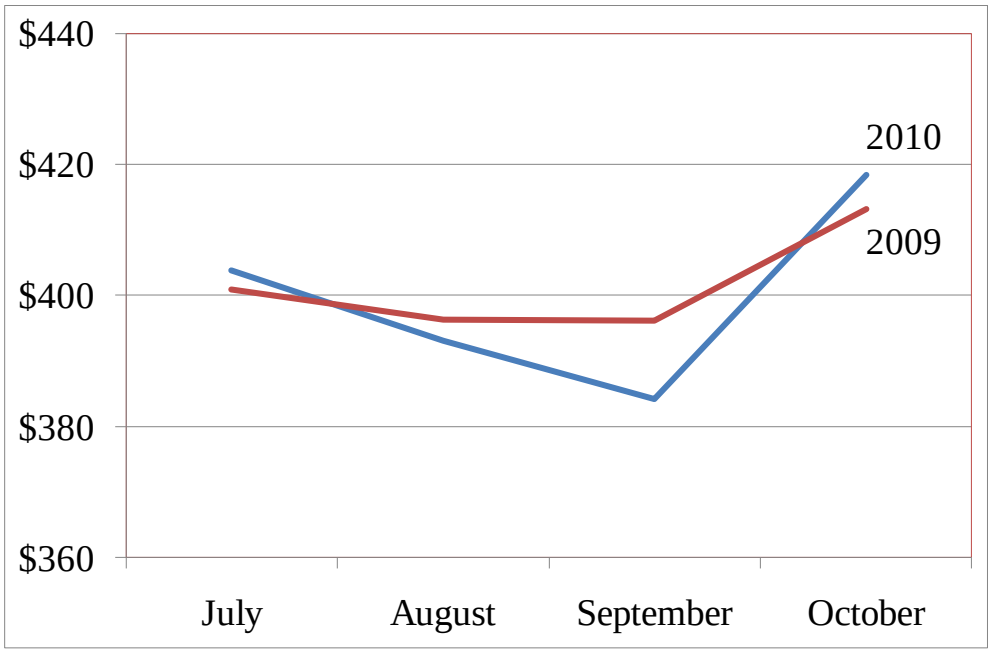
- 60 per cent of respondents to a survey undertaken for the research project stated that after ten weeks, the earthquake either had not affected their business or was no longer affecting their business.
- The direct impact of the earthquake on Canterbury business revenue after ten weeks was a reduction of $130.2 million per month. The estimated impact on costs was an increase of $3.8 million per month, giving a total reduction in net income of $134.0 million per month.
- The largest percentage impact on direct income was in Kaiapoi (down 17.7 per cent) and the central business district of Christchurch (down 10.6 per cent).
- Five sectors accounted for more than half the region's loss of income: Professional, Scientific and Technical Services (15%); Other Store-based Retailing (13%); Property Operators and Real Estate Services (12%); Food and Beverage Services (7%); and Finance (7%).
- Largest falls relative to the size of the sector were: Sport and Recreation Activities; Library and Other Information Services; Other Store-Based Retailing; Accommodation; Insurance and Superannuation Funds; Food and Beverage Services; Rental and Hiring Services (excluding Real Estate); and Non Store Retailing, and Retail Commission Based Buying and/or Selling. All of these sectors experienced a reduction in current revenue of more than 9 per cent.
- The value of exports through the Port of Lyttelton and Christchurch International Airport remained higher from July to October 2010 than in 2009. This suggested that the export sector in Canterbury was not greatly affected.
- Based on survey replies, the anticipated impact of the earthquake in a year's time (after week 10) is an increase in monthly revenue of $77.2 million, an increase in costs of $22.9 million and hence an increase in net income of $54.3 million. Hence, businesses are anticipating that revenue will rebound within a year but only by 59.3 per cent of the losses experienced by week 10. Further, it is anticipated that this rebound will be offset by increased costs.
- Paymark transactions data show a large fall in consumer spending immediately after the earthquake in some areas (notably the central business districts of Christchurch City and Kaiapoi) and in most sectors (notably personal retail). The aggregate figures show that consumer spending bounced back in October, but that Kaiapoi remained adversely affected and four sectors recorded reductions of more than $1 million in September/October 2010 compared to July/August 2010.

- Based on the survey responses, the AERU/CDC Economic Impact Assessment Model projected a loss of 826 jobs ten weeks after the earthquake and a recovery of 509 jobs within a further twelve months.
- The increase in the number of unemployment benefits in September 2010 was just 205. This was one-quarter of the predicted impact in the modelling exercise, which provides some evidence that the government's emergency wage subsidy had the intended effect of keeping people in employment who would otherwise have lost their job as a result of their employer not being able to cover their costs.

Some consumer spending data can be presented to illustrate the more general point that there had been important distributional impacts, even though aggregate spending in the economy had remained buoyant following the 4 September earthquake. The AERU research team was provided with limited access to aggregate data on electronic card transactions. These data were provided by Paymark, which is New Zealand's major electronic payments provider, processing more than 75 per cent of all electronic transactions in the country.

Figure 4 presents monthly values of Paymark electronic transactions for Canterbury for the months of July to October in 2009 and 2010. The impact of the earthquake on the September 2010 value is clear, but so is the quick rebound in October. The Paymark database recorded 8.0 million transactions in Canterbury in August 2010; this fell to 7.7 million in September and rebounded to 8.4 million in October 2010. There was a small increase in indirect taxes introduced on 1 October 2010; this fall in the number of September transactions and rise in October goes against the trend that would be expected with that increase in indirect taxes. Hence this series probably underestimates the impact of the earthquake on what would have happened in its absence.

Figure 4 Monthly Values of Paymark Electronic Transactions for Canterbury (millions of dollars)



Source: Paymark Electronic card transaction values.

A further indication of the resilience of aggregate spending in Canterbury after the earthquake is provided in Table 4. Comparing spending in September/October with spending in July/August, it can be seen that spending grew faster in 2010 (2.8 per cent) than in 2009 (1.5 per cent).

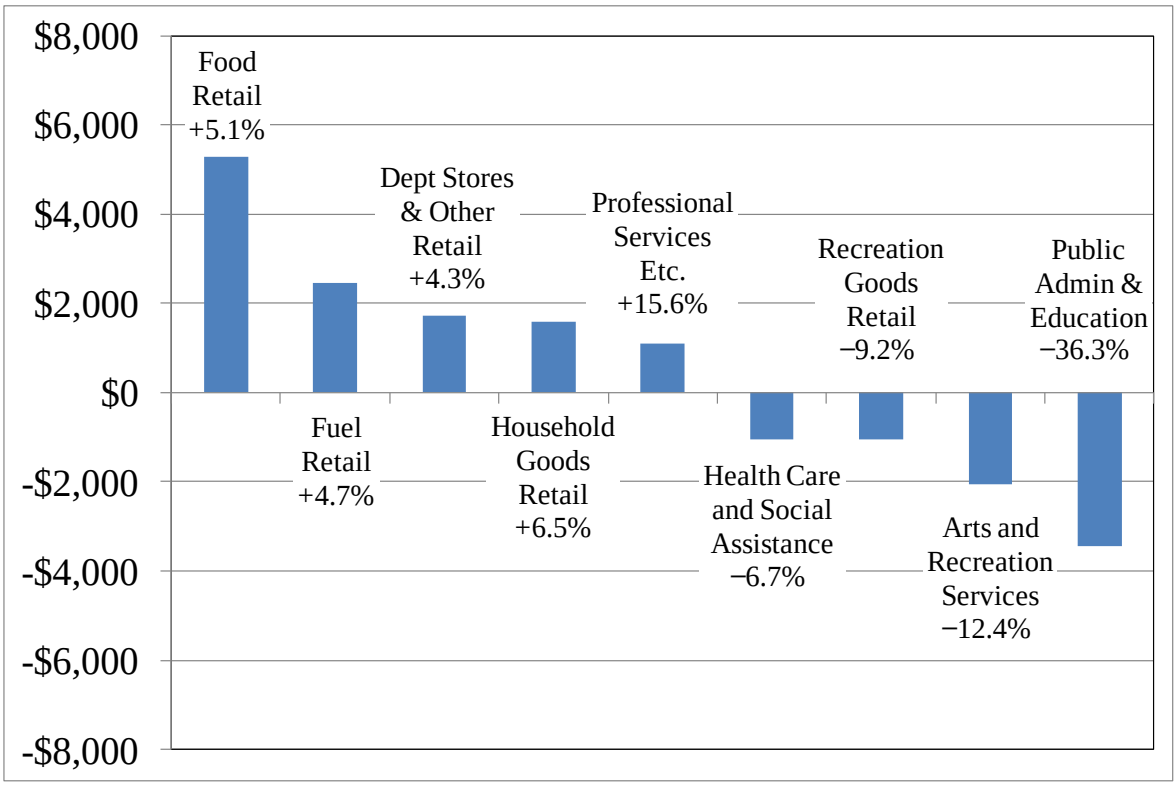
Table 4: Average Consumer Spending Recorded by Paymark Transactions, July/August and September/October, 2009 and 2010

Year	July/August	September/October	Percentage Increase
2009	$398,617,323	$404,663,847	+1.5%
2010	$398,369,925	$409,349,397	+2.8%

Source: Paymark Electronic card transaction values.

Although the aggregate data reveal that consumer spending in September/October 2010 was stronger than might have been expected from the 2009 trend, it is possible that some sectors of the Canterbury economy suffered falls as other sectors experienced growth. The Paymark data disaggregates the transactions into 22 sectors based on standard ANZSIC codes, and so it is possible to analyse this possibility taking the average value of Paymark transactions for the months of July and August 2010 as the starting point and comparing this with the average value in September and October 2010. The largest sector changes featured in that analysis are presented in Figure 5.

Figure 5: Largest Sector Changes in Paymark Transactions, September/October Compared to July/August 2010 ($000)



Source: Paymark (2010) Electronic card transaction values.

Fuel Retailing and Food Retailing both showed strong increases although in the former case this would have been assisted by an increase in the price of petrol of 11 cents per litre (6.3 per cent) in October. Household goods retailing continued to show strong growth and the residual retail category (which includes department stores) also bounced back strongly over the combined two months. There was also strong growth in the Professional, Scientific and Technical Services sector (up $1.1m, or 15.6 per cent).

Only four sectors continued to show a reduction in consumer spending over the combined two months. These were: Public Administration and Safety and Education and Training (down by 36.3 per cent); Arts and Recreation Services (12.4 per cent); Recreational Goods Retailing (9.2 per cent); and Health Care and Social Assistance (6.7 per cent).

Thus, while the economy as a whole demonstrated strong resilience, some sectors suffered serious losses of consumer spending in the two months after the earthquake. Within the retail sector, there were considerable disparities in different segments: fuel retail, food retail, department stores (and other retail not elsewhere classified) and household goods retail experienced more spending than might have been expected; electrical and electronic goods retailing as well as clothing, footwear and personal accessories retailing experienced small falls in consumer spending; and recreation goods retailing and arts and recreation services endured a loss of consumer spending close to ten per cent. Outside the retail sector, the Paymark data suggest that health care and social assistance experienced a moderate reduction in consumer spending, and that public administration and education experienced a very sharp fall.

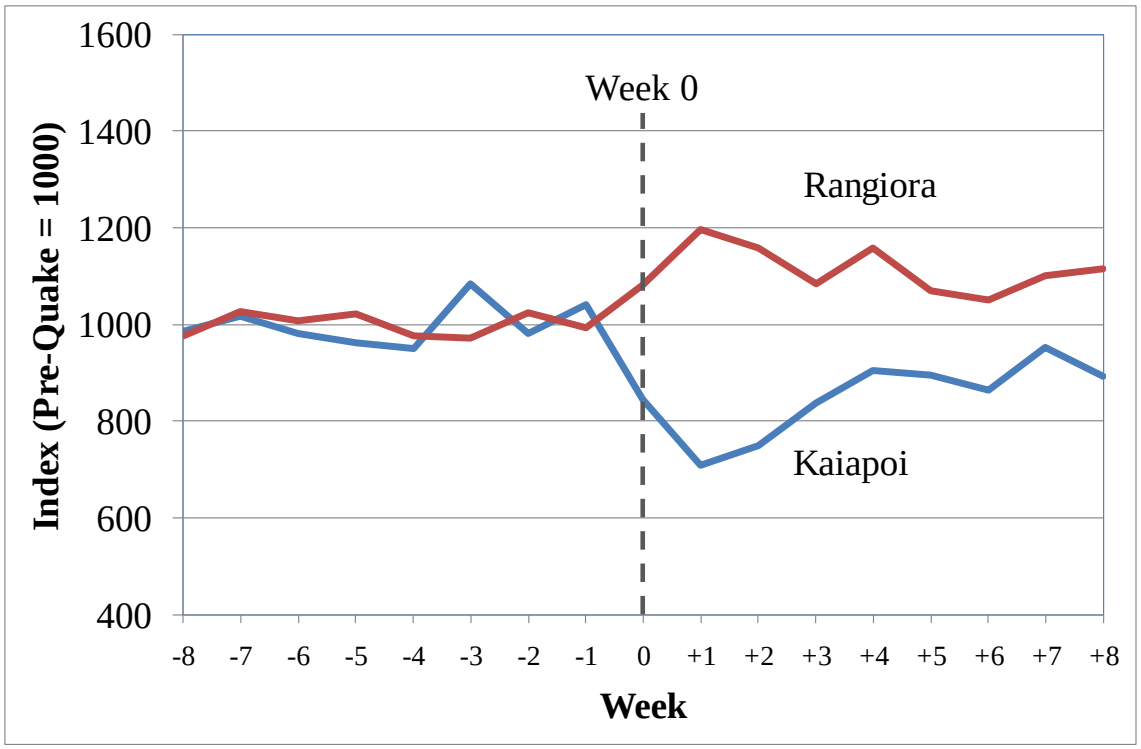
An important consideration when analysing potential impacts of the earthquake on consumer spending is the geographic area where purchases were made, to examine possible shifts or redistributions of sales from one part of the city or the region to another. For this study, Marketview provided aggregate data on their customers' spending in 12 shopping locations. The Marketview database is derived from BNZ credit and debit card holders spending with retail merchants to provide a tool for understanding and measuring consumer spending behaviour.

Paymark data are available weekly, with weeks beginning on the Monday. This means that the earthquake on Saturday 4 September took place in the week beginning 30/08/2010. For the purposes of this study, that week was defined as Week 0. To protect confidentiality, the data for different shopping areas were normalised so that average spending for the eight weeks prior to the earthquake (5 July to 29 August) was set equal to 1000. This allowed percentage changes to be shown but not the relative turnover of each shopping centre.

Kaiapoi and Rangiora are two small towns north of Christchurch city separated by about ten kilometres. Kaiapoi was greatly affected by the 4 September 2010 earthquake, losing its supermarket, while Rangiora was largely unscathed. Figure 6 draws the time series for Kaiapoi and Rangiora. A disastrous fall in consumer spending in Kaiapoi after the earthquake is obvious in the Figure. Spending in Week 1 after the earthquake was 29.9 per cent below its weekly average for the eight weeks before the event. Spending slowly recovered over the next seven weeks, but was still 10.7 per cent below the pre-quake average in the last week of November.

It is equally clear from the graph that some of the lost custom in Kaiapoi made its way to Rangiora. Spending increased 19.7 per cent in Week 1. Although there was some erosion of this increase since that peak, in Week 8 spending in Rangiora was still 11.4 per cent higher than the weekly average before the earthquake.

Figure 6: Index of Weekly Spending in Rangiora and Kaiapoi, 5 July to 31 October 2010



Source: Marketview Consumer Spending – BNZ transactions.

5 Regional Economic Development after the Earthquakes

In thinking about whether the large earthquakes in 2010/11 (and the ongoing aftershocks) require major changes to the regional economic development strategies previously in place, there are two underlying factors to consider:

- Have the earthquakes changed the fundamental strengths and opportunities that had previously been the core drivers the region's economic development (equilibrium effects)?
- Do the short-term impacts of the earthquakes, including the transition path taken during the recovery phase, have long-term impacts on the region's economic development (hysteresis effects)?

To answer these questions, the AERU returned to the ten strengths identified in the Canterbury Regional Economic Development Strategy (CREDS), listed in Table 1 above. There are weaknesses in some of these strengths, but the overall assessment is cautiously optimistic.

Canterbury is a great place for people to live

Canterbury is not as good a place for people to live as it had been before the 4 September 2010 earthquake. To illustrate, consider this summary from CERA (2011, p. 9):

> By August 2011, more than 7,000 aftershocks had shaken the greater Christchurch area. Communities have been significantly impacted, interrupting day-to-day life and damaging the infrastructure and services that communities rely on to function. In the worst affected suburbs, after each major quake, houses and facilities were without power, water and sewerage for days on end, and roads were damaged and unsafe for travel. Liquefaction caused flooding of houses,

> punched holes in roads and covered the ground with tonnes of silt. Some schools were forced to relocate, and hundreds of students have left secondary and tertiary education facilities many not returning to the facilities they were using in September 2010.

The same source commented that ten performing arts venues were out of action (including the Christchurch Town Hall and Convention Centre). There was major disruption to sporting and recreation facilities (including the loss of the city's AMI Stadium and the consequent decision to shift Rugby World Cup games out of the region). On top of this, the loss of infrastructure has meant that undertaking routine tasks can be more difficult such as shopping, access to schools, longer commutes and recreation facilities.

The quality of the city's education institutions has been an important part of the quality of life in Christchurch. This sector was particularly hard hit through damage to school infrastructure (leading some schools to "double-bunk" on less damaged sites) and reductions in school rolls through movements away from the city. This latter impact is anticipated to continue, leading to discussions about teacher redundancies in 2012.

The importance of restoring Canterbury as a great place to live is reflected in the overarching vision statement of the Canterbury Earthquake Recovery Authority (CERA, 2011, p. 18):

> Greater Christchurch recovers and progresses as a place to be proud of – an attractive and vibrant place to live, work, visit and invest – mō tātou, ā, mō kā uri a muri ake nei for us and our children after us.

The Canterbury economy has long been built on export growth

The preliminary assessment of this driver of economic development has been positive. Christchurch International Airport and the Lyttelton Port of Christchurch have continued to operate. The agricultural, forestry and fishing sectors were not significantly affected by the earthquakes. Some damage to agribusinesses was reported in the September earthquake but this was relatively easily remedied and exports were not affected. Some diversion of routes for export may have taken place due to temporary closure of ports but with no discernible long-lasting impact. Indeed, exports and imports from the two major ports and the airport had grown above their August 2010 levels by October 2011.

In the case of ICT, specialist manufacturing and food and beverage manufacturing again no serious loss of output was reported with facilities generally being able to continue operating. The outlook for education of overseas students in Christchurch is not positive, however; there is an understandable nervousness about travelling to study in a region with ongoing seismic activity, particularly since a large proportion of the fatalities in the February 2011 earthquake involved foreign nationals attending an English language school.

There is a wealth of experienced business people in Canterbury

Prior to February 2011, the Christchurch central business district housed more than 6,000 businesses, employing 51,300 people. A large percentage of these were in the retail sector, with the Christchurch central city accommodating 618 shops, employing 4,250 people. Further, prior to February 2011, there existed 446,000 square metres of office space within the central business district (CCC, 2011b). Thus the on-going closure of the inner city for safety reasons represents a major blow to business in Christchurch.

Nevertheless, resilience has been a key theme in public discussions of the business sector in Christchurch. A survey of 260 businesses across the city by MYOB (2011) found that two-thirds were planning for revenue and customer growth over the next twelve months, compared to a national average of 48 per cent. It is further suggested that the damage in the earthquakes might create new potentially attractive business opportunities in Christchurch.

The CEDM model found that "business services are a key growth sector in Christchurch. The relocation of businesses from the central business district has impacted on this sector. Some find themselves in temporary office accommodation, often not in ideal conditions with crowded office space. Thus there are important issues around the retention of personnel and businesses within the region and how to facilitate their recovery. In general these types of businesses favour locating in central business districts where facilities and places to meet are readily available. Also to attract key staff to these businesses a vibrant city centre is generally thought important.

Canterbury businesses are responsive to market signals

This is an interesting issue in the post-earthquake environment. There is considerable confusion around planning requirements, ranging from what land will be classified as unable to be used for buildings to what restrictions will be placed on building height in the central business district. There are uncertainties around insurance entitlements and how firms can meet shortfalls between insurance payouts and the costs of a new building designed for the increased seismic risk. The fundamental market signal of what is the value of a square metre of office space in the central business district may take some time to be determined, especially as the heart of the central business district remains closed as demolition of some high rise buildings continues.

In the meantime, business owners previously located in the central business district are not standing still. Rental office space on the main roads leading into the city centre have quickly been leased to relocated businesses, and new office space is being build to accommodate the displaced demand. This is an example of a potential hysteresis effect, where the short-term response to market signals may have a long-term impact on the transaction costs of doing business in Christchurch.

Canterbury has abundant land, water and other natural resources

At one level, Canterbury continues to have abundant land, water and other natural resources. At another level, however, the seismic activity has created a serious issue for real estate in Christchurch and the district immediately north of the city. On 23 June 2011, the Government announced that all land in Christchurch and Waimakariri District are categorised into four residential zones – white, green, orange and red. The white zone (essentially on the hills to the south of the city) needed further data to be collected before an assessment could take place. The Green zone had no significant land issues. The orange zone contained areas where many buildings had been damaged beyond repair but more detailed assessment was needed before a final classification to green or red. The red zone classification meant the land itself had been extensively damaged with a high risk of future damage from seismic activity. Land repair would be impossible or uneconomic, and so residents cannot remain in these zones. There were about 5,000 properties in Christchurch and around 100 properties in Waimakariri inside the residential red zone. This means that in the short-term there is a shortage of residential properties in the greater Christchurch area.

There is a solid skill base in the Canterbury labour force

The Canterbury Economic Recovery Agency and the Canterbury Development Corporation have created the Canterbury Employment and Skills Board (see www.cesb.org.nz) to develop a ten-year strategic labour market and skills plan to assist in the recovery. The Board recognises that a substantial number of construction-related jobs will be created in the region as the rebuild commences. At the same time, the demand for skilled workers in the region's knowledge-based sectors is expected to continue.

Canterbury has strong public and private research institutions

Canterbury has two research universities in the province. The University of Canterbury is based in Christchurch city. It reports that due to the earthquakes, it lost about 1,500 students (out of a total EFTS role of 15,673 in 2010), including about 25 per cent of its first-year students and about one-third of its international students. Some buildings and facilities suffered major damage and many have extensive remediation requirements. Although only a few buildings have been identified for deconstruction, there are a number which will remain closed for up to two years. Consequently the University of Canterbury faces a major funding shortfall of about 12 per cent over the period 2012 to 2019. Lincoln University is a specialist land-based university located about 15 km to the south-west of the city of Christchurch. It was more affected by the September 2010 earthquake, but had only one building closed by that event.

Canterbury offers visitors a range of national iconic attractions

Tourism, prior to February 2011, generated NZ$2.3 billion to Canterbury's regional economy, representing a considerable portion of economic activity in the region. Canterbury saw a significant reduction in international and domestic visitors in the period March to April 2011. The total amount of international visitors to Canterbury in March 2011 declined by 45 per cent (representing 130,000 people) compared to March 2010, with an added decline of 14 per cent (or 35,000) of domestic visitors over the same period (Statistics New Zealand, 2011). The total number of guest nights for the Canterbury region also declined between March 2010 and March 2011, showing a decrease of 30 per cent (or 165,000), most likely due to a lack of capacity (Statistics New Zealand, 2011).

Six months after the February earthquake the downward impact was continuing. In August 2011 international guest nights in Canterbury declined by 30 per cent compared to the same month in the previous year. In contrast, domestic guests nights decreased by 9 per cent during the same period. The loss of accommodation due to the earthquakes had a major impact on the tourism industry in Christchurch. After the February earthquake the number of establishments had decreased by 25 per cent compared to the same month in the previous year. Half a year later, in September 2011, the number of establishments was down 18 per cent compared to the same month in the previous year (MED, 2011c).

In the longer-term, the earthquakes have had a profound impact on the heritage built environment of Christchurch city. Following the February 2011 earthquake, the buildings within the central city were assessed by structural engineers, with 362 buildings assessed being deemed to require some kind of structural work or demolition. Of these 362 buildings, 241 were targeted for complete demolition, including 86 buildings holding significant cultural or historical value within Christchurch. A further 82 buildings were targeted for partial demolition, of which 22 were heritage buildings, with the remaining 39 buildings (from the original 362) assigned to be "made safe", or given structural reinforcement, of which 22 were heritage buildings (CCC, 2011a).

With the substantial number of heritage buildings requiring demolition or partial demolition comes a significant loss of cultural capital in Christchurch. The loss of such buildings also marks the loss of historically significant sites in the city, which was viewed by many as a crucial part of Christchurch's broader identity and attractiveness to some tourists. The CERA (2011, p. 53) draft recovery strategy recognises that the recovery of the local economy and tourism needs to be supported through "ensuring culture and heritage forms part of the region's identity and contributes to a quality urban environment", but it is clear that much has been lost.

Canterbury has a good infrastructure, including the airport and seaports

The core large infrastructure assets of the region, including the airport and seaports, remain operational. For the most part, road, rail, electricity and sewerage networks have been restored to a functional level or better. It is generally accepted that there is a need for new investment in sport and recreation facilities and in arts and culture venues.

Canterbury is well-connected, with effective working relationships

This is an interesting heading about which opinions might differ. New collaborative partnerships have been formed. The Canterbury Employers' Chamber of Commerce and the Canterbury Development Corporation combined to create the Canterbury Business Recovery Group as a joint venture. The Canterbury Business Leaders Group brings together some private sector business leaders to aid economic recovery. The Canterbury Central Government Leaders Group is made up of senior leaders of central government agencies based in the region so that they can collaborate to restore and enhance services for recovery.

At the same time, however, there have been public disputes between business interests and the Christchurch City Council, and arguments between local and central government about decisions and processes. Central Government created its own agency (CERA) to lead and coordinate the ongoing recovery effort. Legislation has vested special powers in CERA and in the Minister for Canterbury Earthquake Recovery "in order to enable an effective, timely and co-ordinated rebuilding and recovery effort" (http://cera.govt.nz/about-cera). The arrival of a new and very powerful central government agency into Christchurch inevitably disrupts some local relationships and creates some tensions when multiple parties are contesting local leadership (see, for example, Dalziel and Saunders, 2003).

6 CONCLUSION

The discussion in this paper is necessarily preliminary. Although it has been more than twelve months since the first major earthquake on 4 September 2010, the region continues to experience sizeable aftershocks and there are parts of the central business district that remain closed until unstable high-rise buildings can be safely demolished. The discussion is based on the premise that the pre-existing regional economic development strategies continue to offer a useful framework for discussing the future regional policies. Section 5 has highlighted how that framework can be used, without coming to any simple conclusions.

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Study on the Relationship between Change of Underused Land and Commercial Activity of the Central Areas of Japanese Local Cities

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ABSTRACT

Recently, the increase of underused land such as outdoor parking lots and vacant area has caused a decrease of business area and the decline of central areas in Japanese local cities. In this study, we constructed a database of underused land by using housing maps on GIS and analysed the relationship between the change of underused land area and commercial activity in central areas of 37 core cities in 2005. Results show that the total area of underused land increased about 10% between 1985 and 2005 in Japanese core cities. Additionally, in central areas, commercial activity declined in comparison to national trends and the average of core cities. Moreover, the transformation of business areas to underused land has resulted in a decline of commercial activity in cities where underused land area increased from 1995 to 2005.

1 INTRODUCTION

Currently, low use and unused lands such as outdoor parking lots and vacant areas have increased due to suburbanization of urban functions in Japanese local cities. The increase in these areas, termed underused land, is related to decreases of business areas and the decline of central areas. However, the secular change of underused land in Japanese local cities has not been clarified on a nationwide scale, and the relationship between changes in underused land area and commercial activity has not been quantitatively clarified.

It has been generally accepted that studies intended to understand land use regarding underused land focused primarily on outdoor parking lots. Chujyo *et al*. (2002), Higuchi *et al*. (2001), Koike *et al*. (2007), Ikaruga *et al*. (2004), Mizokami *et al*. (2011), and Onishi *et al*. (2010) studied Japanese cities, and Davis *et al*. (2010a) studied Tippecanoe County, Indiana, in the United States. Additionally, Lee *et al*. (1998) and Igawa *et al*. (1998) researched the distribution of unused land and outdoor parking lots in a Japanese city. All of these studies were limited by area. Therefore, a city to city comparison has never been analysed on a nationwide scale. Mitsuda *et al*. (2009) focused on 20 Japanese cities and Davis *et al*. (2010b) focused on 35 areas on the Upper Great Lakes Basin in the United States. These studies have both clarified the distribution of outdoor parking lots, but were just focused on one time, and have not considered changes in underused land.

With all these factors, most quantitative studies are focused on one city, and studies with a number of cities remained simply collective analyses at one time.

To analyse the relationship between business area and outdoor parking lots, Oba *et al*. (2008) assessed the changes in outdoor parking lots and total yearly retail sales on seven Japanese core cities in 1985 and 2005; outdoor parking lots within a one km^2 were based on the highest point of official land price at 2005. In addition, there are several studies that used building modeling to represent the transformation of business areas to parking lots in Japan (Nakamura *et al*, 2004), Saito *et al*. 2008).

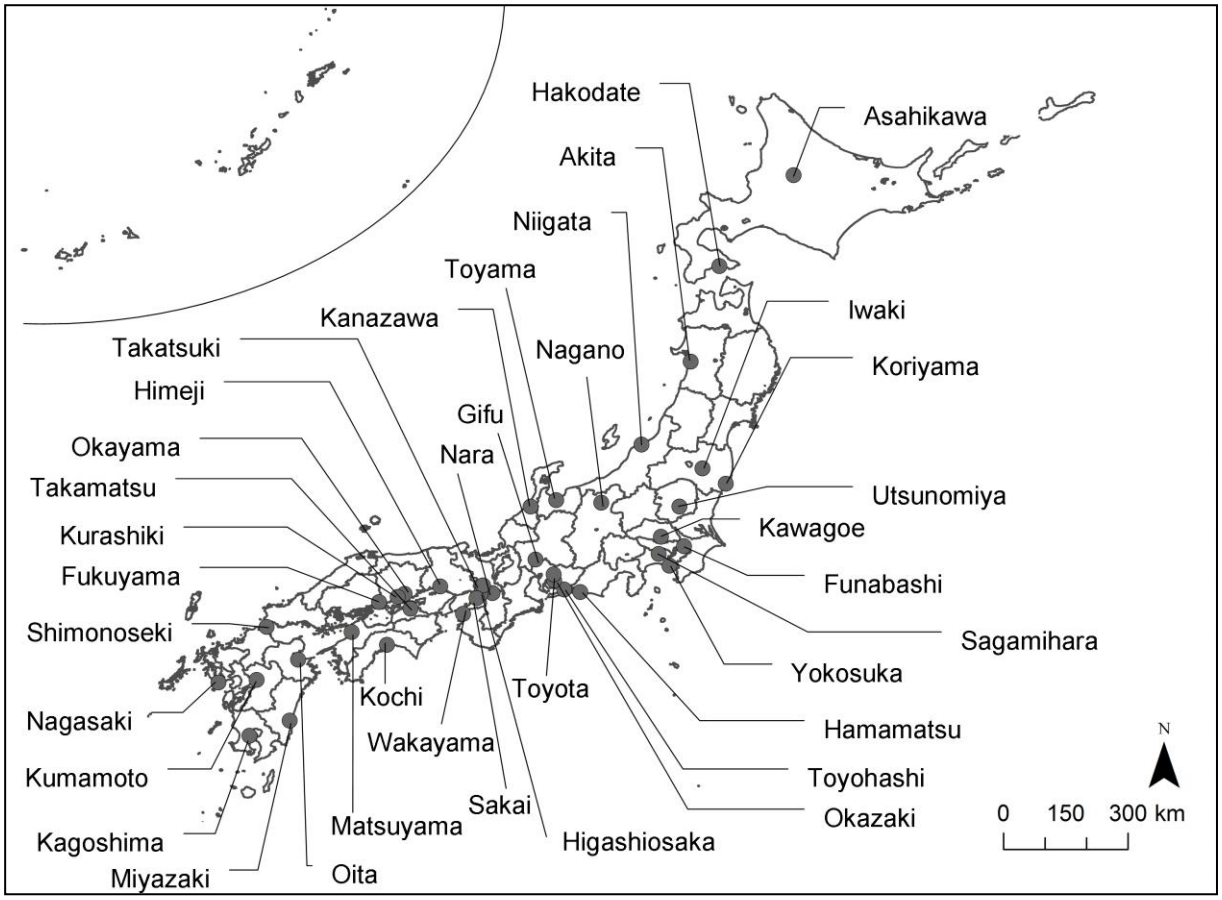
There are many studies of the relationship between underused land and commercial activity, but to our knowledge there are no studies that analyse the transformation of underused land on the basis of established data. In this study, we constructed a database of underused land by using housing maps on GIS in order to understand the land use regarding underused land in central areas of 37 Japanese core local cities in 2005. Additionally, we analysed the change in total yearly retail sales and the transformation of business areas to underused land. This data was used to quantitatively clarify the relationship between the change in underused land and commercial activity.

2 CONSTRUCTING A DATABASE OF UNDERUSED LAND

Time period and study area

In this study, we define local cities as those that have over three-hundred thousand people, excluding several large cities, as of October 2005. We selected 37 Japanese core cities, and underused land at least some or all included within the central area. Figure 1 shows these 37 core cities.

Figure 1 Thirty-seven Core Cities in Japan



The central area was defined as a 500 m radius around the highest point of official land price in 2005; targeting of the isometric area allowed a city-to-city comparison on a nationwide scale. In order to analyze the distributional change of underused land, we constructed underused land data in 1985, 1995 and 2005. We designated 2005 as the time of present land use condition and 1985 as the time of the occurrence of underused land resulting in suburbanization of commercial function. In 1995, distribution of underused land which had a moth-eaten appearance was a problem in Japanese central area at the end of the bubble boom, and this time is a crucial period of the problem of underused land increase.

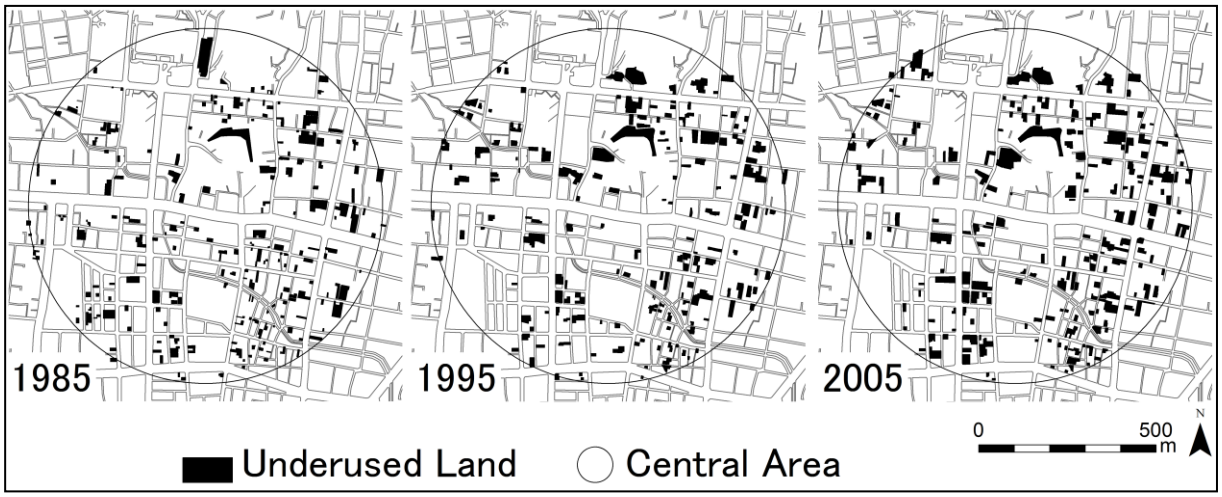
The method of constructing the data of underused land

In this study we focused on outdoor parking lots and material storing sites as low use land. Additionally, unused lands and lands that have vacant housing were selected as vacant lands. Parking structures such as multilevel car parking towers and parking lots for bicycles were excluded from underused land. The polygon data, which include spatial information such as the area of underused land and location, were constructed in multiple pieces by using housing maps on GIS. Lots were defined as 'divided land by property lines or block lines in housing map'. In the cases where property lines or block lines were not found on land that have many structures, lot data was composed by 30 cm mesh data including the quality of the nearest structure in each lot. Initially, we constructed underused land data based on property lines or block lines. Then, we also constructed land use data including the identification of areas that were underused land at any point in time. In order to get an overview of changes in land use, the quality of land use was classified into seven categories listed in Table 1 based on utilization purpose and service delivered in each lot. For example, the change of underused land in Utsunomiya is shown in Figure 2.

Table 1 Land Use Type

Land use type		Utilization of land
1	Residensial land	Dwelling
		Multifamily dwelling
2	Mixed residential land	Dwelling and commerce facility
		Dwelling and accommodation
		Dwelling and industrial plant
		Dwelling and doctor's office
3	Business area	Commerce facility
		Accommodation
		Business office
4	Industrial land	Industrial plant
5	Public service land	Doctor's office
		Public facility
6	Natural land	Cultivated land
		Non-cultivated land
7	The rest	Multilevel car parking tower
		parking lots for bicycles
		storage or other

Figure 2 Secular Change of Underused Land in Utsunomiya



3 SECULAR CHANGE OF UNDERUSED LAND IN JAPANESE LOCAL CITIES

The change of underused land area in 37 cities

Figure 3 shows the secular change of the average and underused land area in 37 central areas. The total area of underused land increased by about 10% between 1985 and 2005 in Japanese core cities. In 11cities (Akita, Iwaki, Utsunomiya, Kawagoe, Funabashi, Yokosuka, Kanazawa, Himeji, Okayama, Oita and Miyazaki) underused land area consistently increased between 1985 and 2005. In contrast, underused land area constantly decreased in Sagamihara, where land readjustment and land redevelopment of U.S. military installations have been implemented in the central area. However, it is reasonable to say that underused land area increased in Japanese local cities across the country. Interestingly, 15 of the 37 cities had the largest underused land area in 2005, and few cities have more than 13% of the central area as underused land. Moreover, underused land areas increased from 1985 to 2005 in 24 cities.

The change of land use regarding underused land

We define the transformation of other land use to underused land as ‘transformation to underused land’ and transformation of underused land to other land use as ‘transformation from underused land’. Figure 4 shows the average area of ‘transformation to underused land’ and ‘transformation from underused land’ in each period and segments of land use. Looking at the changes of underused land area based on time period, the period between 1995 and 2005 is smaller than the period between 1985 and 1995. Focusing on the seven segments of land use, the rate of change in land use regarding underused land is high on residential land, business area, and public service land in each of the underused land areas transformed. In Utsunomiya, which shows a change of underused land similar to the average of cities, the average rate of land use in central area was shown as business area (33%), public service land (22%) and residential land (12%). This result shows that the rate of changes in land use regarding underused land was high with regard to these factors.

Figure 3 Secular Change of Underused Land Area in 37 Cities

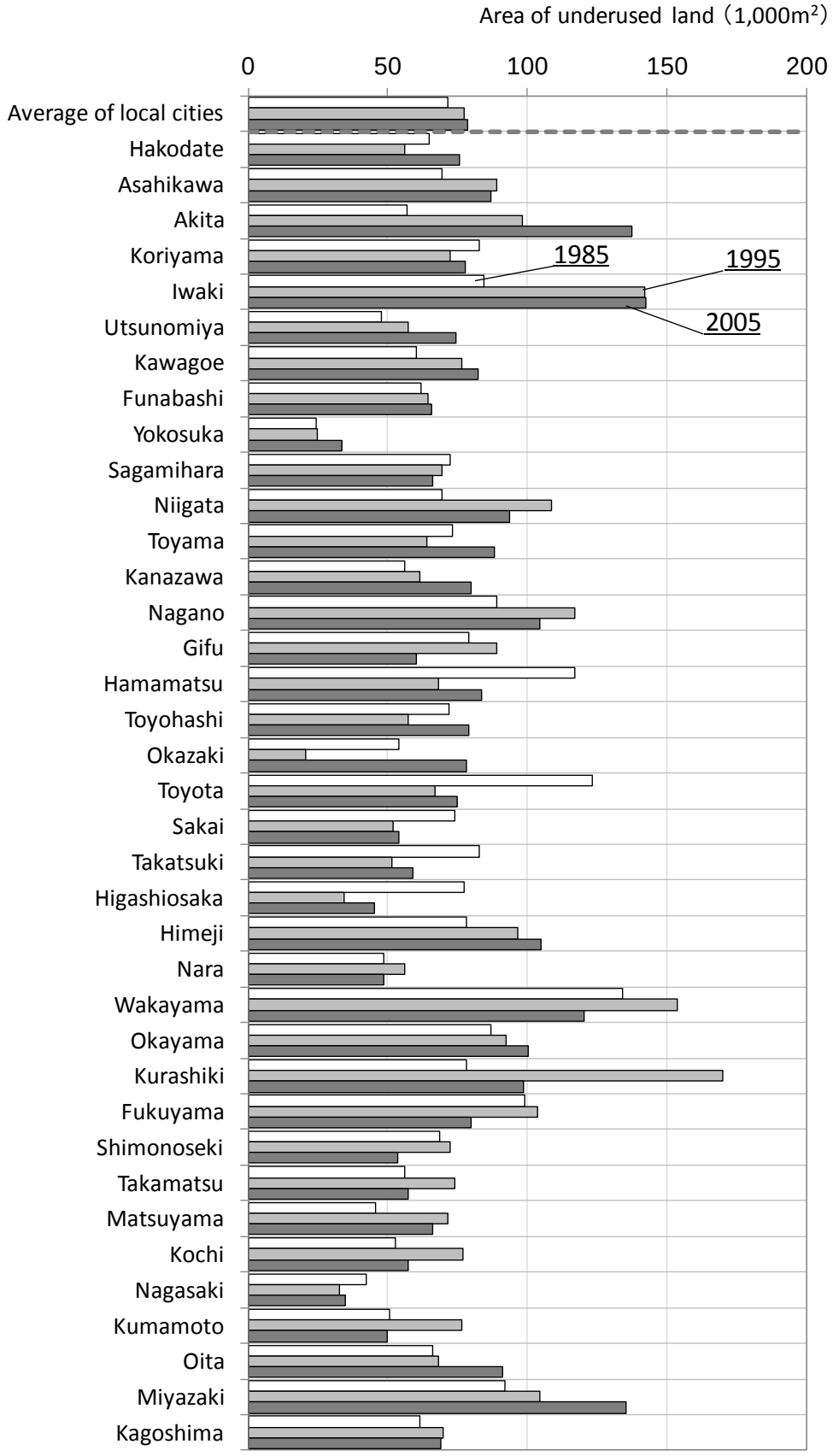
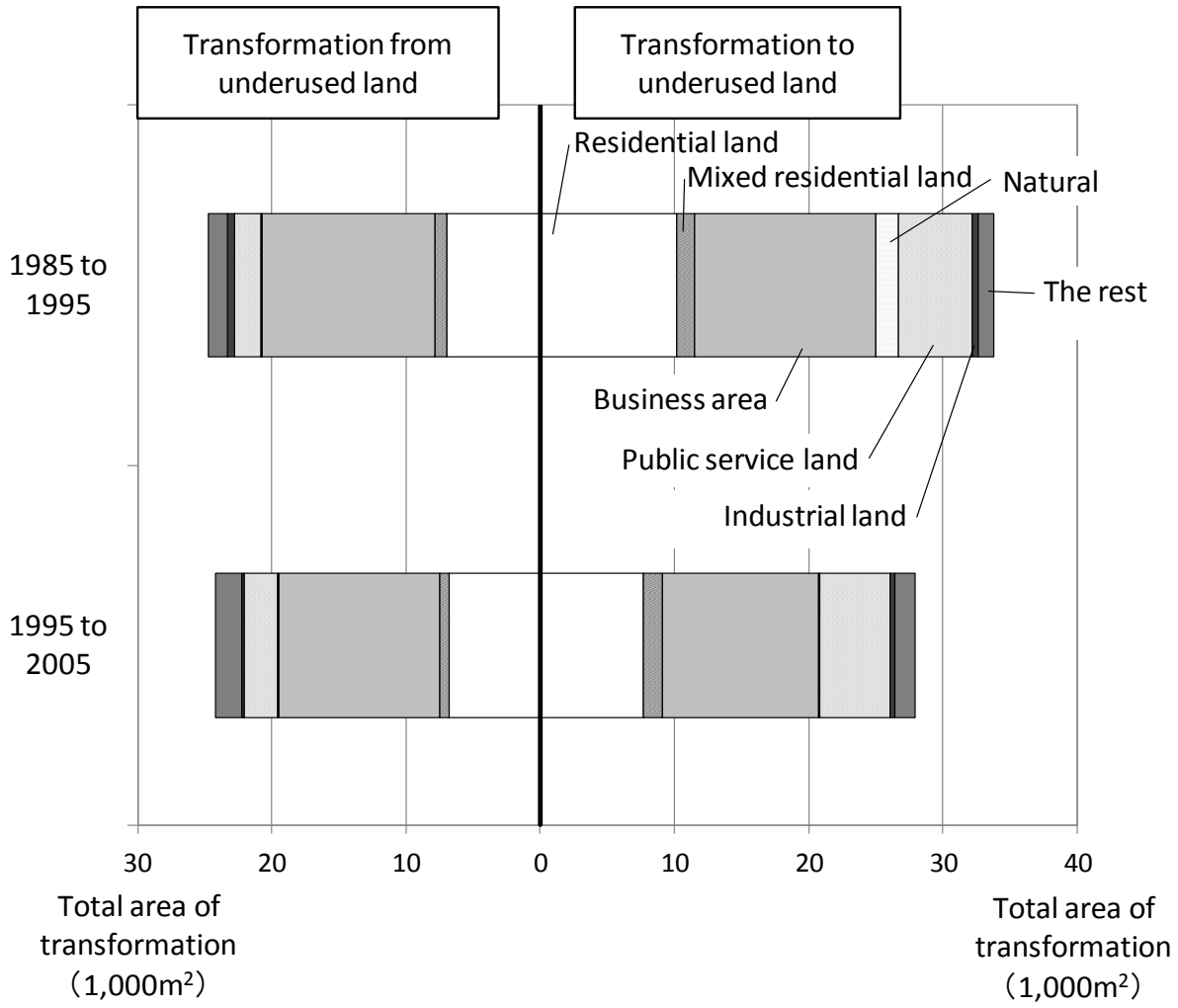


Figure 4 Change and Transformational Patterns of Underused Land



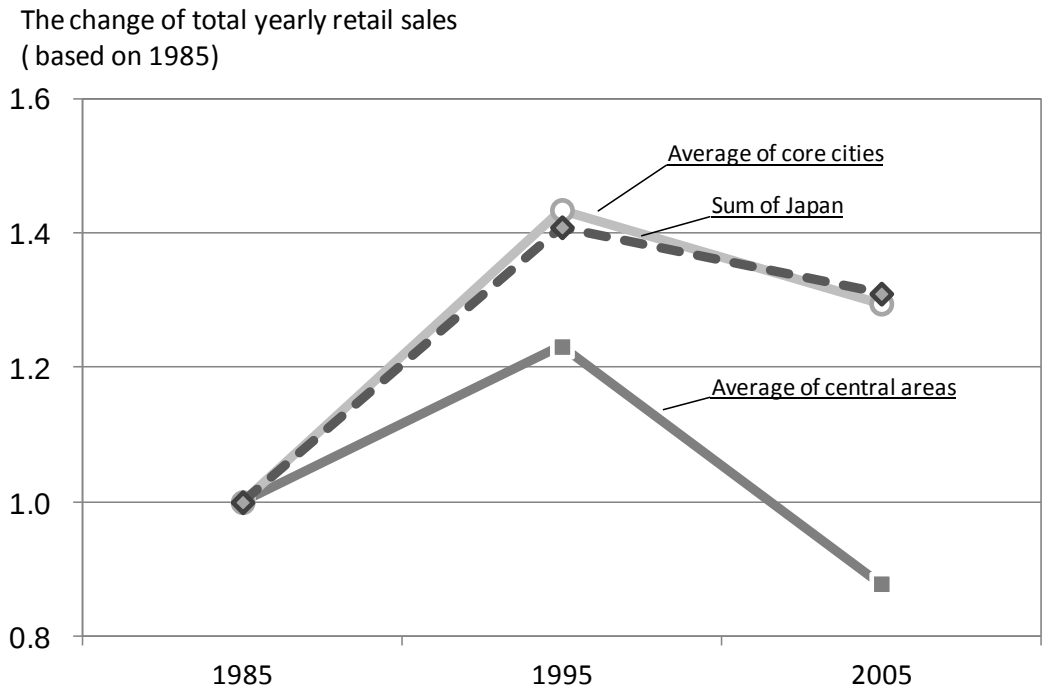
4 ANALYSIS OF THE RELATIONSHIP BETWEEN THE CHANGE OF UNDERUSED LAND AND COMMERCIAL ACTIVITY

The change of commercial activity in central area

Data for business activity in central area were defined by total yearly retail sales in one km^2 mesh data of commercial statistics. To use the data of total yearly retail sales in central areas, the area of crossover between each mesh and central area was first determined. Then, the sum of proportional division calculated from ratio of the area of crossover in one km^2 was averaged over total yearly retail sales in central areas. To be precise, the year of commercial statistics differ from time period in this study except for the statistics of 1985. Therefore, we use the statistics of 1994 for 1995 and 2004 for 2005. Additionally, to evaluate the characteristics of secular change on commercial activity in central areas, we compared the sum of Japan to the average of core cities and central areas. In analysis of commercial activity, commercial statistics are used for the sum of Japan, and the average of core cities calculated by using 1km2 mesh data which overlap the city boundaries. Figure 5 shows the secular change in total yearly retail sales normalized to 1985 for all Japan, average of core cities, and average of central areas. The three data sets displayed a similar pattern of change, namely the rate of total yearly retail sales demonstrated an upward trend from 1985 to 1995,

and a downward trend from 1995 to 2005. During the period of the economic bubble in Japan (1985 to 1995) total yearly retail sales had increased due to the booming Japanese economy. However, between 1995 and 2005, the total yearly retail sales declined as a result of bust the economic bubble. In central areas, the change of total yearly retail sales showed a similar change to sum of Japan and average of core cities between 1985 and 1995. Between 1995 and 2005, the change in average retail sales for central areas was markedly different than that of the sum of Japan and average of core cities; by 2005, the value was well below that of 1985. Therefore, it is clear that commercial activity has been on the decline in central areas.

Figure 5 Comparison of Total Yearly Retail Sales



Relationship between transformation of underused land and commercial activity

It is well known that there are a variety of factors that influence the increase of underused land area. This chapter focuses on cities with an increase or decrease in underused land between 1995 and 2005. In the notation below, 'high city' defines cities where underused land has increased, and 'low city' defines cities where underused land has decreased (Table 2). Figure 6 shows the average of total yearly retail sales in high city and low city. In 1985 and 1995, there was no difference in retail sales between high city and low city, but the average of total yearly retail sales in high city was lower than that of low city in 2005. This is one of the reasons why commercial activity in high city declined in comparison to low city.

Figure 7 shows the average area of transformation from underused land to business area and from business area to underused land in high city and low city between 1995 and 2005. Focusing initially on the transformation from underused land to business area, low city values are larger than high city values; this is a statistically significant difference based on t-test (p-value is 0.021). In contrast, high city showed larger numbers than low city with regards to transformation of business area to underused land, and this result was also statistically significant different according to a t-test (p-value is 0.012). Collectively, these results show that in comparison to low city, commercial activity is so declined in high city that the area of transformation business area to underused land increased.

Table 2 City Classification Based on Change of Underused Land Area

High city				
Hakodae	Akita	Koriyama	Iwaki	Utsunomiya
Kawagoe	Funabashi	Yokosuka	Toyama	Kanazawa
Hamamatsu	Toyohashi	Okazaki	Toyota	Sakai
Takatsuki	Higashiosaka	Himeji	Okayama	Nagasaki
Oita	Miyazaki			

Low city				
Asahikawa	Sagamihara	Niigata	Nagano	Gifu
Nara	Wakayama	Kurashiki	Fukuyama	Shimonoseki
Takamatsu	Matsuyama	Kochi	Kumamoto	Kagosima

Figure 6 Comparison of Commercial Activity within 'High City' and 'Low City'

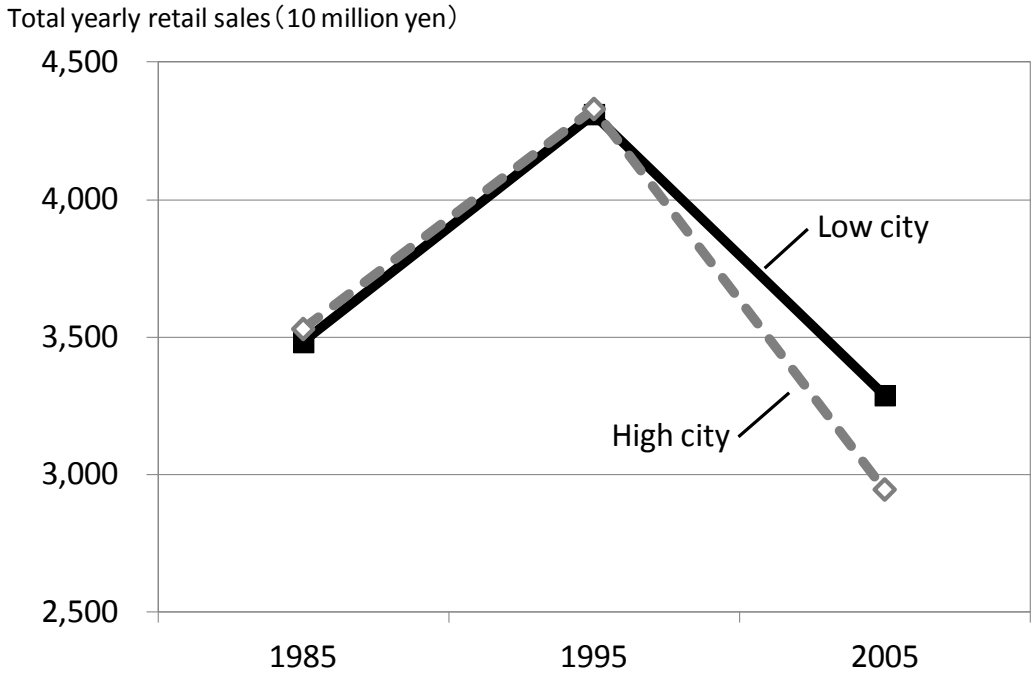
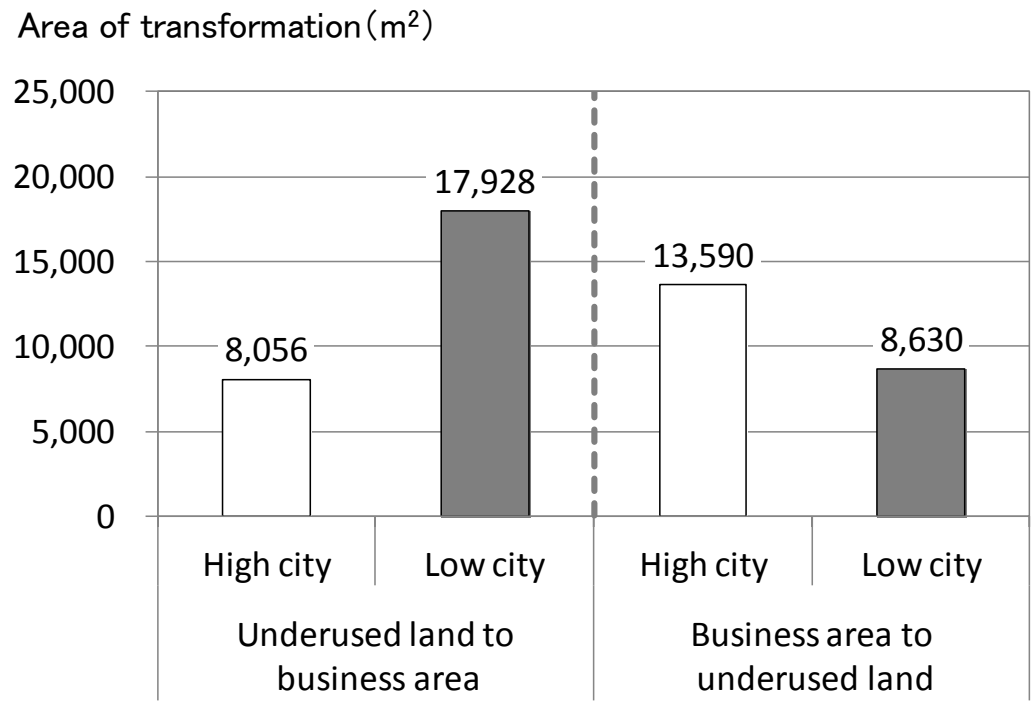


Figure 7 Area of Transformation Regarding Underused Land



5 CONCLUSION

Recently, declining commercial activity and increasing amounts of underused land have been identified as a problem in central areas of Japanese local cities. The relationship between changes in underused land and commercial activity has not yet been quantitatively determined. The aim of this study was to clarify the secular change of underused land, and analyze the relationship between changes in underused land area and commercial activity by construction of a GIS database of underused land in 37 Japanese core cities at three time points.

Results show that the total area of underused land increased by about 10% between 1985 and 2005 in Japanese core cities; the underused area increased in 11 of 17 cities between 1985 and 2005. Moreover, overall more underused land was found in 2005 compared to 1985. Taken together, underused land increased in the central area of local cities on a nationwide scale. When this data was compared with the sum of Japan and the average of core cities, total yearly retail sales decreased in central areas. Focusing on cities of underused land area increased or decreased, not only a decline of total yearly retail sales was shown in cities where underused land area has increased (named high city), but also the area of transformation from business area to underused land in high city was significantly larger than in cities where underused land area was decreased (named low city). Accordingly, transformation of business area to underused land resulted in a decline in commercial activity.

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Developing the Carbon Neutral Investment Model for Local Government

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ABSTRACT

The City of Onkaparinga (Onkaparinga) in the south of Adelaide has successfully undertaken measurement of the carbon footprint of its operations and has devised a target of achieving carbon neutrality for the organisation by 2013. The purpose of this study was to undertake an assessment of the carbon neutral target and provide a pathway for action. The study involved the development of an economic assessment model that specifies Onkaparinga's baseline emissions profile to 2039/40, a range of emission reduction actions and, for the baseline and each action, a stream of capital and operating costs and benefits. For each action the model generates standard investment indicators such as payback period and net present value (NPV) as well as a cost of mitigation metric – cost per tonne of CO2-e mitigated. While some actions were shown to be an expensive means of emissions reduction (e.g. over $100/tonne of CO2-e) other actions were shown to have a negative cost, i.e. financially beneficial to the Council.

1 INTRODUCTION

The City of Onkaparinga (Onkaparinga) has successfully undertaken measurement of the carbon footprint of its operations, devised targets for emissions reduction, and implemented strategies to meet and exceed these targets (City of Onkaparinga, 2008).

Onkaparinga's *Climate Change Strategy 2008-2013* expands the framework for action with the following target:

> "Achieve carbon neutrality for the organisation by 2013 (for the purposes of this target carbon neutrality refers to the organisation's energy, waste and transport related emissions – not those from other sources including outsourced services" (City of Onkaparinga, 2008)

This target provides Onkaparinga with the opportunity to continue its leadership through the development of a strategy that will provide not only environmental benefit, but also an example of sustainable development by a Local Government during a time of significant anticipated growth.

The purpose of this study was to undertake a comprehensive assessment of the carbon neutral target and provide a pathway for action that provides direction for Onkaparinga to meet its target in a responsible way. The study intended to provide:

- Certainty in planning for the financial commitment of carbon neutrality
- A clear framework to guide the development or purchase of carbon offsets

- A ready point of reference for appraisal of progress against stated goals
- Accurate positioning of the carbon neutral claim in the context of the National Carbon Offset Standard
- Direct links to existing Onkaparinga programs and commitments
- A central focus of decreasing the ongoing cost-burden of the commitment to carbon neutrality, and ensuring continued adherence to the principles of the carbon management hierarchy.

Onkaparinga's commitment should be understood in the context of the potentially flexible concept of "carbon neutral", as well as the rapidly evolving National policy setting for climate change action and its impacts on voluntary action.

Use of the concept "carbon neutrality" has accelerated greatly since it first began appearing around 2003 and 2004, with many companies now making such claims (Clean Air-Cool Planet and Forum for the Future, 2008) as well as several Local Government organisations in Australia seeking to apply the concept to their operations (see Table 1). However there is no universally accepted definition of the term, no mandated standards for carbon offsets or carbon neutrality and "diverse opinions and expectations about what it should entail" (Commonwealth of Australia, 2008, p. 13). There are a number of recognised standards for carbon neutrality and a growing consensus of best practice in this area (Commonwealth of Australia, 2008). In July 2010, the National Carbon Offset Standard came into practice in Australia, which provides greater certainty around the expectations for the use of the term carbon neutral.

Table 1 Examples of Local Government Commitments to Carbon Neutrality

Name	Commitment	Coverage
City of Onkaparinga	Carbon neutral by 2013- Corporate scope 1 and 2 emissions	Buildings, streetlights, vehicles and machinery, Sewage Treatment and Effluent Disposal Schemes (STEDS)
City of Maribyrnong	Organisational target to become carbon neutral by 2015	Buildings, streetlights, vehicle fleet, water sewerage, waste
City of Darebin	Carbon neutral by 2020	Street lights, buildings, transport, waste
City of Adelaide	Carbon neutral by 2020, 60% reduction in carbon emissions by 2012	Corporate buildings, traffic and public lighting, vehicle and plant, waste
City of Sydney	"In 2008 became the first carbon neutral local government in Australia"	Gas, fleet, refrigerants, mains electricity, events, flights, taxis, major contractors
City of Fremantle	"the City of Fremantle is Proud to be Western Australia's first carbon neutral local government"	emissions from electricity, gas and fuel usage, as well as emissions from waste to landfill, taxi and air travel
City of Melbourne	Zero Net emissions by 2020	Council and community emissions

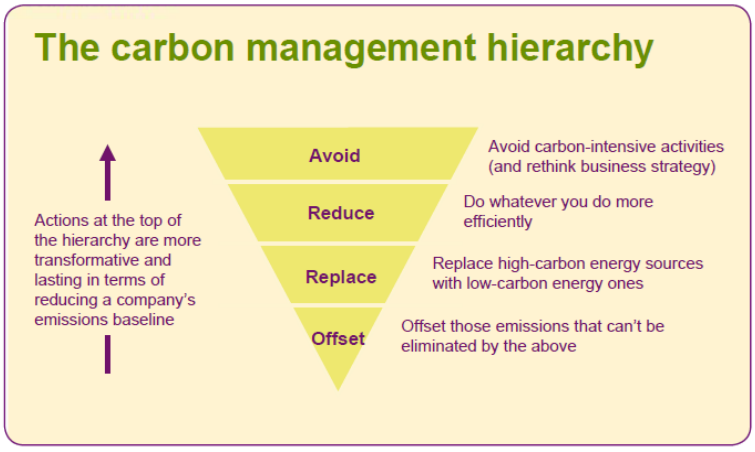
The following definitions of carbon neutrality assist in understanding its proper, and potentially improper, applications:

1. Making no net release of carbon dioxide to the atmosphere (2006 Oxford American Dictionary, cited in Clean Air-Cool Planet and Forum for the Future, 2008)

2. True corporate carbon neutrality means there is no net increase of atmospheric greenhouse gases from the existence of the company – or from a clearly-defined part of the company that accounts for a significant portion of the company's overall climate impact. If a company makes a claim regarding a specific product, then there should be no net increase of atmospheric greenhouse gases from the existence of that product. The process for achieving neutrality should begin with an inventory of the company's entire carbon footprint (or a full life-cycle analysis of a particular product) and the setting of a clear boundary. The company should then embrace a neutralization strategy that prioritizes the avoidance of emissions, their reduction through energy efficiency, the replacement of high-carbon energy sources with low- or zero-carbon alternatives, and then the use of high-quality carbon offsets. Every claim must be backed up by easily accessible, clearly communicated information regarding the company's full carbon footprint; the boundaries it has applied; and the strategy that has been embraced to achieve neutrality. (Clean Air-Cool Planet and Forum for the Future, 2008)
3. Commonly refers to a situation where the net emissions associated with a product or an organisation's activities are equal to zero through the acquisition and retirement of carbon offsets that meet additionality criteria. (Department of Climate Change, 2010b)

The first definition, while concise and essentially accurate, provides no guidance regarding how to define "no net release of carbon dioxide" in relation to an organisation or a product. The second definition provides substantially more guidance regarding the breadth of emissions sources that should be included in such a claim, referring specifically to an inventory of the carbon footprint or the application of life cycle analysis techniques in the case of a particular product. This definition also places an emphasis on the hierarchy of actions that are expected of an organisation making such a claim, in order for that claim to be considered genuine. This infers the behaviour and systems that an organisation demonstrates to reduce emissions are as important as any eventual "neutralisation" of emissions.

Figure 1: The carbon management hierarchy



Source: Clean Air-Cool Planet and Forum for the Future (2008).

The third definition repeats the concept of zero net emissions associated with a product or an organisation, but here the emphasis in the definition is placed on the quality of the offsets that must be acquired and retired to achieve neutrality. Specifically this definition emphasises additionality: the characteristic that ensures the purchase of the offset provides a benefit that is genuinely additional than would have occurred without the purchase being made.

In summary, carbon neutrality can be considered to be a useful framework for driving committed action within an organisation to achieve deep and lasting reductions in greenhouse gas emissions in its own operations, and ensuring that those emissions that cannot be eliminated are offset by genuine reductions in emissions outside the organisation. Such committed action is well supported by a body of scientific knowledge that points to the importance of targets for the rapid reduction in the concentration of atmospheric greenhouse gas.

It is important to note that the concept of carbon neutral is contingent on the voluntary purchase of some form of carbon offset. A carbon offset is an investment in a project or activity that reduces greenhouse gas emissions or sequesters carbon from the atmosphere that is used to compensate for greenhouse gas emissions from the investor's activities (EPA Victoria, 2009).

For several years, individuals and organisations in Australia have been voluntarily purchasing carbon offsets. This ranges from substantial investments by corporations or major events, to purchases of only a few dollars for an individual domestic flight. The Australian market for voluntary carbon offsets was estimated to be worth $150 million, and responsible for delivering 6 million tonnes of carbon offsets per annum (RMIT, 2010).

A critical concept in a voluntary carbon market is that of additionality. Ensuring additionality means making sure that a party is not spending money on an environmental benefit that would have happened anyway under business as usual conditions, either because it is compelled by law, or because the business case behind an action is already sufficiently compelling. It is a key concept in ensuring the integrity of the voluntary carbon market. The definition of additionality under the (now terminated) Greenhouse Friendly program is provided below:

> A project will be considered to have demonstrated additionality if the anticipated future revenue from generating greenhouse gas abatement is relied upon to ensure the financial viability of the project: that is, the project generates abatement that is beyond "business-as-usual' investment. Additional abatement projects are generally associated with an investment or behaviour change that would not normally be undertaken as part of the organisation's established operating practices, or under existing internal investment requirements. (Commonwealth of Australia, 2006, p. 19)

Natural conditions, as well as business conditions, need to be considered for additionality. For example, revegetation offsets had to meet the criteria recognised under the Kyoto Protocol for size, type, and age, and satisfy the regulator that it was occurring due to direct human intervention, and not for example, naturally occurring afforestation (Commonwealth of Australia, 2006).

The move toward carbon pricing under an emissions trading scheme, first through the Rudd Government's attempted Carbon Pollution Reduction Scheme and now the successfully passed Clean Energy Future carbon pricing package of the Gillard Government, introduced a new challenge to the voluntary carbon market. By legislating a national emissions target (5% reduction on 2000 levels by 2020), Australia's future greenhouse gas emissions essentially became fixed, *irrespective of voluntary action undertaken by individuals or organisations*. In other words, voluntary action would simply result in a redistribution of emissions reduction towards some areas and away from others; the net result for the nation as a whole would not change. The voluntary market therefore required new guidance regarding carbon offsets that could be purchased and retired with the assurance of additionality.

To provide this guidance, the Federal Government introduced the National Carbon Offset Standard (NCOS), which came into force in 1st July 2010. The purpose of the Standard is described below.

> The National Carbon Offset Standard ('the Standard') is intended to ensure that consumers have confidence in the voluntary carbon offset market and the integrity of the carbon offset and carbon neutral products they purchase. It provides guidance to businesses who wish to make their organisation carbon neutral or develop carbon neutral products in a way that achieves emissions reductions, through the purchase and retirement of carbon offsets that are beyond those achieved by the CPRS and achievement of Australia's national emissions reduction targets. (Department of Climate Change, 2010b)

The NCOS provides a definition of additionality with a focus on national and international targets:

> A requirement that a project or activity provide abatement that is additional to any that would occur in the absence of the project or activity, *and that is additional to abatement that would occur anyway to meet Australia's Carbon Pollution Reduction Scheme cap or International Target*. (Department of Climate Change, 2010b, emphasis added)

The implication of this definition is that additional abatement can occur only in those sectors of the Australian economy that are not covered by carbon pricing, since abatement in covered sectors is anticipated in response to the price itself. The major sector of the economy that is responsible for greenhouse gas emissions and not covered by carbon pricing is land use and agriculture.

Supporting frameworks for the development of additional carbon offsets are to be provided through the Carbon Farming Initiative (CFI). This scheme "establishes the institutional framework for a market-based approach to reducing emissions in the land sector. The credits created by the scheme will be able to be sold into a variety of markets" (Parliament of the Commonwealth of Australia, 2011). A memorandum published by the Parliament of the Commonwealth of Australia explains the operation of a voluntary market in the midst of a carbon price:

> In Australia, any company or person wishing to offset their emissions and achieve carbon neutrality for goods or services can do so under the National Carbon Offset Standard. Once the [Carbon Farming Initiative] scheme commences companies will be able to surrender ACCUs [Australian Carbon Credit Units] generated under this scheme to offset their emissions. To ensure that such action is a genuinely additional reduction of greenhouse gases to that already committed by the Government, the Government will ensure that this abatement is not counted towards Australia's Kyoto target or any subsequent international obligation. Such voluntary action is thus guaranteed to be of additional benefit to combating climate change beyond the mitigation driven by other policies and programs.

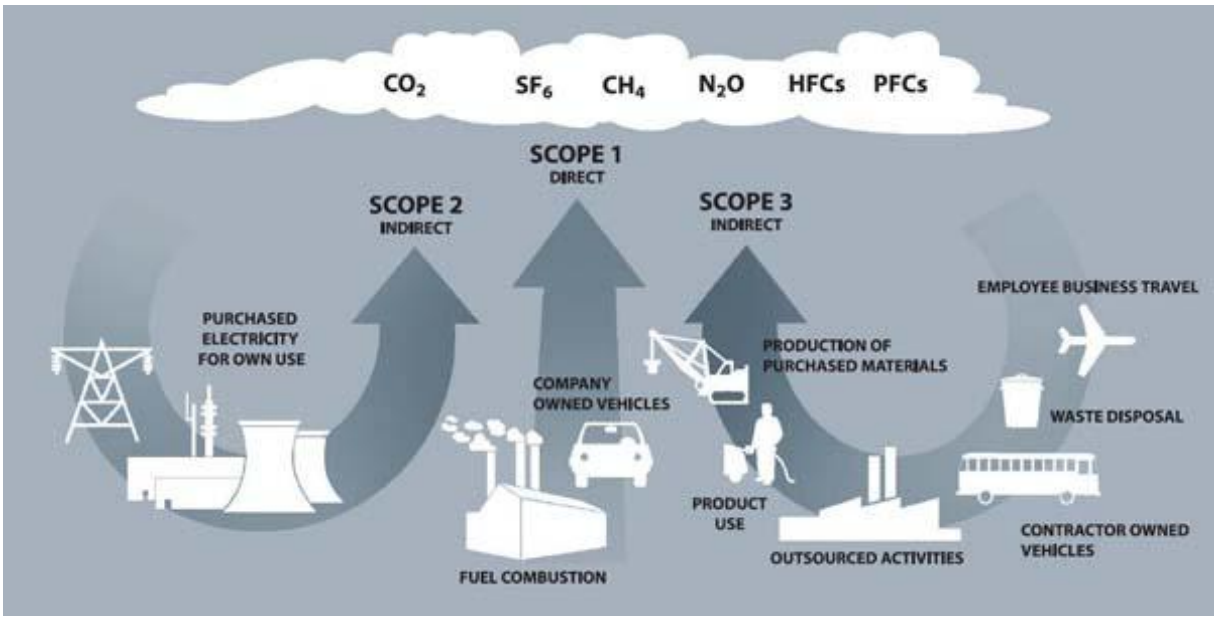
At the time of writing, framework methodologies for different types of offset projects are being developed for approval under the CFI, which is intended to then enable fast tracked approval of carbon offset projects (Department of Climate Change and Energy Efficiency).

After a period of considerable policy flux, certainty is returning to the voluntary carbon offset market in Australia. The opening of the CFI should enable organisations like Local Governments to meet voluntary commitments to carbon offsetting with confidence that their investment is providing a benefit that is above and beyond that to which Australia is committed through legislation.

DEFINING THE SCOPE OF THE MODEL

The model is based on Onkaparinga's corporate greenhouse gas emissions reported in its *2008-09 Inventory of Corporate Greenhouse Gas Emissions* (see Figure 3), with the model commencing with the financial year 2010/11 and ending 30 June 2040. Key reporting dates are 2013/14 (first carbon neutral target year), 2020/21, 2030/31 and 2039/40. The corporate emissions come from energy used by the City of Onkaparinga (electricity, gas and fuels) and from fugitive emissions from the disposal of corporate waste to landfill and council owned wastewater treatment. It does not include the emissions arising from outsourced services (such as collection and disposal of commercial and household waste to landfill) and embodied emissions in goods purchased by Onkaparinga. The model can estimate scope 1, 2 and 3 emissions. However, for the purposes of reporting corporate emissions and all related metrics, scope 1 and 2 emissions were used.

Figure 2 Representation of Different Scopes for Greenhouse Gas Reporting

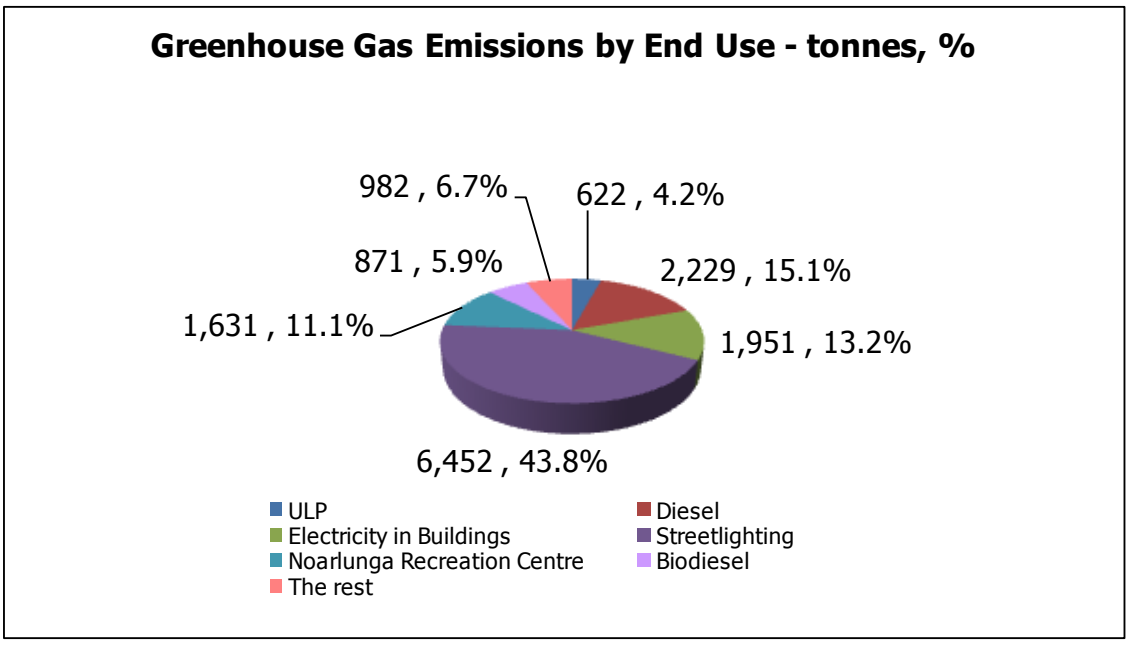


Source: World Resources Institute

Frameworks for mandatory reporting of greenhouse gas emissions have the long established protocol of reporting Scope 1 emissions (direct emissions, such as from the combustion of fuels) and Scope 2 emissions (indirect emissions associated with the purchase of electricity or steam) (Department of Climate Change, 2008). While the mandatory reporting requirements of Scope 1 and 2 emissions are obvious inclusions, many significant sources of emissions that are closely associated with the organisation or product may be Scope 3 emissions (a description of Scope 1, 2 and 3 emissions is shown in Figure 2). The challenge then becomes deciding which Scope 3 emissions to include. Many organisations selectively measure and include certain Scope 3 emissions. Emissions from corporate travel are a common, ad hoc, Scope 3 inclusion.

Currently, the main contributors to Onkaparinga's emissions profile are electricity and gas use in council-owned buildings (24% of total emissions), fuel use by council-owned vehicles (25% of total emissions) and electricity use by street lighting (44% of total emissions).

Figure 3 Onkaparinga's Baseline Corporate GHG Emissions Profile



Source: City of Onkaparinga (2009).

DEVELOPING THE BASELINE EMISSIONS PROFILE

The first part of the model is the baseline emissions profile. Figure 4 describes the components and the associated flow of information that make up the baseline emissions profile. The baseline emissions profile uses the 2008/09 reported emissions as its starting point. The profile includes commitments made by Council by 30 June 2010 and assumes no further voluntary behavioural change by Council employees beyond trends currently observed. Energy use and fugitive emission trajectories were derived from assumptions (documented in the model) based on:

- Analysing trends and anomalies in 5 years of inventory data
- Reviewing Council policy and undertaking internal consultation
- Reviewing external literature and undertaking external consultation

All assumptions were reviewed by an internal reference group (IRG) convened for this project. The process for developing these assumptions and constructing Base Case emissions for each emission source is outlined in Figure 5 below, using the emission source of fleet vehicles as an example. All relevant assumptions, associated quantitative data (where relevant) and sources are documented within the model.

Energy use and fugitive emissions were converted to emissions - measured in tonnes of carbon dioxide equivalent (tCO2-e) - using emission factors. Emission factors were sourced from the National Greenhouse Accounts (NGA) Factors workbook series.[1] Similarly, expected changes in emission factors were modelled out to 2040, based on analysis of past trends and external expert advice.

[1] With the exception of the biodiesel emission factor which references CSIRO *et al* 2003 report - *Appropriateness of a 350 ML Biofuels Target*.

Figure 4 Baseline Emissions Profile Flow of Data

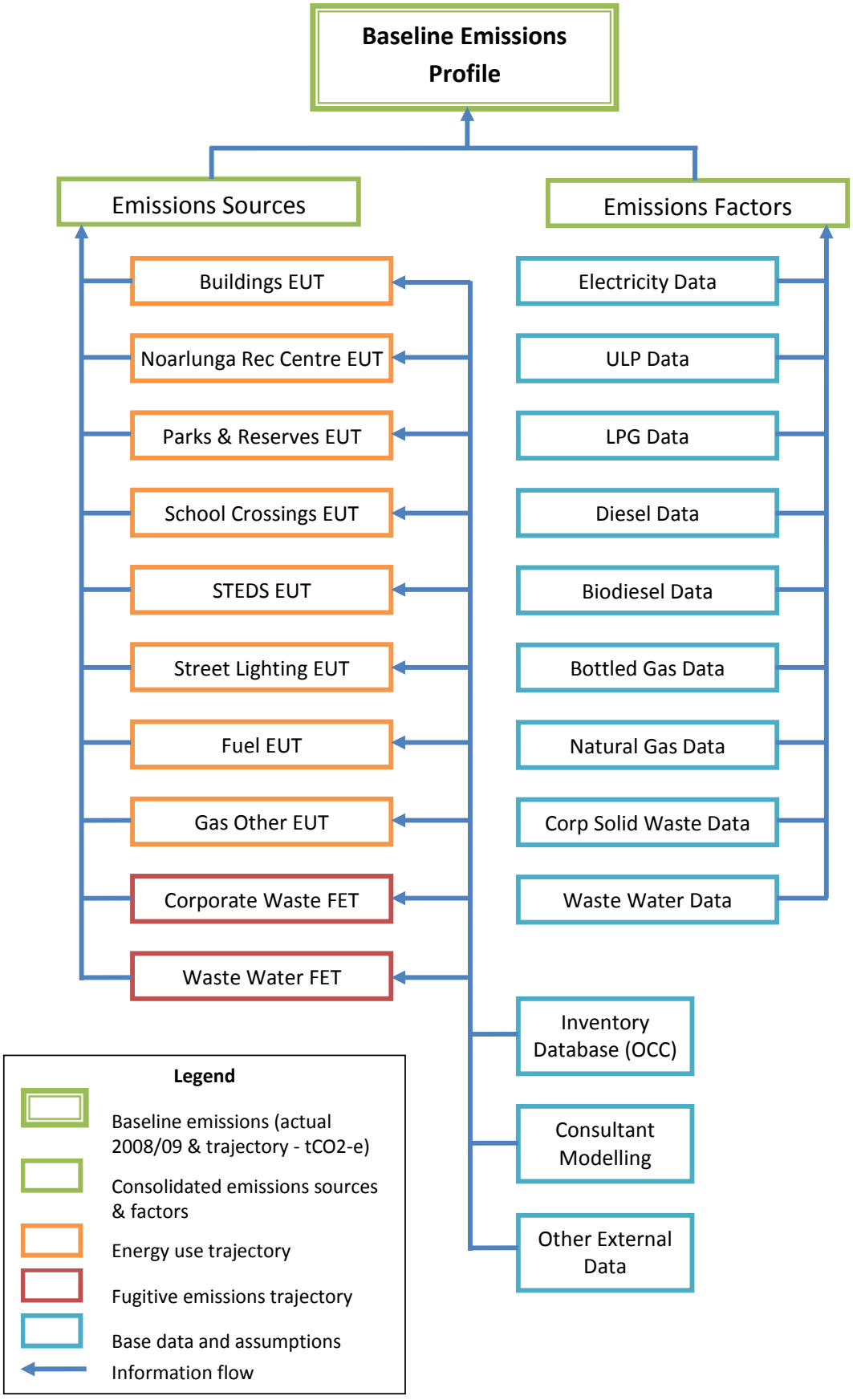


Figure 5 Process for the Development of Onkaparinga's Base Case Emissions

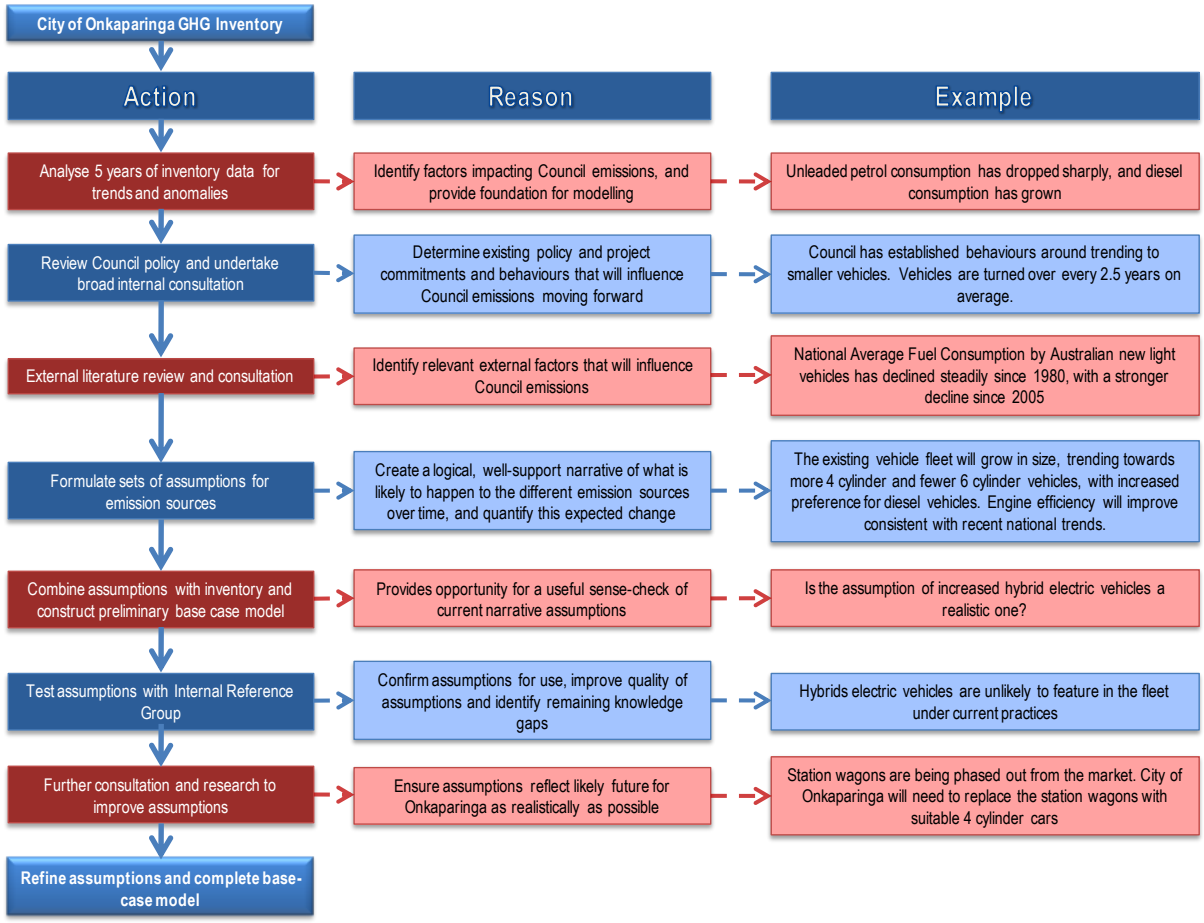


Figure 6 Modelled Base Case Emissions for City of Onkaparinga

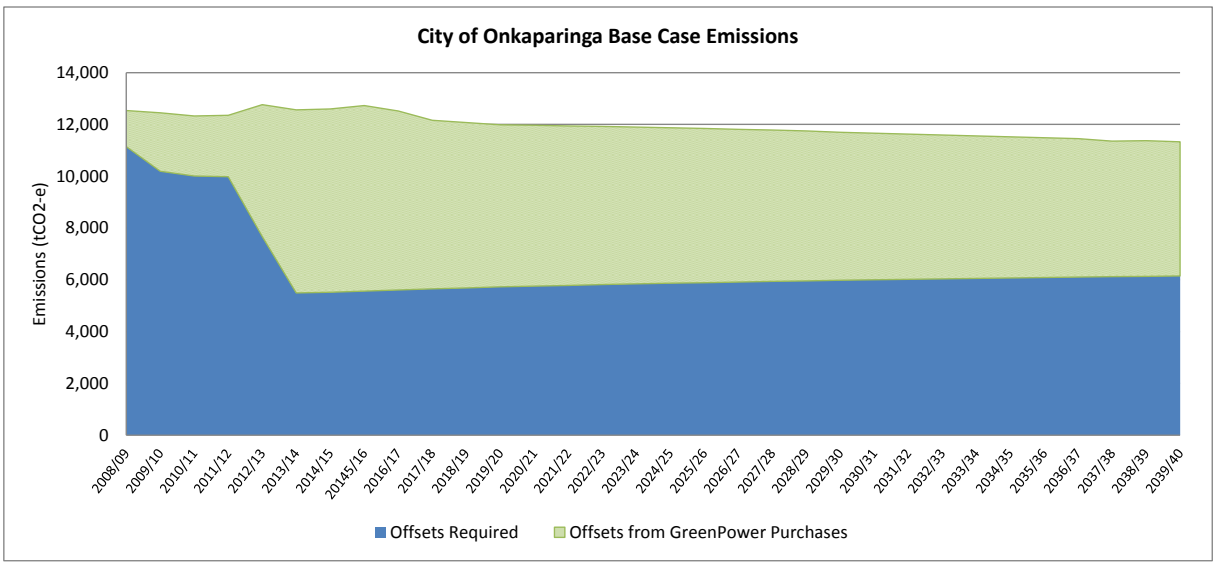


Figure 6 illustrates the baseline emissions profile. The green line in the graph represents Onkaparinga's corporate emissions over time. Onkaparinga has been purchasing some greenpower and is committed from 2013/14 to purchase 100 per cent of its electricity purchases as greenpower. The green hatched area under the graph represents the Onkaparinga's greenpower purchases, and the blue area under the graph represents the Onkaparinga's residual emissions for which, from 2013/14, the council is committed to buying offsets.

IDENTIFYING AND MODELLING EMISSION REDUCTION ACTIONS

Following the development of the baseline emissions profile, emission reduction actions were identified and confirmed for relevance. Actions were sought on their ability to reduce the emissions profile of Onkaparinga over time, in order to minimise the amount of offsetting that would be required in future. Energy use trajectories were derived for the actions from assumptions (documented in the model) based on:

- Identifying areas of high energy use with potential for savings
- Reviewing external literature and external consultation to identify and quantify potential actions
- Internal consultation to identify and quantify potential actions and review feasibility.

All assumptions were reviewed by the IRG. Energy use trajectories were modelled for each action:

- Without the action (i.e. the baseline)
- With the action.

Table 2 lists the actions modelled.

Table 2 List of Actions Modelled

Emission Source	Action
Street lighting (electricity)	Installation of high efficiency lights on all new street lights 80W and smaller
	Replacement of all in-situ streetlights 80W and smaller with high efficiency lights
Buildings (electricity)	Retrofit buildings using a suite of existing cost effective technologies
	Upgrade irrigation pumps at Willunga Golf Course
	Upgrade fairway turf at Willunga Golf Course
Large vehicle fleet (fuel, mainly diesel)	Replace waste trucks with hybrid drive train waste trucks
Small vehicle fleet (fuel: ULP, diesel and LPG)	Replace 4 cylinder vehicles with electric vehicles

COSTING ACTIONS

Once the energy use trajectories were developed, a stream of capital and operating costs and benefits for the baseline and the action were calculated in 2010 dollars. Incremental costs and benefits of the action (i.e. action cost/benefit net of the baseline cost/benefit) were then calculated. Costs were derived from assumptions (documented in the model) based on:

- Reviewing external literature and external consultation
- Internal consultation

Electricity and natural gas price projections were based on Australian Government Treasury modelling, with a long-term real price increase of 1.13 per cent per year assumed. Fuel price projections relied on AECOM modelling work for the NSW Government on the introduction of electric vehicles, with a long-term real price increase ranging from a 0.4 to 1.6 per cent per year assumed. Water pricing was based on SA Water short-term price forecasts and a 3 per cent per year real price increase was assumed.

All assumptions were reviewed by the IRG.

CALCULATING NET BENEFIT OF ACTIONS

The calculation of net benefits of an action was undertaken using the general framework for cost benefit analysis (CBA). Three metrics were calculated to assist decisions about implementing alternative actions, these being:

- net present value (NPV), measured in dollars;
- breakeven year, measured in number of years from initial investment; and
- cost of mitigation, measured in dollars per tonne of CO2-e mitigated.

Net Present Value

This involved estimating a stream of costs and benefits for both the base case and the action. From these streams of benefits and costs, the net present value of the action was calculated. This can be expressed generally as:

Net present value (NPV) = discounted incremental benefits less discounted incremental costs.[2]

More formally, for action 'a', the NPV can be expressed as:

$$NPV^a = \sum_{t=1}^{n} \frac{(B^a - B^b)_t}{(1+r)^t} - \sum_{t=1}^{n} \frac{(C^a - C^b)_t}{(1+r)^t}$$

where:

B^a is the stream of benefits from the action

B^b is the stream of benefits from the base case

C^a is the stream of costs from the action

C^b is the stream of costs from the base case

r is the discount rate

t is the time period in years

n is the number of years over which the analysis is conducted.

A discount rate of 7% (with a range of 4% to 10% factored into the model) was used and the analysis was conducted over 10, 20 and 30 year time periods.

[2] Discounting refers to the process of adjusting future benefits and costs to their equivalent present-day values (Sinden and Thampapillai, 1995).

Breakeven Year

The NPV indicates whether or not the action will generate a net benefit within the period of analysis. If so, it is possible to determine in which year the calculated NPV becomes positive.

This is known as the breakeven year and can be an important consideration in deciding on whether or not to invest in a particular action, i.e. "How long will it take to turn a profit?"

Cost of Mitigation

The decision rule under normal investment conditions is that an action is considered to be potentially viable if the NPV is greater than zero. However, when the action is aimed at achieving an environmental benefit, for example, and that benefit or service does not have a market value, then the standard decision rule is less useful.

The calculation of NPV is still worthwhile, however, in informing decision making in these circumstances, particularly where the estimated NPV is a negative value. For example, the question can be asked, "Are un-priced net benefits of protecting the environment worth the value of priced net costs from undertaking the investment?"

As the non-market or un-priced benefits are not included in the calculation, the results of the CBA are presented as a threshold value. Presenting the results as a threshold value emphasises that there are significant unpriced values that have been excluded from the analysis.

The standard threshold analysis was extended in this study to unitise the threshold value in terms of the physical measure of environmental benefit. This unitised measure, the cost of mitigation metric, is expressed as the cost per tonne of CO2-e mitigated. It provides an indication of the cost effectiveness of the action.

This metric was calculated from the incremental emission savings (which are the incremental energy savings multiplied by the appropriate emission factor) divided by the present value of that action for that given period of time. The model has calculated the cost of mitigation for the reporting years by dividing the NPV of the reporting period by the cumulative tonnes of emission saved to the reporting date. Hence:

$$CM^a = \frac{-NPV^a}{M^a}$$

where:

CM^a is the cost of mitigation for action 'a' expressed in dollars per tonne of CO2-e mitigated

M^a is the cumulative tons of emission saved to the reporting date.

Note that if CM^a is negative, it simply indicates that the action reduces both emissions and costs when compared with the base case.

To be consistent with the calculation of NPV, the cumulative tonnes of emission saved, M^a, was calculated as an incremental value, i.e. the emissions calculated under the base case less any emissions calculation under action 'a'. This can be expressed as:

$$M^a = \sum_{t=1}^{n} (E_t^b - E_t^a)$$

where:

E_t^b is the emissions under the base case in time period t

E_t^a is the emissions under action 'a' in time period t.

For each source of energy under the base case the emissions were calculated as the product of the quantity of energy from that source and the emissions factor for that energy source. Thus:

$$E_t^b = \sum_{i=1}^{m} (ES_{it}^b . EF_{it})$$

and

$$E_t^a = \sum_{i=1}^{m} (ES_{it}^a . EF_{it})$$

where:

ES_{it}^b is the use of energy from source i under the base case in time period t

ES_{it}^a is the use of energy from source i under action 'a' in time period t (expressed in units relevant to the energy source, e.g. kWh for electricity,)

EF_{it} is the emissions factor for energy from source i in time period t (expressed as tonnes of CO2-e per unit of energy)

i is the energy source

m is the number of energy sources.

Although the emissions factor for many energy sources will remain constant over time, for electricity in particular it is expected to decline as distributors utilise an increasing proportion of renewable energy. Emission factors were sourced from the National Greenhouse Accounts (NGA) Factors workbook series (Commonwealth of Australia, 2009, 2010).[3] Expected changes in emission factors were modelled out to 2039/40, based on analysis of past trends, review of relevant literature and external expert advice.

ACTION CASE STUDY: WILLUNGA GOLF COURSE PUMPS

The Willunga Golf Course, owned and operated by Onkaparinga, irrigates its turf with an allocation of recycled water. Irrigation is delivered via a sprinkler system powered by two 40W pumps capable of delivering the required peak capacity of 1,200 litres of water per minute. The pumps are approximately 20 years old.

Consultation with Onkaparinga staff responsible for the operation of the course and external suppliers of pumping equipment suggested that the peak capacity requirements could be provided by two 22W variable speed drive pumps operating in tandem. This change over has been assumed to provide a 45% energy saving in delivering the same pumping task.

The upfront capital cost of this changeover was estimated to total $60,000. Cost savings from energy are delivered immediately upon commissioning of the new system. Furthermore, the downsizing of the pumps along with dual variable speed drives is assumed to provide a more controlled flow of water in the irrigation system, with fewer pressure shocks. Significant further annual cost savings are realised through a reduction in maintenance requirements.

The results of the analysis of the pump replacement action are shown in Table 3. The key points to note are:

[3] With the exception of the biodiesel emission factor which references CSIRO *et al* (2003).

- a net present value of over $77,000 by 2020/21;
- a payback period for this action of less than 5 years;
- 345 tCO2-e mitigated by 2020/21 compared to carbon emissions under the base case;
- a cost of mitigation of -$223 per tonne CO2-e, which implies a positive financial return to Onkaparinga as well as contributing to the objective of carbon neutrality.

Table 3 Summary Results for Willunga Golf Course Pump Replacement

Action 1 – Replace irrigation pumps	**At 2020/21**	**At 2030/31**	**At 2039/40**
Mitigation (Cumulative tCO2-e)	345	549	549
Net Present Value ($)	77,083	139,649	125,158
Cost of Mitigation ($/tCO-2e)	-223	-255	-228
Estimated payback period:	5 years		

The NPV was calculated to increase to almost $140,000 when calculated over 21 years (to 2030/31) but declined when calculated over 30 years (to 2039/40). This seemingly anomalous result occurs because pump replacement was assumed to have occurred under the base case (scheduled in 2029/30) and the benefits from the base case investment in the later years will more than offset the benefits of the original action.

A similar explanation applies to the cumulative mitigation of tCO2-e where, under the base case, the eventual replacement of the pumps will mean there are no net reductions in emissions thereafter. Consequently, the cumulative net reduction in emissions estimated to total 549 tCO2-e by 2030/31 was unchanged in 2039/40.

DEVELOPING A TARGET EMISSIONS PROFILE

Through discussion with the IRG, the most cost effective and feasible actions were chosen to inform emission reduction targets. Table 4 lists the actions that were used to develop the target emissions profile.

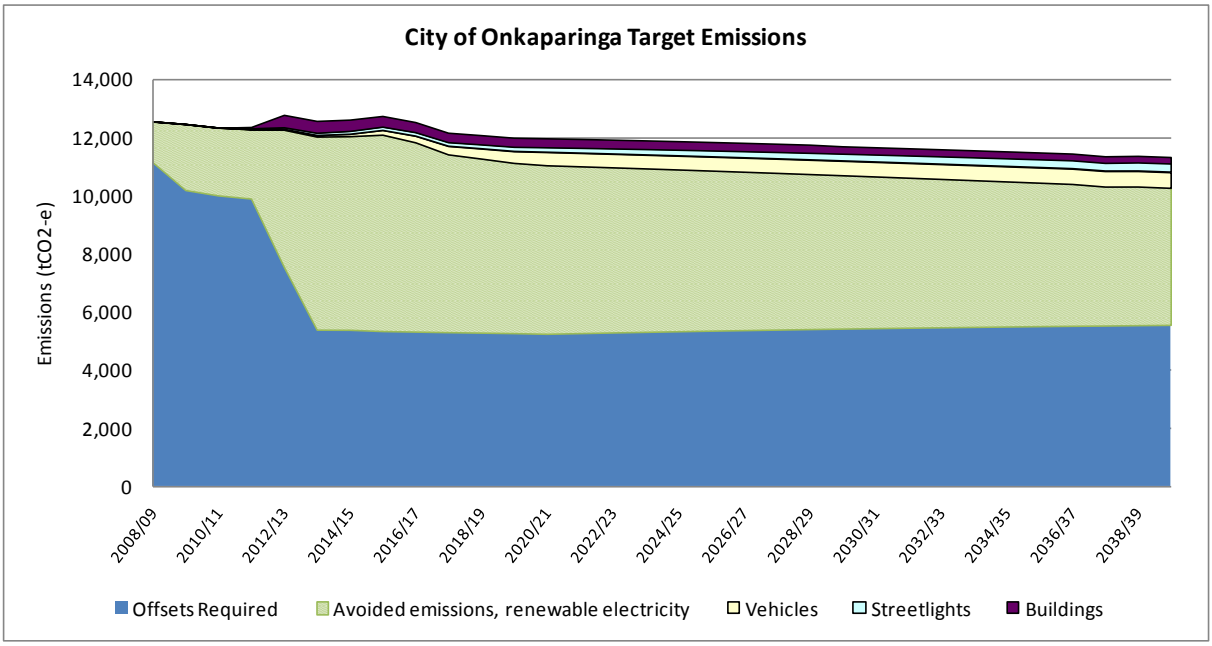
Table 4 List of Actions Modelled for the Target Emissions Profile

Emission Source	**Action**
Street lighting (electricity)	Installation of high efficiency lights on all new street lights 80W and smaller
Buildings (electricity)	Retrofit buildings using a suite of existing cost effective technologies
	Upgrade irrigation pumps at Willunga Golf Course
Large vehicle fleet (fuel, mainly diesel)	Replace waste trucks with hybrid drive train waste trucks
Small vehicle fleet (fuel: ULP, diesel and LPG)	Replace 4 cylinder vehicles with electric vehicles

The target emissions profile shows a 53 per cent decline in greenhouse gas emissions from 2010/11 to 2020/21, 8 per cent greater than the decline in emissions in the baseline emissions profile for 2020/21. As shown in Figure 7, the proposed actions for Buildings including upgrade of pumping at the golf course deliver a fast reduction in the avoided emissions.

Larger mitigation however is achieved through actions directed at vehicles. This mitigation builds slowly until around 2020/21.

Figure 7 Modelled Target Emissions for the City of Onkaparinga



EXCLUDING STREET LIGHTING FROM THE MODEL

As indicated in Figure 3, emissions from street lighting is the single largest source of emissions for Onkaparinga Council, making up 44% of total emissions in the baseline year, consistent with estimates from other South Australian Councils (ICLEI, 2006, cited in LUCID Consulting Engineers, 2009).

The majority of the street lighting in Onkaparinga is operated under the Street Lighting Use of System (SLUoS) arrangement, where a tariff is "charged to Councils...for the use of public lighting that is owned and maintained directly by ETSA Utilities" (LUCID Consulting Engineers, 2009, p. 37) and Councils pay for the electricity consumed.

Recently some more energy efficient lighting options have been approved by ETSA under the SLUoS tariff. However this has occurred with a prohibitive annual tariff premium of 75% (LUCID Consulting Engineers, 2009, p. 21; ETSA Utilities, 2010). This far outweighs any financial incentive that could be provided by reduced energy consumption.

On behalf of the Local Government Association of South Australia, legal advisors Finlaysons provided advice as to "whether the responsibility for the reporting of energy consumption of public street lighting lies with the Local Government or with ETSA Utilities" (Finlaysons, 2010). Their determination stated that " Based on the provisions of the NGER Act, ETSA is responsible for reporting the energy consumed by public lighting installations on the "Standard" tariff, *because it has "operational control" of the lights*" (Finlaysons, 2010).

Inclusion of street lighting in a carbon neutral target may also be counterproductive. Should Councils accept a significant price penalty for efficient lighting and assume offsetting responsibilities, pressure to enact broader scale technological change would lessen. Offsetting emissions from inefficient lights could even be construed as expenditure that preserves an

inefficient technological and regulatory status quo. By contrast a transfer of reporting of these emissions to electricity distribution companies would likely be the most effective means to achieve efficiency improvements in street lighting since these organisations may then have the incentives as well as the resources to address the issue at scale.

Therefore, while these emissions were modelled under the Base Case and actions to reduce emissions from this source under current regulatory and cost arrangements were investigated, this modelling and report also prepared cases that excluded emissions from street lighting for the purposes of outlining a pathway to carbon neutrality for Onkaparinga.

The final decision regarding this exclusion rests with Council. In order to model the impact of this exclusion, a copy of the whole model – less street lighting – was created i.e.

- Baseline – with street lights excluded (known as the Pathway Base Case)
- Actions – with actions associated with street lights excluded (known as the Pathway Implementation Case)

DISCUSSION AND CONCLUSIONS

By adopting a rigorous approach to planning to meet the carbon neutral commitment, based on modelling of baseline emissions and various emission reduction actions to 2040, Onkaparinga has gained a number of valuable insights into the risks, opportunities and limitations that a commitment to carbon neutrality affords a Local Government.

Despite the modelling of a reasonably aggressive portfolio of emission reduction actions, it is clear that Local Governments could expect a significant level of residual greenhouse gas emissions that will require the purchase of both GreenPower and other offsets in order for a carbon neutral commitment to be met.

The requirement for GreenPower reflects limitations in the number of effective building retrofits that may be delivered in a given period, limitations in the reductions that might be achieved per project, and a large and dispersed group of building assets ranging from very large to very small.

The requirement for other offsets reflects a large body of emissions from the consumption of liquid fuels. These emission sources show only a slow underlying response to technology improvements. They are dispersed over a very large amount of plant and equipment, making rapid changeover to more efficient technology essentially impossible. They are also subject to growth in peri-urban municipalities like Onkaparinga.

However, within liquid fuel emission sources, electric vehicles provide a strong option for good value emission reduction in the medium term. Pricing of this technology remains uncertain, however indications are that it will be a matter of when, rather than if, this technology becomes a viable option for Local Government fleets. Preparations should be made for adoption of such technology.

Despite their limited overall contribution to cutting emissions, most of the emission reduction actions assessed showed a positive NPV to 2020, short payback period and negative cost (i.e. profitable) mitigation of greenhouse gases. One of these actions has already been implemented, and others have been supported and expanded on by more detailed investigations. It is these opportunities that Local Governments will benefit from identifying and implementing as a matter of priority. A structured approach to the concept of carbon neutral, that aims to reduce the long term cost to the Local Government, assists in identifying such opportunities. They will mitigate exposure to rising energy prices, reduce operational

expenditure particularly in buildings, while contributing to the attainment of important environmental objectives. In this way, the concept of carbon neutrality can provide genuine environmental improvements, as well as advantage to the organisation, provided the carbon neutral hierarchy is closely adhered to.

Another key finding of this process was the distinction between Local Government control and Local Government influence. The main area in which this is relevant is street lighting. Local Governments lack control over these assets, with tariff barriers to the implementation of more efficient lights. Were Local Governments to retain street lighting as part of the carbon neutral target, then offsets for these emissions may be purchased, and an environmental benefit may be achieved.

However, through the considered decision to exclude these emissions from the target, Onkaparinga may in fact contribute to achieving a greater national outcome. Offsetting would be an economically and environmentally inferior result compared to change over to more efficient lights. This large scale changeover is only likely to occur with a shift in responsibility for the emissions from Local Governments (who pay the electricity bills) to network operators (who control the assets). As such, a fluid interpretation of an organisation's responsibilities under the carbon neutral hierarchy should be maintained, with an eye to contributing to greater outcomes overall than might be achieved through the potentially narrow-minded and expedient progression to the purchase of offsets.

Local Governments may also apply influence to improve opportunities to reduce emissions in cost effective ways. For example, the first generation of electric vehicles in Australia will not qualify for Government discounts for purchasing. Based on the modelling undertaken for this project it is this discounting, rather than the technology price itself, which makes this emission reduction action financially unattractive. With sufficient organisation, Local Governments may be able to exert useful influence to, for example, extend Government discounting to all zero-emission vehicles. This will then enable emission reduction targets to be met in ways that are more cost effective and in better agreement with the carbon neutral hierarchy.

Carbon neutrality is a highly used but oft poorly understood concept. Through the insistence of rigour and the development and application of a tailored financial model, Onkaparinga have positioned themselves to apply the concept of carbon neutral wisely and judiciously for the right balance of benefits. This is a critical outcome, for it will contribute to ongoing support for rigorous actions for continued environmental improvement at the Local Government level.

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Responding to Regional Economic Restructuring and Adaptation in the Latrobe Valley, Gippsland

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ABSTRACT

Regional and rural communities are more exposed than their metropolitan counterparts to the impacts of economic restructuring, natural disasters and climate change due to their reliance on smaller and less diverse economies. The capacity of regional communities to adapt to major shocks is dependent, in part, on institutional arrangements that enable integrated and participatory approaches to regional development. We begin by outlining the socio-economic impacts of restructuring of the regional economy, and the framework the Victorian Government has used to design responses to these changes. The presenters will argue by seeking early engagement and careful pre intervention activities the adjustment process may be more easily navigated in the longer term through aligning regional priorities, building local institutional capacity, addressing asymmetries of information and increasing the skills and capacity of the workforce. We argue the legacy of this participation is institutional arrangements that enable greater resilience and adaptability in the face of competitive and restructuring pressures.

DISCLAIMER

The views expressed in this paper are those of the authors and should not be regarded as representing the views of the Victorian Government nor the Department of Planning and Community Development.

INTRODUCTION

The Federal Government has legislated to introduce a carbon price from July 2012 and proposed that impacts upon households, trade exposed firms and regions reliant on affected industries will be ameliorated through a number of complementary assistance packages (Combet, 2011). The Latrobe Valley region in Victoria has attracted significant media attention in the national carbon pricing debate regarding local impacts associated with the Federal Government's *Clean Energy Future* policy. As is often the case, national discussion about policy issues can overlook stories of local participation and action. Given the relative importance of carbon intensive energy to the Latrobe Valley region, the policy response to these changes, will require careful consideration. We argue that how communities in the Latrobe Valley respond to these current adjustment tasks will depend in part on the strength of locally based institutions and their capacity to marshal resources to address the likely impacts of pricing carbon across the economy. The Victorian Government has initiated a

proactive regional development strategy in partnership with local and federal government and business and community organisations in the Latrobe Valley to position the region for the future. The regional development strategy is evolving and reliant on the collective will of three tiers of government and regional stakeholders to navigate a shared outcome and development trajectory that will see the Latrobe Valley community through a period of considerable change, restructure and ultimately renewal.

The paper is organised as follows. First, we outline a history of structural adjustment policy in Australia and Victoria. Second, a definition of the contemporary approach to regional development policy which is applied in Victoria, and has framed the government's response in the Latrobe Valley, is developed. Third, to set the context for current policy responses we provide an historical perspective on the development of the Latrobe Valley and previous policy responses to economic change. Fourth, we examine the design features of the current response to the *Clean Energy Future* policy which focuses on an integrated approach to regional development issues. Finally, we draw conclusions and identify early lessons for other policy makers facing simular predicaments.

NATIONAL INDUSTRY RESTRUCTURING REVISITED

The late 1980s and 1990s saw significant structural reforms in the Australian economy with the overall intent of adopting greater international competitiveness (Parham, 2004). In this time, financial, economic and labour markets were deregulated and a national reform agenda introduced to tackle an identified national long term decline in productivity (Forsyth, 2000, p. 235). This approach to economic policy was based on the implementation of a series of restructuring plans for trade-exposed industries such as motor vehicle, textiles clothing footwear, heavy engineering, steel and shipbuilding. The plans were designed to be temporary and to provide assistance to help Australian industry modernise, innovate and find new markets while at the same time allow Government to progressively lower levels of protection afforded to most of their products. The general tariff reduction program was a key part in the initiative entitled *Building a Competitive Australia* and announced the phase down of general tariff rates. By way of example, average effective rates of assistance for manufacturing declined from 24 per cent in 1978-79 to 15 per cent in 1990-91 and five per cent by 2005 (Beer, 2006). These tariff cuts were accompanied by measures to enhance labour market and training programs, rural adjustment schemes and increased services and loans to exporters.

In 1995 the Council of Australian Governments (COAG) committed to implement a range of microeconomic reforms under the direction of a National Competition Policy (NCP). The purpose of NCP was to forge a national market by using a more coordinated approach of promoting competition across different jurisdictions (Australian Treasury, 2009, p. 55). These reforms in Victoria extended to non-tradeable sectors such as water, gas, electricity and transport and state-owned enterprises (Costar and Economou, 1999). Victoria achieved significant reform across these areas leading to increased efficiency, improved service quality and reliability and lower prices for consumers (Victorian Department of Treasury and Finance, 2011). The distributional effects of these reforms were, however, uneven with costs borne by particular individuals, communities and regions (Beer, 2006; Birrell, 2001; Productivity Commission, 1999, 2005).

Regional and rural communities experience more acutely the pressures of structural adjustment and are subject to continual change due to economic forces, changing policy settings, demographic shifts, and other external shocks. These changes can be amplified in regional areas because of smaller economies, less diversity, and greater distance to access markets. Regions supported by more than one industry are less likely to be severely affected

by shocks (Australian Government, 2009, p. 4). Similarly, those with a skilled workforce are typically more resilient than those with fewer skills. In the context of a globally competitive economy, regions have to adapt to these changes to position themselves for longer term sustainable economic growth and to avoid the sharper economic and social impacts structural adjustment can bring.

Structural adjustment involves large and relatively sharp compositional shifts in the structure of an economy. It is defined as changes in the relative size of industries, in the characteristics of the workforce and in the size and mix of activities within regions, generally across a time period of less than 20 years (ACIL Tasman, 2008). The driving forces behind structural adjustment are often to increase a region's competiveness and productivity in the longer term. The forces can be related to market factors, such as increased competition, changes in demand for goods, changes in the availability or management of natural resources, or demographic or technological change. Alternatively, they can be as a result of policy change by governments, such as trade and investment liberalisation, regulatory or taxation reform, or implementation of more stringent environmental standards.

Responding to the concern raised by regional and rural communities undergoing changes brought by successive macro and micro economic reforms, the Productivity Commission undertook a wide-ranging review of the impact of NCP on regional and rural Australia in 1999 with an update of regional modelling impacts of the reforms in 2005. The review found that NCP and related reforms directly contributed to productivity and price changes in infrastructure sectors during the 1990s, increasing Australia's Gross Domestic Product (GDP) by 2.5 per cent or $20 billion (in 2005/06 dollars) (Australia Treasury, 2009, p. 56). Regional modelling conducted in 2005 to assess the impact of the policy found benefits had generally accrued in all regions examined except Gippsland in Victoria. The estimated decline in activity in the Gippsland region was thought to be due to the cumulative negative effects of electricity and gas, rail, water and statutory marketing authority reforms, which more than outweighed the positive effects of road and telecommunications reform (Productivity Commission, 2005). Although the aggregate effects may have been positive at a state and national level, these findings demonstrate that the costs of economic reform can be distributed unevenly, particularly in regions, and this impact has necessitated proactive policy responses from Australian governments.

TRADITIONAL ROLE OF GOVERNMENT IN REGIONAL INDUSTRY RESTRUCTURING

The appropriate role for Government has been thoroughly reviewed in the past 30 years of institutional reforms in the Australian economy (McColl and Young, 2005; Productivity Commission, 1998, 1999, 2001). These reforms have been framed by a neoclassical perspective of the economy which argues that government should reduce institutional barriers in the economy and ensure the market mechanism can work freely (McDonald *et al*, 2010). The view holds that Government should only intervene in the operation of the market where there is evidence of a failure to produce efficient outcomes - for example, when negative externalities such as pollution occurs or when public goods need to be provided. This perspective is supported by bodies such as the Productivity Commission (2001) who promote the view that Government intervention to constrain or prevent structural change is likely to cause distortions and decrease productivity by attempting to prevent or delay resources moving to the most productive uses. Furthermore, that rather than preventing or delaying structural adjustment, the broad rationale for considering government intervention includes addressing perceived equity concerns, expediting adjustment, improving the efficiency of

adjustment, and addressing other market failures (Productivity Commission, 2001). The central role of government then is to facilitate structural adjustment and or manage the rate and impact of long-term change (Walsh, 2008).

In this sense one of the key responsibilities of government in implementing any reform is to identify those groups of society disproportionately impacted (Productivity Commission, 1999). While structural adjustment delivers significant benefits overall, it is often the case that the distribution of these benefits are uneven. There will be times when particular individuals, businesses, communities and industries will suffer dislocation, including through job losses, reduced expenditure and capital being sunk prematurely. These situations are most likely to occur when change is rapid and concentrated in areas where there is little diversity in industry and hence few other employment opportunities. Importantly, the case for additional support measures is strongest where a policy change clearly imposes a significant burden on a specific group who has limited capacity to adjust, and where existing support measures are considered inadequate (Productivity Commission, 1999, 2001; Walsh, 2008; Garnaut, 2008). Targeted adjustment assistance can be appropriate in situations where the affected group is relatively easy to identify and limited in its capacity to handle the adjustment pressure, and where the impacts can be clearly associated with the proposed policy change (McColl and Young, 2005, p. 4; Garnaut, 2008, p. 395).

State and Federal Government's have a long history and record of carrying out structural reforms and assistance measures in the Australian economy. A number of key lessons can be drawn from this experience of particular relevance to regional development practitioners as well as policymakers. McColl and Young (2005) find in a review of over nine Federal Government programs implemented since the 1930s, a number of key factors should be observed. The study suggests Governments should focus on:

- improving institutional arrangements, in particular, providing clear definition of interests, rights and obligations in resource access and use;
- facilitate structural adjustment by establishing and using efficient markets enabling dynamic response to changing social, economic, technical and biophysical conditions;
- assisting regional leaders to adapt to change by improving understanding among both regional leaders and regional communities of the issues involved in the adjustment process;
- providing increased access to relevant information and training; and
- investing in specific and targeted economic (industry or regional) development and adjustment packages and projects.

This traditional perspective on regional industry restructuring tends to limit the role of government to temporary measures that facilitate efficient market adjustments. Policy responses to these exogenous shocks need to be considered within broader policy approaches to regional development to maximise equity outcomes. These contemporary approaches emphasise the importance of institutional arrangements in enabling regions to build competitive advantage and respond to change (Pike, Rodriguez-Pose, and Tomaney, 2006; Considine, 2008). In the following section, we examine the key design features of this contemporary approach to regional development.

CONTEMPORARY APPROACHES TO REGIONAL DEVELOPMENT

Partnerships Approach and Competitive Advantage

Institutional reforms from the 1970s, and their uneven spatial effects, led to renewed interest in regional development theory from the 1990s in Australia (Beer, Clower, Haughton and Maude, 2005; Rainnie and Grant, 2005). Acknowledging the importance of addressing spatial inequity, reports such as the Industry Commission (1993) and the Kelty Report (1993) emphasised the importance of regional leadership, partnerships and collaboration among stakeholders. The McKinsey Report (1994) brought forward the notion of 'marketisation' and 'best practice' to the regional development lexicon, to highlight the importance of regionally based leadership and innovation strategies. The concept of competitive advantage argued that each region has its own endogenous strengths in the context of a globally competitive economy and that these strengths should be the starting point for thinking about economic development (Porter, 1990, 2000). In more recent times these theories have been further refined.

Constructed Advantage

Internationally, the idea that competitive advantage is simply created has been reformulated to suggest it is more accurately described as constructed advantage to recognise the deliberate effort that goes into exploiting endogenous strengths (European Commission, 2006, p. 76). Central to this approach is a stronger focus on actors, agencies and models of governance that are both innovative and strategic. The notion that regional advantage must be constructed points to the importance of developing a strong institutional framework characterised by high levels of interaction and supported by proactive public policy (Coulson and Ferrario, 2007, p. 595). This might be thought of as ‘social capital’ or the concept of ‘institutional thickness’ as first articulated by Ash Amin and Nigel Thrift (1994) as a strategy to anchor firms and institutions in the region, and to align, as far as possible, their actions to the regional interests of employment and income generation (Giunta et al 2000, p. 16 as quoted in Grant, 2004, p. 52).

An ideal model of governance within this approach to regional development would be characterised by:

1. A strong local institutional presence representing a multiplicity and variety of organisations;
2. High levels of interaction both formal and informal in nature;
3. Mutual awareness of a common agenda to mobilise action and infuse legitimacy and trust into interactions; and
4. Patterns of coalition that bring coordination to interaction while minimising the risk of oppositional behaviour.

The concept of constructed advantage presents government with both a challenge in terms of strengthening local institutional competence to adapt to changing economic circumstances, but also an opportunity to develop a more integrated and participatory response. However, a key factor affecting the role of government within such an approach is the need to balance development of innovative and strategic responses with greater recognition that local economies are territorially embedded in a ‘place’.

Place Based

Increasingly across Australia but to a larger extent internationally, 'place based' approaches to regional development are being applied and or considered by Governments when addressing complex issues such as land use planning, water management and climate change (Tomaney, 2010). 'Place based' development policies are partially a response to the perceived failures of past regional policies but also a recognition of greater factors that affect the performance of local firms (OECD, 2009, p. 5). Past approaches have emphasised the provision of large scale infrastructure, the attraction of footloose investors and Government subsidies designed mainly to compensate for the effects of industrial restructuring and low growth (Tomaney, 2010, p. 10). The 'place based' approach devolves a greater role to local and regional institutions emphasising bottom-up, locally designed and owned strategies aimed at promoting growth potential in all local economies. It stresses the importance of integrating policies for land-use, infrastructure and business support. It places a particular emphasis on 'soft' factors of development such as high-level skills and innovative capacities of firms and public sector organisations and especially the role of inter-firm networks in contributing to growth. The Victorian Government has been involved in implementing such place-based approaches to address locational disadvantage and promote regional development over the past decade (McDonald *et al*, 2010).

Place based approaches are characterised by a framework or series of components considered essential to successfully delivering outcomes. These generally include:

1. A strategic planning framework – which examines the wide range of direct and indirect factors that affect the performance of local firms;
2. Capacity building – developing the capacity of key stakeholders and stakeholder organisations to participate in local planning processes;
3. A cross-sectoral governance structure – which brings together key government, private and community sector stakeholders;
4. Local engagement and planning processes – providing funding and support for formal community planning processes involving government, business and community stakeholders; and
5. A coordinated multi-year investment plan – an agreed framework for identifying and coordinating the forward investment plans of key stakeholders – linked to the regions strategic goals and outcomes (OECD, 2006).

Having reviewed theoretical perspectives on structural adjustment and regional development the following sections will examine how these ideas have been applied in the Latrobe Valley region in Victoria. The development of this case study involved a review of relevant policy and historical documentation related to the Valley.

REGIONAL ECONOMY AND INSTITUTIONAL ARRANGEMENTS

Energy Producing Region

The Latrobe Valley is located some 150km south east of Melbourne and roughly spans are area between the Strzelecki ranges and Great Diving Range in the Gippsland region of Victoria. The sub region has a total population of more than 75,000 people living in the disparate urban settlements of Traralgon, Morwell, Moe/ Newborough and Churchill. The area most prominently straddles the local government area of Latrobe City but also parts of Baw Baw Shire and Wellington Shire. Nestled between, under and around these settlements

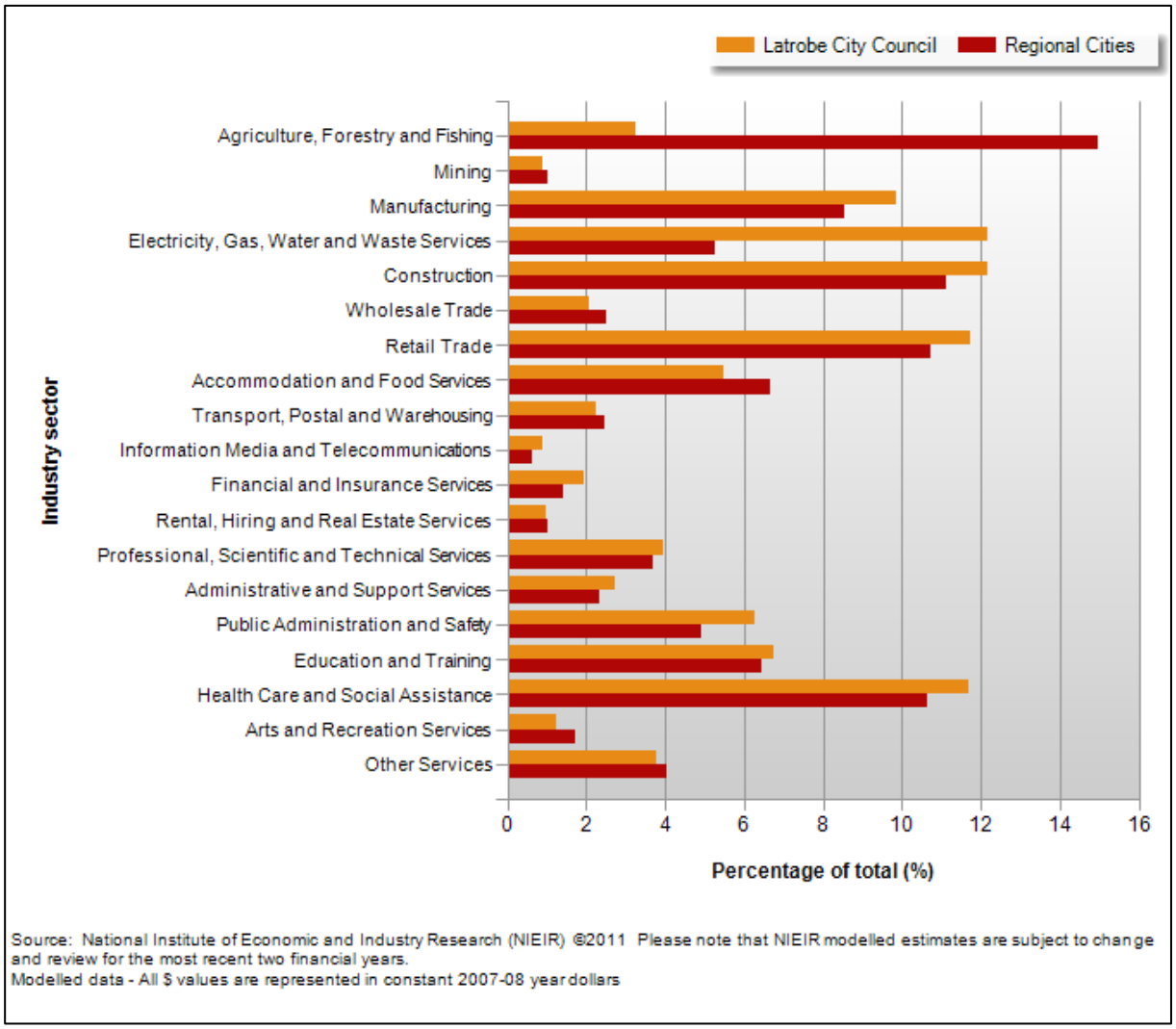
are vast quantities of brown coal resources. The region annually produces about 65 million tonnes of coal for electricity generation and conversion to briquettes and char while supplying around 88 per cent of Victoria's energy needs. The importance of Gippsland's energy and mining sector to the region's economy has long been held up as a key driver of growth and higher wage levels and has underpinned the competitiveness of Victoria's manufacturing sector over many years. Up until the early 1980s, the Latrobe Valley experienced a long period of significant growth, linked inextricably to the development of its power stations and demand for electricity production.

Growth of the mining sector began in the Latrobe Valley in 1924 after technologies were established for the commercial use of brown coal for generating electricity. Through significant public investment the area developed around the utilisation and extraction of the brown coal resource. Communities were established as company towns set up and operated by the Victorian agency responsible for electricity production: the State Electricity Commission of Victoria (SECV). The collocation of power stations and mines reflected the development of energy from brown coal, which requires greater volumes to produce the same amount of electricity as black coal (Tomaney and Somerville, 2010).

In the 1990s the Latrobe Valley experienced the break-up of the State Electricity Commission and privatisation of Victoria's electricity supply, generation and distribution network. The institutional reform, which was supported by successive State and Federal Governments, had a significant and wide reaching impact on the region's economy. Over the period 1988- 1994 employment declined by almost 8,000 in the mining, electricity, gas and water sectors. The population of the Latrobe Valley fell from 79,450 to 73,439 in the ten years to 2002 as skilled workers left (Birrell, 2001). By 2007 population had fallen further to 72,905 (Tomaney and Somerville, 2010). Defying regional Victorian trends, Latrobe City Council was the only local government area (LGA) to experience a decline in population in the period 1991-1996 (Grant, 2004). Consistent with this decline in population and as previously stated, the Productivity Commission inquiry into the impact of National Competition Policy recorded a projected fall in employment in Gippsland (relative to what it would have been in the absence of the institutional reforms) of 11.8 per cent between 1991 and 1996 (Productivity Commission, 2005, p. 111).

The Latrobe Valley still deals with a stigma carried over from these events and persistent intergenerational disadvantage exists within pockets of the community. A recent study has shown the post codes of Moe, Morwell, Traralgon and Churchill are all categorised as being among the most disadvantaged 10 per cent of the population in Australia (DPCD, 2011, p. 6). However, significant community effort and actions have begun to turn this image around (Miller, 2009). More recently the community has begun to present itself as unified, well informed and strategically addressing the complexity of issues associated with the national drive towards a lower carbon economy. The Latrobe Valley has since rebounded from this period of recession and today as Figure 1 shows, excluding the power sector, the economic profile resembles that of other regional centres around Victoria with remaining traditional industries of manufacturing, agriculture and mining.

Figure 1 Employment by Industry Sector, Latrobe City Council and Regional Cities 2010 (ANZSIC 2006 – Latest Industry Classification)



Source: Latrobe City Council (2011).

State and Local Institutional Responses

The Gippsland region has a relatively recent history of collective regional economic planning and strategy development among local institutions. With a highly dispersed population and contestable regional centres, until recently the region's institutional structure could have arguably been described in terms of Amin and Thrift's (1994) notion of institutional thickness as anorexic (Grant, 2004, p. 65). However more recently, proactive responses to economic change have supported by local government in the Latrobe Valley who have identified that a co-ordinated approach to regional development will assist with: engaging effectively with State and Federal Governments; attracting new industries to the region; and building the regional economy (Latrobe City, 2010).

Institutional reforms undertaken over the past decade have supported the Latrobe Valley to develop a shared regional development vision based on collaborative networking across various local and state government departments. From the mid 2000s, the Gippsland Local Government Network, made up of Mayors and CEOs of all six local governments in

Gippsland, in conjunction with the Victorian Government and the Federal network of Area Consultative Committees, worked together to develop the Gippsland Regional Development Strategy (2006). More recently this work was built upon to develop the Gippsland Regional Strategic Plan 2010. The Gippsland Regional Strategic Plan was developed by the Gippsland Local Government Network, the State coordinated Gippsland Regional Management Forum and Federal Government supported Regional Development Australia Gippsland. The Gippsland Regional Strategic Plan includes a comprehensive analysis of the region's economic, social and environmental challenges and trends, and sets a strategic vision for improving the region's liveability, productivity and sustainability. The plan identifies priority areas for action across five strategic outcome areas: economic resilience, population growth, community wellbeing, natural resources and connectivity. The plan has established 11 major projects (including a recent undertaking to establish a Gippsland wide food plan), which are in the early stages of development through a series of regional working groups drawn from State and Local Government.

The move towards development of region wide integrated regional strategic planning has assisted other policy platforms such as those of the Latrobe City Council in positioning for future change. This strategy also acknowledges that pro-active regional development assistance is preferred to responding to the legacy costs of restructuring as was the case for the Latrobe Valley Ministerial Taskforce (LVMT) in the early 2000s (Latrobe City, 2010, pp. 3, 13). The LVMT was established by the newly elected Labor Government in response to the restructuring experienced by the region as a result of privatising the SECV during the 1990s. The LVMT included Ministers from key economic and social portfolios and the response was coordinated by the Victorian Department of Premier and Cabinet. The LVMT was asked by the Premier to develop a plan and priority projects to assist the region in strengthening and diversifying its economy. The plan was developed over the period of January 2001 to April 2001through a series of public hearings with private and public stakeholders in the Latrobe Valley community. Submissions to the LVMT were received from a range of organisations and individuals including local government, businesses, unions, employer groups, community sector organisations, educational institutions, health care providers, welfare organisations and local residents.

The LVMT *Framework for the Future* plan was designed to improve the region's investment prospects, boost the Latrobe Valley's image and confidence, build the region's skills base, and invest in local communities. Following receipt of the LVMT's report, the Victorian Government approved a $106 million package of 50 initiatives designed to boost community confidence, facilitate economic growth and improve opportunities for the most disadvantaged in the Latrobe Valley. Anecdotal evidence suggests the investment failed to adequately address the adjustment experience many communities faced over the preceding period (Griffin, 2011, p. 64). However, the LVMT exhibits the design features of contemporary approaches to regional development with a focus on coordination and community engagement.

State Government Institutional Reform

An important institutional innovation in Victoria was the establishment of a separate statutory body, Regional Development Victoria (RDV) in 2002, which was empowered with lead responsibility for promoting economic and community development in rural and regional Victoria. The focus of RDV has evolved from a traditional focus on industry attraction and investment in economic infrastructure, to an increasing emphasis on tackling broader strategic issues such as skills development, liveability and, more recently, responding to climate change (McDonald *et al*, 2010). Addressing these issues in a way that effectively responds to

the unique circumstances of each region has required further institutional reforms, particularly to strengthen alignment across State Government agencies and between the three levels of government. In recent years the Victorian Government has embarked upon more targeted institutional capacity building of organisations and governance arrangements to support the development of strategic place based regional planning models. Regional Management Forums (RMF) were established in 2005 in each administrative region to support coordination between State and Local Government (Victorian Government, 2005). Each RMF is chaired by a Departmental Secretary and includes senior regional representation from State Government agencies, and Chief Executives from each Local Government in the region. More recently, senior Federal Government representation has been included in RMF, strengthening coordination across the three levels of government.

In 2008, the then Premier, John Brumby, announced the Regional Strategic Planning Initiative (RSPI) with the following objectives:

- To develop a long-term, state-wide blueprint to manage the growth and change taking place in regional Victoria;
- Support for ongoing development of 'place based' regional plans that are integrated with the state-wide blueprint; and,
- Improvements to the overall processes and governance of regional planning across the State including greater coordination between all levels of government (Regional Development Victoria, 2009).

Regional Strategic Plans, were developed across eight regional areas of Victoria to provide a framework by which communities set their own priorities and work in partnership with industry and governments to deliver initiatives and projects tailored to the needs of their regions. The eight regional strategic plans identify strategies and priorities for industry and business development, transport, community services, health, education, tourism, land use planning and improving the urban amenity within each region. Each plan is formally endorsed by key partners including local government and Federal Government sponsored Regional Development Australia (RDA) committees. The governance arrangements of regional economic planning committees range from formal established bodies such as G21 Alliance in Geelong through to informal coalitions of regional leaders including local governments, RDA representatives and State Government officials. Regionally-based committees are now implementing actions prioritised in their plans and each has identified potential areas for ongoing Government support. RDV's role in regional strategic planning has been to provide advice, leadership and strengthen collaboration in the implementation of regional priorities and ongoing regional development, particularly where State Government input is required to progress priority strategies and actions in the plans.

A new Liberal-Coalition Government was elected in November 2010 and subsequently implemented a $1 billion Regional Growth Fund (RGF) which has $500 million allocated before November 2014 (Ryan 2011b). The institutional framework for allocating these funds and making decisions about regional development have been further refined with:

- co-locating RDV with the Department of Planning and Community Development (DPCD) to ensure integrated approaches to planning and infrastructure delivery;
- giving to Local Councils a direct say over the allocation of funding through the Local Government Infrastructure Program (which provides a direct four year allocation of funding for capital works to each Council in regional Victoria);

- empowering RDA Committees to advise Government on allocations of the RGF to ensure local input and better coordination with Federal Government programs; and
- establishing a Regional Policy Advisory Committee that includes membership from the five non- metropolitan Regional Development Australia Committees as a key advisory structure on Victorian regional policy, and major infrastructure projects (Ryan, 2011a).

This approach supports the Victorian Government's new regional development agenda which places emphasis on supporting locally driven solutions, and alignment between the three levels of government. In the following section we examine how this regional governance platform has enabled a more proactive and integrated approach to economic change in the Latrobe Valley.

RESPONDING TO CLIMATE CHANGE POLICY

National Climate Change Policy

Moves to establish a national carbon pricing regime began in earnest through the States and Territories 2004 Inter-Jurisdictional Working Group on Emissions Trading, later renamed the National Emissions Trading Taskforce (NETT) in 2007. In December 2006, the Howard Government also established a joint business and Government Task Group on Emissions Trading which examined and later reported to the Federal Government on key mechanism design of a proposed Australian domestic emissions trading scheme, together with a set of complementary policies and measures for ensuring productivity. In April 2007, the Federal Opposition together with State and Territory Governments commissioned Professor Ross Garnaut to lead a national review of the impacts of climate change on the Australian economy with recommendations for domestic carbon mitigation through medium to long-term policies and policy frameworks. The review paid particular attention to the distributional impact of a potential carbon pricing regime, highlighting the vulnerability of the Latrobe Valley region. Assessment of relative vulnerability was based on its high level of dependency on the brown coal electricity generation industry and the limited alternative employment opportunities for people made redundant in the event of significant industry decline (Garnaut, 2008, p. 398).

Following the review, the newly elected Rudd Government pushed forward with preparation of a Carbon Pollution Reduction Scheme (CPRS) resulting in the release of a climate change White Paper in December 2008. Key assistance measures included in the package acknowledged the Federal Government's need to address both distributional impacts and persistent market failures that might impede the uptake of lower emissions technologies and processes. Central to addressing these issues was the establishment of a $2.15 billion Climate Change Action Fund delivered in four streams of assistance. This included:

- the provision of information to businesses and community service organisations about the operation of the Scheme and how these entities can manage the expected financial impacts;
- grants and incentives for businesses and community service organisations to invest in energy efficiency projects and low emissions technologies, processes and products;
- structural adjustment assistance in the event workers and communities are significantly impacted by the introduction of the Scheme; and
- structural adjustment assistance for coal mines with high fugitive emissions which will be significantly impacted by the introduction of the Scheme (Australian Government, 2008).

A number of computable general equilibrium (CGE) modelling approaches have been applied to estimate the impacts of the scheme at different spatial scales across the country. Gippsland was shown to experience a decline in GRP of around 2 per cent according to most studies undertaken (Frontier Economics, 2009; Access Economics, 2009). Despite well founded concern and deeply held anxiety regarding uncertainty of the two previous attempts by the Federal Government to establish national climate change policy, local institutions in the Gippsland region have rallied to develop strategies, partnerships and evidence to support a managed and assisted transition to a lower carbon economy. Consistent with this trend, the next section of this paper examines the institutional capacity of locally based development and planning bodies who sought to lead Government in addressing the issue of industry restructure, adjustment and ultimately transition to a lower carbon emissions economy.

Local Responses

In 2009, Latrobe City Council endorsed a policy to address the transition to a low carbon economy. Originally developed before the introduction of the CPRS, the policy has been updated to reflect and is in the process of implementation before the slated introduction of the Federal Government's carbon pricing regime. The policy identifies the expected impacts of carbon pricing on Latrobe City and the region's energy sector and proposes over 30 initiatives and support mechanisms to enable Latrobe City to optimise its transition in this new national reform and regulatory environment (Latrobe City Council, 2010).

Local Governments in the region have also responded in a coordinated way to this national policy change. In mid 2009, amidst heightened national debate regarding the introduction of the Rudd Labor Government's Carbon Pollution Reduction Scheme legislation, Local Governments from the Latrobe Valley led a delegation to the Hunter Valley and Newcastle to learn from the experience of the region in responding to the sudden impacts, in particular the closure of BHP in the 1990s and the Newcastle earthquake. The experience of the Hunter Valley, in particular its rebound from the loss of over 2000 jobs, was seen to be a potential model for pre emptive structural adjustment assistance the Latrobe region may pursue in light of the moves towards a carbon pollution reduction scheme. The delegation, made up of Mayors, CEOs, local councillors and State Government representatives met with a number a senior representatives of NSW State and Federal Governments, Unions, and regional development bodies.

The visitation marked the establishment of a partnership between Victorian local and State government regional development bodies in forging a joint strategy to addressing the impacts of a national carbon pricing regime in the Gippsland region. The partnership led to a working relationship forged towards establishing mutually assured regional development outcomes and development of an early proactive adjustment strategy, modelled on the Hunter Valley Advantage Fund, for addressing the resulting impacts of climate change policy.

State of Victoria Response

In July 2010, the Victorian Labor Government announced its climate change White Paper. Key to the strategy was a commitment to reduce greenhouse gas emission of Victorian brown coal-fired generators by up to four million tonnes through negotiations with International Power to close two units of Hazelwood Power Station in the Latrobe Valley. The policy was estimated to effectively meet Victoria's legislated targets for emissions reduction of 28 million tonnes by 2020 (Victorian Government, 2010). To respond to the adjustment task of the partial closure of Hazelwood, the Latrobe Valley Advantage Fund was included in the package. The Latrobe Valley Advantage Fund was developed to build on existing strengths of the Latrobe Valley economy while taking a proactive regional development approach to

economic diversification and industry adjustment. The Fund sought to coordinate initiatives to strengthen the local labour market and skill base, resource local governance structures, attract new investment to stimulate employment creation and encourage research and development in clean energy sources.

As part of this integrated approach, Regional Development Victoria, as the state body responsible for regional development was guided by a series of principles developed to locate both the role of government and appropriate types of intervention. The Latrobe Valley Advantage Fund covers three streams or areas of focus. These include:

- creating jobs and attracting new investment in industries: supporting development of industries and jobs through networks, cooperation and partnerships; and investment in enabling infrastructure and innovation to support for small, medium and large enterprises;
- skilling the Valley: investing in local capabilities, supporting the establishment and expansion of emerging industries; indentifying new business opportunities and preparing the current and future workforce through development of skills and training opportunities; and
- supporting sustainable research and development: investing in new research, development and demonstration opportunities in the Latrobe Valley and broader Gippsland region, particularly through low-emissions energy development.

Implementation of the Latrobe Valley Advantage Fund began immediately with a number of initiatives announced over the period leading up to the Victorian State election.

In November 2010, the Nationals Liberal Coalition Government came to power promising to retain the $25 million Latrobe Valley Advantage Fund and supplement it with a $5 million Industry and Employment Roadmap (the Roadmap) for the Latrobe Valley. A key element in the election commitment policy was the need to work with local institutions and regional development bodies to plan strategically for impending change and identify industry and workforce development opportunities. We now turn to explaining this evolving strategy, being led by the Victorian Government in partnership with regional leaders, within the context of contemporary approaches to addressing structural adjustment and regional development as it is currently unfolding in the Latrobe Valley.

Developing a Roadmap for Addressing Change and Restructure in the Latrobe Valley

Working through the framework of ‘place based’ and a joined up approach to regional development, the Roadmap’s intention is to work in partnership with regional stakeholders to produce a strategy for addressing structural adjustment that:

- identifies the challenges and opportunities facing the Latrobe Valley economy and labour market;
- provides an evidence base for further investment in regional industry development and employment growth;
- identifies agreed investment priorities to support industry growth; and
- establishes a process to support coordinated regional infrastructure planning between State Government and regional stakeholders.

The intention underlying development of the Roadmap is to provide a locally developed and State endorsed plan to guide future investment within the region, while effectively establishing an investment and infrastructure pipeline to support industry and employment

growth. In the short term the strategy will provide the region's communities with a State supported plan for structural adjustment of the Latrobe Valleys economy and position the region to engage directly with the Federal Government on structural adjustment assistance.

The table In Figure 2 below, informed by application of the Latrobe Valley Advantage Fund, outlines a policy and investment framework in which has broadly informed the project design process of the Roadmap.

Figure 2 Framework for Pro-active Regional Development Adjustment Assistance

Investment Area	Description of Activity/Intervention
Benchmarking Economic Performance	Establishing a 'snapshot' of the Gippsland region economy and workforce including industry, economic, demographic, educational, employment and social indicators. Identify industries in decline, as well as those that are stable or in growth phases
Workforce Development	Education and training to assist displaced workers and support new industry development and attraction
Infrastructure Development	Investing in infrastructure critical to investment attraction and regional competitiveness
Industry Focused Research and Development	Investing in priority research directly related to regional industry and employment growth
Investment Attraction (Attracting new industry and jobs)	Investing in the development of marketing and promotional material targeted at selected industry growth sectors
Regulatory reform to support industry development	Identifying regulatory actions that can assist fast track and support industry and employment growth
Strengthening local governance and planning capacity	Strengthening and linking government, business and community networks – related to industry and employment growth

Source: Regional Development Victoria.

Development of the Roadmap is occurring in the context of a complex and dynamic policy environment that is being influenced by a range of factors that are shaping the Latrobe Valley's economic future. These factors highlight the importance of developing an integrated approach to linking key policy development activities underway in the region and the opportunity the Roadmap project provides to develop a more strategic approach to future infrastructure investment and influencing the Federal Government's response to structural adjustment needs in the Latrobe region. Key to the Roadmap's design has been the establishment of a local governance mechanism to both guide and inform design and potential delivery.

Over the longer term, the Roadmap will seek to enhance the strategic use of government and private sector investment within the region to drive regional productivity and labour market

participation and enhance the region's overall contribution to the Victorian and national economy. The Roadmap, is still in an early stage of development and cannot as yet be critically evaluated for its overall contribution to addressing the structural adjustment challenge of the region. However, the nature of the current adjustment task, the recent history and success and failure of interventions by successive governments, highlights the importance of developing an integrated and joined up government approach to future investment in the Latrobe Valley.

CONCLUSION

In a global economy regions experience the impacts of economic restructuring, natural disasters and climate change more acutely than their metropolitan counterparts. Developing the capacity of regional communities to adapt to changing circumstances, avoid sharper economic and social impacts and position themselves for longer term sustainable economic growth, is a core concern of regional development policy. Traditionally, government responses to this challenge have been narrowly focussed on facilitating efficient market adjustments. In contrast, contemporary approaches have adopted a much broader focus to emphasise the importance of building institutional arrangements that enable and support the development of integrated and participatory responses. The Latrobe Valley has experienced the impacts of successive external shocks. While local leadership and innovation continue to be a common feature of collective responses, successive Victorian Governments have invested significant effort in building institutional arrangements founded upon a shared regional development vision, enhanced networking and multi-level governance mechanisms. This approach has provided a platform for developing a more sophisticated and proactive policy response to address and manage the transition to a lower carbon emissions economy. It also offers a number of important lessons for regional development policymakers.

The first lesson is that the degree of institutional thickness and model of governance employed for knowledge sharing do matter. Coordination and high levels of engagement are an important feature of this approach because of the range of organisations and interests that exist and can contribute to strengthening and diversification of regional economies. Secondly, institutional reform takes time. In the case of the Latrobe Valley, the period of institutional reform undertaken to support development of a shared vision and mobilise coordinated action has been over a decade. Thirdly, irrespective of whether policymakers find the concept of competitive advantage or its more recent variant constructed advantage more convincing, each presents government with both a challenge in terms of strengthening local institutional capacity to adapt and an opportunity to develop a more integrated and participatory response. In the case of the latter, institutional arrangements based on a mix of formal structures (such as local regional development committees) and informal mechanisms (such as brokering and negotiation) are the most effective for addressing specific regional needs.

The approach to addressing transition in the Latrobe Valley is evolving and dependent on building strong relationships between the Victorian Government and key regional actors. Looking back on previous experiences and drawing from the lessons outlined above, addressing and adjusting smoothly to the likely next wave of industry restructure will be best approached through an integrated, multi-partnered and place based approach. The Victorian Government is progressing such an approach in partnership with local and Federal Government and Latrobe Valley community stakeholders.

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Mapping Future Communities: A Proposed Model for Urban Adaptation

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ABSTRACT

A challenge for climate change researchers and planners alike is acquiring an understanding of the future urban form to assess impacts and risks. Most climate change effects won't be evident until 2050 or later, however population projections, dwelling projections and development plans generally do not extend beyond a 30-year time period. To enable the development of effective adaptation strategies now, we need to project community exposure to when climate change impacts are greatest. Geoscience Australia (GA) in partnership with the Department of Climate Change and Energy Efficiency is developing a method to model the future urban form and support adaptation scenario research. The method is based on existing models, but is generalised to enable linkage to GA's national exposure database and be implemented in a nationally consistent manner. The model is presently focussed on building development taking into account growth, retrofit, urban renewal, and relocation strategies for high risk suburbs.

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INTRODUCTION

Climate change is expected to exacerbate a range of natural hazards in Australia leading to more severe community impacts in the future. The need to adapt to a changing hazard environment and increasing community exposure is generally recognised but the evidence base is lacking to inform this. In part, a consistent method for projecting future communities is required that will permit future risk associated with weather related hazards to be understood, and for the best options for community adaptation to be indentified in quantitative terms.

NEXIS (National Exposure Information System) is a nationally consistent database of exposure information at the building level. NEXIS aids risk assessments and scenarios for a number of hazards and links with vulnerability models (Canterford, 2011). NEXIS contains data on the buildings, infrastructure and people potentially exposed to hazard impacts. While NEXIS is a powerful tool, it only holds information about present-day communities.

Previous future risk research has assumed that the urban footprint has remained unchanged. The population at a small area level has been projected using the proportional population change from the Australian Bureau of Statistics (ABS) produced state level projections and then the national projections (Waters, Cechet and Arthur, 2010). This method fails to take into account the changing spatial distribution of communities and the different pace of growth, or even decline they will experience.

Geoscience Australia in partnership with the Department of Climate Change and Energy Efficiency has undertaken development of NEXIS to enhance its usefulness as a tool for climate change research. One aspect of this development aims to extend NEXIS to estimate the spatial distribution of future communities.

The complexity of this problem is high. Population projections are highly uncertain and population changes can be impacted significantly influenced by an unanticipated political decision as well as social or economic change. These challenges are further compounded by the forever changing drivers within a community which both promote and hinder growth.

This paper presents the method chosen to model the spatial allocation of urban development. The model is based on previous 'real world process' models which have evolved from the Lowry-style gravity models from the 1960s (Pettit, 2005). The first section of the paper reviews the literature research from this project. An overview of the model is then presented, followed by a discussion of the limitations. Finally the chosen case study region and implementation is presented.

BACKGROUND

Historically, Australian homeowners have shown a strong preference for detached housing on spacious blocks of land. More than 75 percent of the nations dwellings were classed as detached in 2006 (ABS, 2007). Such a high proportion has come as a result of significant dwelling growth being accommodated by greenfields development on Australia's urban fringes. The preference for greenfields development is a result of both consumer demand and the reduced cost for developers.

In 2010 the National Housing Supply Council (NHSC) stated that there was an increase of $155,611 in cost for developing an infill dwelling in comparison to a greenfields dwelling (Searle, 2010). This factor contributes to a more affordable supply of housing on the urban fringes.

Higher density lifestyles promoted by ideologies such as 'new urbanism' and 'smart growth' are not being pursued by the majority of Australian society, however infill is increasing. This is particularly the case in our larger coastal cities. For example, in an effort to contain Sydney's urban footprint, the NSW Government has set an ambitious target of 445,000 new dwellings from the projected 640,000 (70 percent) to be constructed within the current city boundary for the 25 year period ending in 2031 (Sydney Metropolitan Strategy, 2006).

Developing population projections at the very small area level is a challenging problem. This is due mainly to the difficulty in gaining input data and inter-regional migration data in particular. Small area projections are generally done by taking a projection at a larger geographical level and disaggregating population growth by the historical share of growth (for example: New South Wales Department of Planning, 2008; ABS, 2008). Another approach is to use one of a number of spatial disaggregation techniques.

Simple Area Weighting allocates population to source zones based on area size, assuming that each source zone is homogenous in distribution (Li and Corcoran, 2010). More complex

multivariate regression models look to estimate the density of land classes based on other characteristics. However, an area must already be populated to have characteristics that can be modelled.

Li and Corcoran (2010) argue that dasymetric mapping is the most effective spatial disaggregation technique. Dasymetric mapping stands out from other techniques as it accounts for the spatial distribution of people. This makes it more adaptable to real populations. Geoscience Australia (GA) ran a small number of trials on some suburban communities with differing population distribution patterns. The results of these trials were mixed. In some cases the generated results appeared to be favourable, where as with others some limitations were evident. Firstly, the method makes the assumption that the boundaries for 'base' and 'source' zones remain constant over an entire projection period. Secondly, capacity constraints on growth in particular locations, such as flood prone areas and physical geography, are not taken into consideration. Bielecka argues that dasymetric mapping has an 'inability to classify habitable and inhabitable land' (2005, p. 6). Based on the results of these trials, GA concluded that the results provided by dasymetric mapping will too often be inadequate.

The literature provides a firm understanding of the factors and influences on development within the context of urban planning. A number of the articles outlined the challenges specific to particular cities. Sydney (Liu and Phinn, 2005) and Melbourne (Yigitcanlar, 2008) received notable attention in relation to the ongoing urban sprawl. However, South East Queensland (SEQ) was the most discussed region (Bell *et al*, 2010; Byrne *et al*, 2010; Chhetri *et al*, 2007). This is to be expected as SEQ is one of the nation's strongest growth areas.

Landis (1995) is of the view that profitability is the key driver for development and therefore a project with the highest profitability will be carried out first. Accessibility to activity centres, a CBD and employment opportunities (Chhetri *et al*, 2007) are key indicators for where future housing may be located.

There is evidence of 'relationships between urban form and travel behaviour' (Lund, 2003, p. 416) and therefore transport is acknowledged as linked to growth. However, parts of Western Sydney and outer Melbourne continue to experience high population growth even though they have insufficient public transport and services. This suggests that home buyers are willing to accept longer commuting times in exchange for housing affordability.

A planning approach should address the specific needs of a particular community as 'the speed of urban development varies from one city to another' (Liu and Phinn, 2005, p. 2). A community will have a set of features and characteristics which will shape it over time. Additionally, relationships between areas within a greater region are also influential. For example, the urban centres in SEQ impact on one another (Chhetri *et al*, 2007).

Population density models have a mathematical component which emphasises the change in population density as the distance from the centre of a city is increased. Martori and Surinach (2001) and Griffith (1981) proposed a number of mathematical formulas suggesting that population density decreases as the distance from the centre of a community increases. As the overall population grows, a large proportion of these people will be accommodated within existing areas which will ensure that the gradient will flatten. The most obvious shortfall is that none of these models address 'multi-centred' population clusters. This particular scenario cannot be overlooked as it is increasingly prevalent across Australia in places such as Sydney and other coastal cities.

There are a number of models that try to emulate the development of communities. The first is Cellular Automata (CA). CA is a 'multistage framework aimed at modelling local spatial

processes and global temporal dynamics by the incorporation of explicit decision making processes' (Cheng and Masser, 2004, p. 167). CA looks to utilise both 'top down' and 'bottom up' projection approaches and address the interaction between the two on land development decisions. It places an emphasis on spatial influences, including slope constraints, transportation, coastal attractions, and urban planning support (Liu and Phinn, 2005). CA is a 'fuzzy process' which resembles the development distribution of populated areas more accurately as opposed to the 'sharp boundary' between developed and non-developed areas as is the case in alternative approaches. Implementation of CA models is complex

The 'Projections for Urban Planning' (PUP) model is in some ways a simpler alternative to CA. It looks to 'mimic the urban development process' (Bell *et al*, 2000, p. 560). PUP considers real life factors which act as determinants for where development is best suited. It considers factors such as recreational areas, educational facilities and transport nodes. The model assigns each developable land parcel with a 'weight' which provides an order of preference for development. This weight is attributed using two main factors. Firstly, the drivers (both positive and negative) that may influence development and secondly, the accessibility to the location of each of these drivers.

In comparison to other models, PUP has a number of advantages:

- It has a spatial component
- Provides the user with great flexibility in determining what features will shape changes in population
- The capacity to determine to what degree a feature will influence development based on distance and accessibility
- Highlights the surrounding population densities as an indicator.

There are two acknowledged challenges that the PUP model faces. Firstly, in order to be implemented it requires large amounts of data. Secondly, it is unable to account for urban infill or redevelopment (Bell *et al*, 2000). Urban infill and redevelopment would need to be accounted for if a technique such as this was to be implemented.

Pettit (2005) also proposes a 'real world process' model titled 'What if?' It identifies itself as being similar to PUP and was implemented for the community of Hervey Bay, Australia.

Large Scale Urban Modelling (LSUM) is a methodology which evolved from PUP. Whilst it accounts for the indicators from the PUP model, it also includes analysis of economic and structural change and employment (Chhetri *et al*, 2007). With the acknowledgement of the role played by employment, it is clear that LSUM is a superior model to PUP. However, LSUM has an even greater reliance on data. Furthermore, a large quantity of the data does not exist for all regions and would need to be created through surveys (Chhetri *et al*, 2007).

After studying all of the above techniques, LSUM appears to be most suitable for forecasting the development process of a community. However, the model is extremely data hungry, complex and difficult to implement. However one of the components of LSUM, PUPHAM (Predictive Urban Population and Housing Allocation Model) is more suited to the needs of this project. The required data for PUPHAM would be more easily obtained and it enables the tracking of capacity and dwelling stocks (Chhetri *et al*, 2007).

OUTLINING THE MODEL

The model proposed by GA has been developed by drawing upon the current approaches described. The model uses as input a set of starting conditions in order to produce an output for one scenario. The model is capable of achieving a different outcome which satisfies a differing set of requirements; however this would need different configuration parameters. For example, constraints on urban sprawl may be modelled by an increase in the allocation of development to infill. Alternatively, if initial input data such as hazard maps or non-developable land changes, the process must again commence from the set-up stage. The reliability of model outputs is fundamentally limited by the availability and accuracy of the inputs, particularly in the outlying years where input metrics are less certain or assumed.

The model has been heavily influenced by existing urban growth models such as PUPHAM (Chhetri *et al*, 2007) but has been simplified and generalised to integrate with NEXIS and to be implemented in any location. However, due to its adaptability it is heavily reliant on input data as well as consultation with local councils and communities. Such consultation is vital in understanding the local drivers specific to a community.

The model comprises a number of modules that complete a stage of the model. The modules and the flow of the model are outlined in Figure 1.

Set Up

The 'Set up' module is the first phase of the model and it involves mapping the chosen community in its current form using the data contained in NEXIS. One of the key requirements for the set up is a dwelling projection to determine the appropriate levels of development. If data such as this is not available, the information may be derived from a population projection and average household size projection.

The intention will be to use state government-produced projections at the smallest geographic level possible, however these will not always be available. In such cases we may use any projection or even multiple projections.

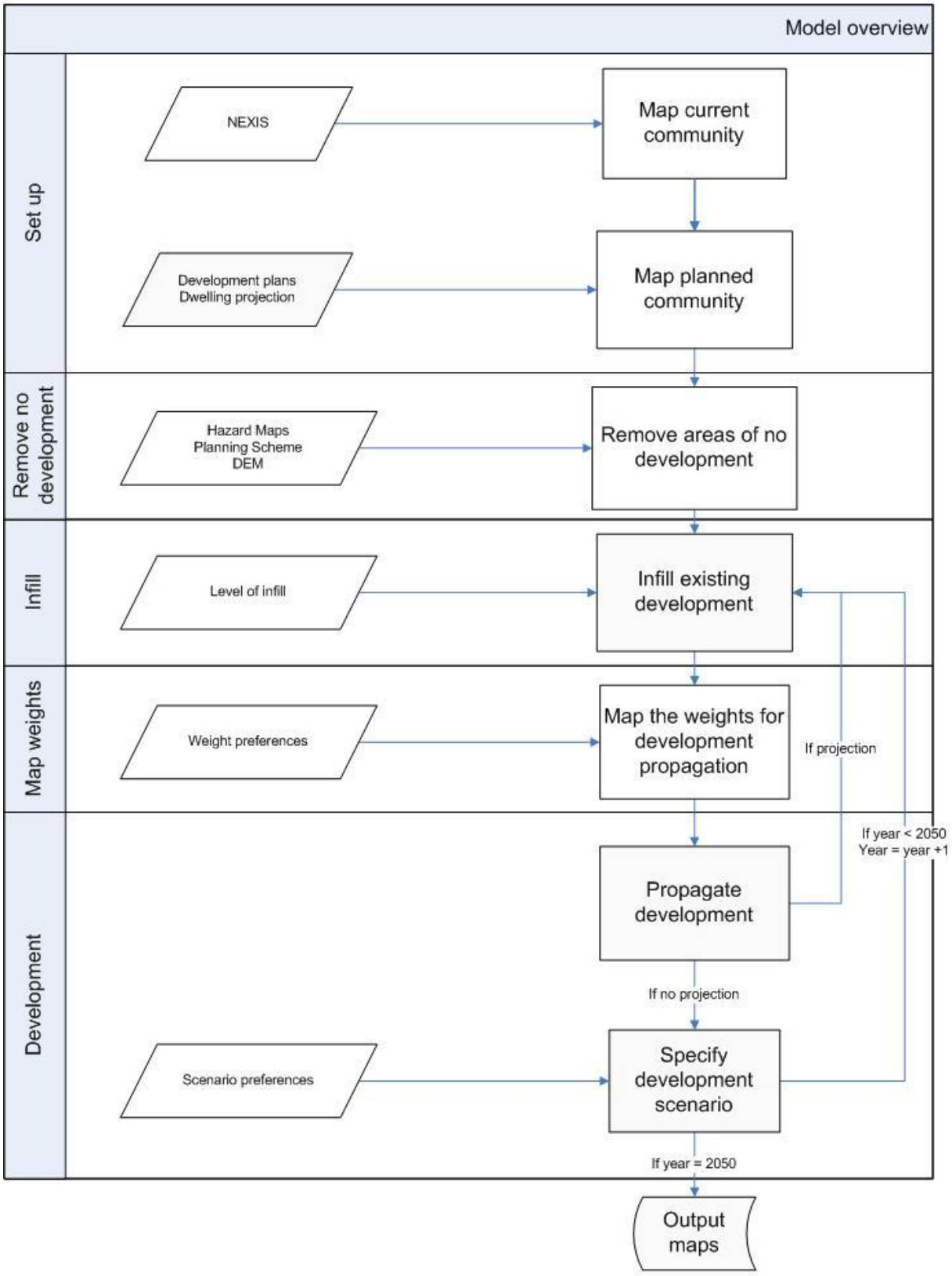
The community is then moved forward according to the council development plans in place. Comparisons between the development plans and dwelling projections will be made. Any differences between the two will be accounted for by infill. This will ensure that a future community map reflects the development plans. In a situation where a community does not have any development plans, the model will commence estimating development from the current year. This process will also be carried out along with detailed input from council representatives.

Remove Areas of No Development

At the conclusion of the set up, the next phase requires the removal of areas that are unable to be developed. There are an extensive number of characteristics which a land parcel may have which leads to its removal. Examples of this include land that is protected or reserved, high hazard areas, and land with a significant slope. Once again this step must involve council participation in making land classification decisions.

The community map is then gridded, and the building age profile is calculated. The size of the grid will be determined as part of the model construction process. The size of the grids is a balance between smaller sizes, where development can more easily be constrained to whole grid cells, and larger grid sizes which can compensate for inaccuracies in spatial allocation and has shorter model run times.

Figure 1 Overview of the Model Components



Infill

This next module, infill, is the first part of the model where an input is automatically generated. Before the new development can be allocated for the first year, land that is already developed must account for a proportion of the growth through infill. This figure may be set by the council; however a default of 35% (Thu Phan *et al*, 2008) will otherwise be used. The proportion of infill which is estimated will then be subtracted from the overall amount of development for that year and the additional dwelling projections will then be calculated.

Mapping of Weighting

The map weighting is the key component to determining which areas are to be selected for development. Each grid is assigned a score according to its accessibility and amenity. The weights are later used by the allocation component to determine ideal development locations. Each score comprises a distance component, and is weighted according to the preferences people place on being close to infrastructure and amenity. Infrastructure such as shopping centres, schools and transport routes, and other more subjective features like bushland and the coast, are all scored.

A community will have a unique set of features. The perceived influence of a feature will always be relative to the community in question. For example, proximity to employment opportunities would be prioritised in an urban centre; whereas proximity to the coast may have greater importance in a 'sea change' community. Establishing a significance level for each feature requires engagement of the local council as well as the local residents or community groups. Ideally, a survey of local residents would be carried out in order to achieve the best results, however time and cost constraints may make this difficult in some circumstances.

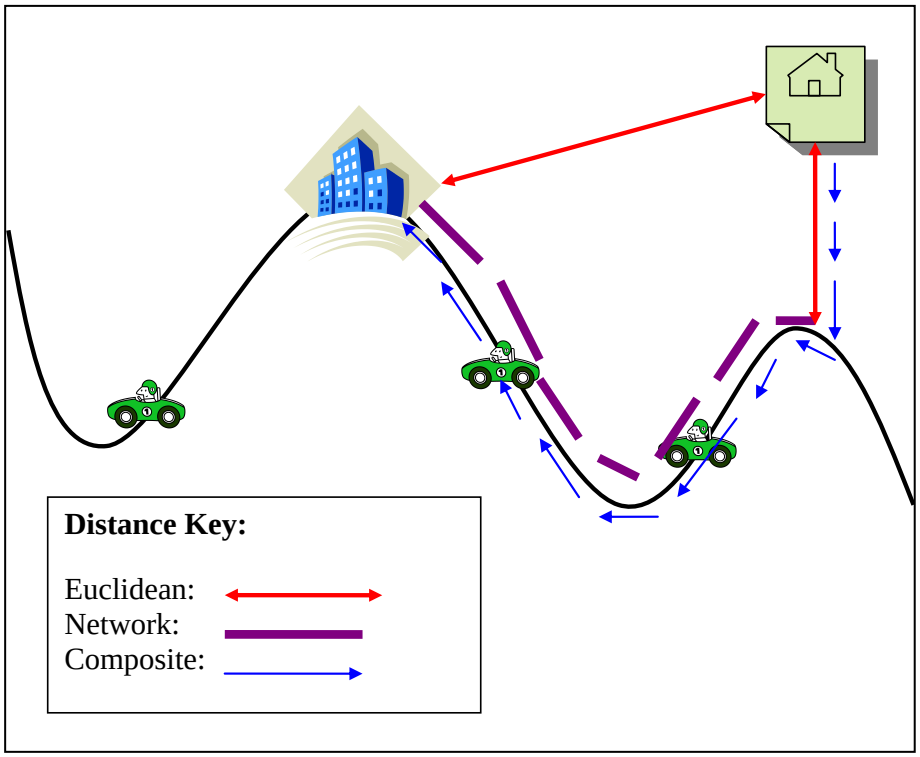
In the absence of a survey, the following factors identified by the literature (e.g. Chhetri *et al*, 2007; Pettit 2005) are proposed to be used, as detailed in Table 1.

Table 1: Variables to be Used in the Weighting

Driver	**Identifier**
Transport routes	All major routes and highways, used for the distance measure
Shopping centres	Shopping centres, CBD
Schools	Primary and secondary schools.
Places of employment	CBD, technology/business parks, major industry
Public transport	Train station, bus routes, tram routes, ferry terminals
Natural areas	Lakes, parks and forests, coastline, rivers
Distance to CBD	CBD

The weighting process determines a score for each grid based on the scores for each input item. All input items have a distance component where the distance between the grid and various features is measured. There are a number of ways to measure distance. However the method chosen for the model is a network distance measure with a Euclidean (straight line) component when there is no adjacent network (see Figure 2). The network distance to the grid centroid is calculated using existing transport infrastructure. Once the route is at the point on the network closest to the grid centroid, the final stage is calculated as a Euclidean distance.

Figure 2 The Euclidean Distance



Note: The Euclidean distance is the straight line distance (black line) between a dwelling location and a feature. The network distance is the distance along a network, such as a road (red dashed line). The distance from the proposed dwelling to the network is calculated as a Euclidean distance.

Each input item then has a weighting associated with it. The item weighting may be user specified and can be varied to model scenarios. The weighting is best identified by a household survey. However the weighting preferences themselves may be part of a comparative analysis of future development and can be changed. A composite score for each cell is then created from the combined scores for each feature.

Development

The module takes the weighting and assigns development for a year based on a combination of the local weight and a probabilistic element. The amount of development in a year is determined by the dwelling projection.

After the development for a year is completed the process returns to the weighting module to recalculate the weights based on the new community. The development process continues until the dwelling projections are exhausted. Beyond the dwelling projections the process continues based on a scenario developed for the community. It is likely that each community will have a number of scenarios to model. This will allow the community to see whether the different scenarios have different outcomes in distribution. The weight–infill–development process continues iteratively until the model reaches a close. This is currently set at 2050 as any results beyond this date are considered too unreliable to be useful. At this point the final map is output.

Modelling Adaptation Strategies

The primary objective of the model is to enable the assessment of risk to future communities and the development of adaptation strategies that can shape the profile of future communities. These adaptation strategies are essentially modelled through repeated iterations of the model with different configurations. The effects of each can then be compared with previous iterations.

It is important to recognise that the model has a probabilistic element. Therefore, if the model were to be run multiple times with the same initial starting conditions, a variation in outputs would be expected. Therefore, it is preferred that each scenario is run multiple times and an average is taken for comparison with other scenarios.

DISCUSSION

Whilst we will argue that the model presented provides us with the framework to best address our needs, it is acknowledged that this methodology has its limitations.

There is an implementation risk that not enough emphasis will be placed on understanding the values and characteristics of a community. Consultation with councils and communities is vital; however greater insight could be gained though surveying a community to gauge the values placed on various locational drivers. The preferred way to obtain these values is through a household survey evaluating people's preferences. An example of this method is the Quality of Life survey conducted by Chhetri *et al*. (2007). The results are then analysed using a method such as Principal Components Analysis (PCA). PCA is able to determine hidden structures of the attitudinal data and allows the variables driving the responses to be revealed through dimensions. PCA also allows the construction of weights to highlight the relative importance of the variables

There are limits to predicting and incorporating the cultural changes that may occur in dwelling preferences in Australia. Dwelling density and average household size changes may be incorporated into the model. However there may be fundamental shifts in planning policy and housing preferences in the future. For example, we may see a shift to living in hostels for single people, or families regularly living across multiple dwellings. These shifts are not capable of being incorporated in the model at this stage.

Many of the impacts of climate change may not be significant until 2050. However the input data, especially the dwelling projections, currently available does not allow analysis at even a national level with any credibility. Therefore, the model is currently limited to the more medium term. Should data be available for a longer period, the model can be easily extended to incorporate the extra time.

CASE STUDY – ROCKHAMPTON

A number of locations across Australia were considered as pilot communities for implementation of the model and Rockhampton Regional Council (RRC) was ultimately chosen. The RRC covers an extensive coastal area of Queensland and is located 600 kilometres north of Brisbane. The major regional centre of Rockhampton is located within the region. However the region also includes the population centres of Yeppoon, Emu Park, Mount Morgan and Gracemere, as well as a number of other small communities.

RRC is seen as a suitable choice for a variety of reasons. Firstly, the region is expected to see a high level of growth, and will therefore require significant development and extensive strategic planning in order to accommodate the growing number of residents. Secondly, the

region is prone to a full range of climate hazards. Flooding is a regular occurrence in Rockhampton on the south side of the Fitzroy River. With the region being located in the tropics, cyclones will always be a risk. The coastal communities of Emu Park and Yeppoon are also at risk of storm surge and coastal erosion. Surrounding vegetation and the nature of the topography, particularly around Rockhampton, leads to the additional threat of bushfires.

RRC faces the added challenge of a low supply of developable land. The flood plain to the south of Rockhampton is extensive and covers a large proportion of vacant land as well as some residential areas and other critical infrastructure. The National Park to the North East of the city prevents development. Many parcels of land outside the National Park boundary are not suitable for development due to building slope constraints. A large area of land within the region is also used for both mining and agricultural purposes; therefore development opportunity becomes even more limited.

Initial engagement with RRC has taken place and will continue in the upcoming months. Throughout this collaboration period, we will continue to develop the model. The first stage of the case study process involves testing the model on historical data. This will be done in order to assess how accurately the model is able to forecast the current environment based on historical data. We hold the expectation that the initial implementation of the model will lead to some adjustments. Following the testing of historical data, the model will be implemented to allocate future development. It is expected that adjustments will be made to all stages of the process

CONCLUSIONS

Building on the current exposure capabilities delivered through NEXIS, this model has a significant deal to offer in terms of understanding future challenges and climate change research. Developing a map which spatially allocates the urban development of a community is a challenge which must be undertaken. Having an in-depth understanding of what a community may look like in 2050 is invaluable information for climate change research.

It is acknowledged that the model has some limitations. All communities, some more than others, can be influenced dramatically through policy, cultural and industry changes as well as many other external factors. Whilst these changes may all take effect at some stage in the future, it is still acceptable to build a model based on the assumption that these influences are being shaped by the drivers that we are currently witnessing.

The model looks to incorporate as many indicators as practical and is capable of modelling a community beyond a 30 year planning period. Such a model will provide a platform for further extensions at a later date as input data becomes available.

It is forecast that we will see a rise in natural hazards in Australia, both in frequency and intensity. As the effects of climate change become more apparent, the exposure of a community can be better understood through the implementation of this emerging model. It is also capable of analysing small areas as the model will have a very high spatial resolution. This will give policy makers a more in-depth understanding of exposure and can facilitate appropriate decisions for community adaptation to the effects of climate change.

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International Research on the Relationship between Urban Structure and Transportation Energy Consumption According to Economic Level

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ABSTRACT

As motorization has progressed around the world, the scope of personal activity is widening due to private motorized modes. Meanwhile, motorization leads to suburbanization by supplying private mobility to individuals, and it is also impacts on global warming. Current research exploring the relationship between urban structure and transportation energy consumption, from the perspective of economic levels in world cities, is not adequate. This research was conducted to generate a database of transportation energy consumption of private motorized modes with individual travel behaviour based on Person trip data from 44 metropolitan areas in 23 countries around the world. Considering the difference in economic levels of cities around the world, we can appreciate that individual travel behaviour (average modal share, daily trip number) and transportation energy consumption are influenced by economic level.

INTRODUCTION

In recent years, the range of individual travel behaviour is expanding with the progress of motorization, and this parallels economic development in cities of the world. Urban structure is also changing to suburbanization as the urban population is moving outside city centres. Moreover, this movement is linked to increases in transportation energy consumption, and has caused serious urban problems such as air pollution and excessive energy consumption (Nakamura *et al*, 2004).

This situation is only expected to worsen because of two trends that have been observed worldwide. First, as mentioned above, is the general increase in the standard of living with economic development (Salvatore, 2004). Second, as economies develop so too does reliance on faster transportation modes since individuals are only willing to spend a limited amount of time travelling (1.1 h/day on average); consequently, the world is shifting toward faster modes that are also more energy intensive (Schafer and Victor, 1999). In order to combat this, new city planning methods and management strategies for technical development that reduce transportation energy consumption are required. Many of the planning techniques and research since 1970 have focused on developing the urban structure based on the concept of sustainable development.

The usage of on-road gasoline and diesel in urban areas of the US is as much as 77% of total fuel consumption in the US, and fuel consumption and CO_2 emissions from gasoline and diesel in urban areas tend to be higher than that of buildings and industries (Parshall *et al*, 2010). In Europe, the concept of compact cities is used as a sustainable urban planning related

to foster efficient urban space. In Japan, compact cities have been institutionally specified in a basic policy of urban planning (Taniguchi *et al*, 2008). Since suburbanization and increases in trip length are connected to increases in transportation energy consumption, it is indispensable to control individual travel behaviour and reduce transportation energy consumption. It is important to guide travel behaviours and develop the urban areas as sustainable space in the future.

Improvements in individual mobility due to economic development, and the progression of motorization, are accelerating suburbanization, which in turn broadens low density zones around the urban area irrespective of country (Eom and Schipper, 2010). Furthermore, the increase of trip lengths as a result of city suburbanization is directly linked to increases in transportation energy consumption. This makes it difficult to say that policies for reduction of automobile use and transportation energy reduction are not successful. In this way, motorization is increasing steadily every year as the economic level of city develops with time.

There is limited research regarding the characteristics of travel behaviours from the viewpoint of economic level for understanding the relationship between urban structure, travel behaviours and transportation energy consumption. In addition, quantitative analysis of the impact of traffic characteristics on transportation energy consumption based on economic level is insufficient. Moreover, as time progresses traffic demands from private modes of transportation are increasing parallel to economic development worldwide. Strategies need to be established to improve the energy consumption and urban-transport problems, from a traffic perspective, in order to mitigate the speed of motorization. Therefore, it is critically important not only to estimate the transportation energy consumption of a city, but also to clarify how the relationship between transportation energy consumption and individual travel behaviours differ based on economic status.

Consequently, we have built a database of world cities, as the first step of study regarding the use of economic level to estimate transportation energy consumption of individual motorized modes, with related indicators of travel behaviours based from person trip data from 44 metropolitan areas in 26 countries around the world. We have used this database to clarify the causal relationship between urban structure, travel behaviours, and transportation energy consumption based on variations in economic levels of cities.

FEATURES OF THIS RESEARCH

Newman and Kenworthy (1989a, 1989b) and Kenworthy and Laube (1999) highlighted the strong negative correlation between population density and transportation energy consumption, which contributed to the body of research regarding sustainable urban development. However, much international comparative research on the relationship between transportation and land use has generally been limited either to comparisons of aggregate national data or to qualitative discussion (Giuliano and Dargay, 2006). These studies include Newman and Kenworthy's research that found an inverse relationship between urban density and fuel consumption per capita (Newman and Kenworthy, 1989a, 1989b). A study by van de Coevering, P. and Schwanen (2006) criticized the point-of-view of Newman and Kenworthy, and suggested instead that certain unwritten rules were followed with regard to the 'organism of the city', specifically, how a city functioned with regards to transportation and land use, responding to different policy stimuli. This recapitulates the way an organism functions within a certain set of fixed biological rules. Jakapong and Chumnong (2010) analysed the relationship between urban structure, traffic characteristic, and the relevance of transportation energy consumption in terms of economic level by looking at motorbikes and passenger cars,

and their impact on energy consumption or greenhouse gas emission in Thailand. This research was limited and highlighted the fact that research on the relationship between urban structure, travel behaviour, and transportation energy consumption from the perspective of the economic level of a city was inadequate.

The research reported here explores the difference in the economic level of 44 cities in South Korea, Japan, Europe, the United States, and developing countries throughout the world, based on a previous study that identified cities that were in the top and the bottom 15% ranked by Gross Regional Domestic Product (GRDP) (Choi *et al*, 2011). In addition, this research exploits Person Trip (PT) data that explains detailed features of travel behaviours in metropolitan areas so that the result of this research retains objectivity and reflects actual trip conditions. Moreover, the estimation model of transportation energy consumption was developed using a database containing travel behaviours that was aggregated from this PT data. Finally, we examined the causality between economic level and urban structure, travel behaviours, and transportation energy consumption for the cities of the world.

METHODOLOGY

(1) Definition of Trip in this Research

From the viewpoint that reduction of transportation energy consumption can be obtained by controlling the individual modes of transportation appropriately, the current research extracted the data for trips made by private motorized modes (passenger car, motorcycle, and taxi). Hence, freight traffic, which is mainly through-traffic making it difficult to determine the supplying and consumption districts for fuel, was excluded from this research. In addition, the trip mode used in the trip with the longest trip time in a complete trip was treated as the representative mode for the trip. Furthermore, the extracted trip below 4 km/h on the representative mode was excluded from target trip as walking. In this research, the trips that obey the above limitations were extracted from the total trip made within the target area and used for estimation of transportation energy consumption.

(2) Estimation Method for Transportation Energy Consumption

The most common method to estimate transportation energy consumption is to measure the total consumption of fuel in a city by applying statistical data of the total amount of fuel sold, and then converting the total sold fuel into energy per unit amount of fuel (Kenworthy and Laube, 1999; Morimoto, 2002). In addition, it is difficult to determine the supplying and consumption districts for fuel (Matsuhashi *et al*. 2004). Alternatively, in Japan, as an estimation method of transportation energy consumption, integrating energy intensity and trip length is generally used. Although the former is suitable for grasping a discharge of the total amount or total evaluation of the measure against fuel, there are limitations regarding vehicle type and the evaluation of travel behaviour in an independent trip (Morimoto, 2002). Since the latter may differ in the estimation value of energy intensity with various statistical materials, the comparison between cities could be difficult.

This research exploits the data on traffic behaviour for every individual trip based on PT data and the formula for fuel efficiency of a gasoline vehicle considering travel speed defined from measurement of “sdsdynamo” experiment conducted by the Ministry of the Environment in Japan. From this data and estimation formula, transportation energy consumption is calculated using equation (1).

$$E_k = \left(\frac{\sum_i^{n^k} T_i \cdot I_i \times 365}{O_k} \right) / P_k \quad (1)$$

E_k =Annual transportation energy consumption by private motorized modes per capita in city *k* (MJ per capita);

T_i = Transportation energy consumption by private motorized modes in single trip *i* (MJ); *i*=1,…, n^k; where n^k is the number of trip sample in city *k*);

P_k = Urban population in city *k*;

I_i = Expansion coefficient of each trip *i*; and

o_k = Average occupancy ratio of passenger car in city *k*.

Moreover, in formula (1), the transportation energy consumption by private motorized modes in single trip *i* can be calculated using equation (2).

$$T_i = FC_{(V_i)} \cdot HV \cdot L_i \quad (2)$$

HV = Average calorific value of gasoline (MJ/L);

$FC_{(V_i)}$ = Fuel efficiency of a vehicle on trip i at speed v (cc/km; a motorcycle is assumed to have a half the efficiency of a car and vehicle is assumed to be gasoline vehicle); and

Li = Trip length of trip *i* (km); and

V_i = Trip speed of trip i by private motorized modes (km/h).

However, in this research, private motorized modes are limited to passenger cars, taxi and motorcycles. The fuel efficiency of private motorized modes on trip *i* at speed *v* is obtained using equation (3) (Oshiro *et al*, 2001).

$$FC_{(V_i)} = [829.3/V_i] - 0.8572V_i + 0.007659{V_i}^2 + 64.09 \quad (3)$$

The model parameters in equation (3) are inferred from the results of research conducted in Japanese research institute. However, the model parameters can be customized to country or vehicle type. The results in equation (3) are based on the use of a passenger car. Eventually, the renewal estimation method becomes a function of vehicle speed in an individual trip. For cases where the PT data has insufficient trip information, the improved method is a form of equation (1). For European cities and several Korean cities, travel behaviours such as average vehicle speed, average trip length, and modal share of private motorized modes, are representative values due to limitations in gathering world data. Therefore, we evaluated an alternative estimation method for cases lacking these data using equation (4).

$$E_k = P_k \cdot G_k \cdot \gamma_k \cdot l_k \cdot e \quad (4)$$

E_k = Transport energy consumption in city *k* (MJ);

P_k = Population in city k (persons);

G_k = Average daily trip number in city *k* (trips);

γ_k = Modal share of private motorized modes in city *k* (%);

l_k = Average trip length in city *k* (km/trip); and

e = Intensity of energy consumption (MJ/person・km).

This is useful for estimating transportation energy consumption based on average trip length for private motorized modes per day, average number of daily trips in city *k*, modal share of the private motorized modes of transportation, and population in city *k*. Additionally, the average speed of the private motorized modes and intensity of heat combustion are multiplied to estimate fuel efficiency of vehicle.

If a city has its own PT data, the renewed estimation method is promising. However, when this model cannot be applied due to the lack of PT data, the alternative method can be improved by incorporating vehicle speed. This improvement is realized by changing the intensity factor *e* in equation (4) into e_k. The estimation method for the factor *e* can be revised by:

$$e_k = FC_{(V_k)} \cdot HV \quad (5)$$

e_k = Intensity of energy consumption of city *k* (MJ/person・km);

$FC_{(V_k)}$ = Fuel efficiency of a vehicle at average speed V_k (cc/km); and

V_k = Average vehicle speed in city k (km/h).

DATABASE ON TRANSPORTATION ENERGY CONSUMPTION OF CITIES IN THE WORLD BASED ON ECONOMIC LEVEL

Target Metropolitan Areas

This research extracted 44 cities with the standard 15% of upper and below in Gross Regional Domestic Product (GRDP) from 119 cities selected based on previous research (Choi *et al*, 2011). The 44 cities that were extracted from the 26 countries had a population of over 800,000, and differed in economic status (Table 1). The distribution of the target cities was as follows: 10 cities in Asia (5 cities in Korea and 5 cities in Japan), 14 cities in Europe, 14 cities in the United States, and 6 cities in developing countries.

Table 1 Target Areas in this Research

	Extracted Cities	
	Top 15% by GRDP	**Bottom 15% by GRDP**
Asia	Osaka, Tokyo, Nagoya, Fukuoka, Hiroshima	Pusan, Kwangju, Suwon, Daegu, Sungnam
Europe	Munich, Oslo, Zurich, Hamburg, Paris, Helsinki, London	Prague, Valencia, Warsaw, Athens, Seville, Budapest, Moscow
U.S.A	Charlotte, San Francisco-Oakland, Washington, Boston, Seattle, Denver-Aurora, New York	Oklahoma, Tampa-St. Petersburg, Province, San Antonio, Buffalo-Niagara Falls, Jacksonville, Hartford
Developing Countries	Sao Paulo, Kuala Lumpur, Tripoli	Managua, Nairobi, Phnom Penh

Statistical Data Related to Travel Behaviours

In this research, statistical data for each area was based on the travel behaviours of Korea, Japan, Europe, the United States, and developing countries, which was originally collected by research institutes around the world (see the notes to Table 2).

Definitions and Calculation Methods of Travel Behaviour

Table 2 defines the data definition used in the current research and the origin of the data. Since this research employs PT data, various data regarding different properties of travel behaviour can be extracted. The definition of calculation methods agrees with the definition of data possessing bounded means.

Table 2 Definition of Data in this Research

No.	Indicator	Unit	Definition of Data	Data Sources
1	Urban City	N/A	Boundaries of a metropolitan area are set based on different factors. Search for the most relevant area to study mobility, that is, an economic area where the bulk of daily home-work journeys occurs, which is sometimes referred to as the "labor catchment area".	Korea:(3), Japan: (3), Europe:(2), USA:(3), Developing countries:(3)
2	Population	Inhabitants	Total number of residents in the urbanized area.	Korea:(2), Japan: (2), Europe:(2),USA:(2), Developing countries:(2),
3	Urban Density	Inhabitant /ha	Ratio between the population (Indicator 2) and urban surface area.	Korea:(2), Japan: (2), Europe:(2), USA:(2), Developing countries:(2),
4	GRDP per capita	$/person	Ratio between the GRDP of the urbanized area and its population.	Korea:(4), Japan: (4), Europe:(2), USA:(5), Developing countries:(2),
5	Passenger cars per thousand inhabitants	Vehicles/ 1000 inhabitants	Number of passenger cars in urbanized area includes all vehicles with three/four wheels or more used primarily for private transportation of persons, but does not include taxis or public transport vehicles. - Population figures used to compute the ratio is defined above (indicator 2).	Korea:(4), Japan: (4), Europe:(2), USA:(4), Developing countries:(2),
6	Average distance of private motorized modes	Km/trip	With reference to trips defined by indicator 8, including automobiles, motorcycles, and taxis, the actual distance is sought, not a straight line distance. - In this case, trips extending beyond the urbanized area are considered.	Korea:(3), Japan: (3), Europe:(2), USA:(3), Developing countries:(3),
7	Daily trips per capita	Trip/ day/ person	Characterized as: - Trips made by persons over 5 years of age who reside in the urbanized area. - Trips with at least one extreme (origin and/or destination) inside the urbanized area. - All reasons for travel and all transport modes, motorized, or otherwise. - Trips on foot are included. - Trips made using several modes are counted as one trip and assigned to a "primary mode".	Korea:(3), Japan: (3), Europe:(2), USA:(3), Developing countries:(3),
8	Percentage of private motorized trips	%	Percentage of the total number of daily trips (Indicator 8) made by the private motorized modes (i.e., private cars, motorcycles, taxis).	Korea:(3), Japan: (3), Europe:(2), USA:(3), Developing countries:(3),
9	Annual transportation energy consumption	MJ/ person	Evaluating value of annual transport energy consumption by private motorized vehicles and motorcycles per capita.	Korea:(4), Japan: (4), Europe:(2), USA:(4), Developing countries:(2),

Notes

(1) KTDB: Korean Transport Database. MLITT: Ministry of Land, Infrastructure, Transport and Tourism. JICA: Japan International Cooperation Agency. UITP: International Association of Public Transportation. FHWA: Federal Highway Administration U.S. Department of Transportation.

(2) Korea: Population and housing census (2005). Wealthy Asian: Periodic surveys (censuses, mobility studies) of International Association of (UITP) 2001. Developing countries: The study on master plan for urban transport in the metropolitan area (Cairo, Tripoli (2001); Phnom Penh, Belem, Chengdu, Jakarta, Kuala Lumpur (2000); Damascus, Managua (1998); Manila(1997); Bucharest (1999); Lima, Hanoi (2005); Ho Chi Minh (2003); Nairobi (2004)).

(3) Korea: Household Travel Survey ((2005)-Inchon. Suwon. Sungnam (2006)). Japan: The Nationwide Person Trip Survey (2005). U.S.A: NHTS (National Household Travel Survey, 2001). Developing countries: Household Interview Survey of each country (Cairo, Tripoli (2001); Phnom Penh, Belem, Chengdu, Jakarta, Kuala Lumpur (2000); Damascus, Managua (1998); Manila (1997); Bucharest (1999); Lima, Hanoi (2005); Ho Chi Minh (2003); Nairobi (2004)).

(4) Korea: The Statistics Report of each city (2005). Japan: The Statistics Report of each city (2005). U.S.A: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 2001.
(5) U.S.A: Regional Economic Accounts Bureau of Economic Analysis U.S. Department of Commerce.

To estimate transportation energy consumption, four main travel characteristics were considered: trip length, trip speed, daily trip number, and modal share of private motorized modes, as mentioned in the previous chapter. These data on travel characteristics were calculated from person trip data released by public institutes around the world. However, the data fields of the person trip data differ by country. It should be noted that the calculation method of travel behaviour differs slightly by country and depends on the how the person trip data was configured. Moreover, due to the limitations in the data from European cities and some Korean cities, travel behaviours were estimated throughout the whole urban area using the cities average of trip values on travel behaviour. A table showing the calculation methods to explain travel behaviour data is available from the authors. The database produced using these data sources and methods is provided in an appendix to this paper.

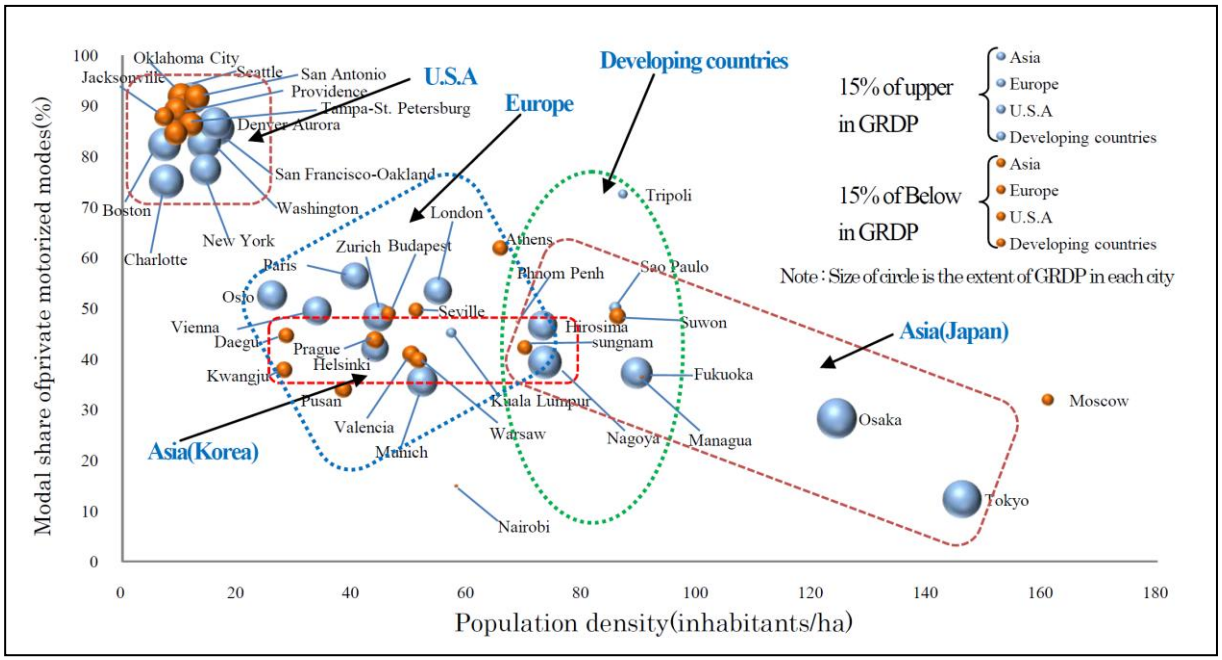
THE RELATIONSHIP BETWEEN CHARACTERISTICS OF TRAVEL BEHAVIOURS AND URBAN STRUCTURE AND THE DIFFERENCE OF CHARACTERISTICS OF TRAVEL BEHAVIOURS IN AN ECONOMIC STANDARD

Using the database described in the preceding chapter, this section examines the causal relationship between urban structure and travel behaviours. Differences in travel behaviours as they relate to the economic level of city were determined. Cities selected in this research have varying levels of urban structure from dense to low population density.

First, the relevance of the relationship between urban structure and the modal share of private motorized modes in 44 cities in the world are shown in Figure 1. It turns out that the population density of each city is lowest in the United States (average density: 11.5 inhabitants/ha), medium in Europe (average density: 57.1 inhabitants/ha), and highest in Asia (average density: 75.8 inhabitants/ha). In cities with lower population density the private modal share was increased. Especially, the cities where population density is very low and where the modal share of private motorized modes is very high are mainly situated in the United States, and it is found that the cities where densely-populated and the modal share of private motorized modes is medium level are mainly Asian cities in Japan or South Korea.

Next, the analysis of the relationship between economic level and modal share of private motorized modes in cities with comparable population density was conducted. A higher modal share of private motorized modes was revealed in cities with a high economic level, such as London, Paris, Zurich, and Helsinki (average density of 46.0 inhabitants/ha) compared to cities with a relatively low economic level, such as Valencia, Warsaw, Budapest, and Prague (average density of 48.0 inhabitants/ha). In this con-text, Table 3 shows that the number of registered passenger cars is higher in citied with high economic levels. In the case of Asia, modal share of private motorized modes for Tokyo, Osaka, and Nagoya, which are high economic level (average density: 101.4 inhabitants/ha) is lower than Pusan, Kwangju, and Suwon, which are cities with a relatively low economic level (average density: 50.4 inhabitants/ha). It could be conjectured that this is the result of the development of public transport as well as the maintenance of spaces for pedestrian and non-motorized modes (NMM: walking and bicycles), since both the economic level and population density are high; therefore, traffic demands on the roads could shift the majority of public transport to non-motorized modes.

Figure 1 Relationship between Urban Structure and Modal Share of Private Motorized Modes by Economic Level



According to Table 4, the modal share of public transport and non-motorized modes is high. On the other hand, although there is a difference in the modal share of all modes between in all cities, a similar finding is seldom seen in cities of the United States. In the United States modal share of private motorized modes is lower as the economic level of a city becomes relatively high. In New York, Washington, Seattle, and Boston, which have high economic levels, the use of non-motorized modes (12.1%) and public transport (5.1%) is high. That is to say, in cities where the economic level is higher there is development of public transport and maintenance of space for a pedestrian and non-motorized modes; this holds true for cities in United States that have a low population density.

Table 5 Registered Passenger Cars in the World

	Top 15 Per Cent		Bottom 15 Per Cent	
	Urban density (inhabitants/ha)	Passenger car (vehicles/ inhabitants)	Urban density (inhabitants/ha)	Passenger car (vehicles/ inhabitants)
Asia	101.4	0.313	50.3	0.263
Europe	46.2	0.430	67.1	0.384
USA	12.7	0.492	10.3	0.613
Developing countries	76.7	0.243	29.3	0.045
Average	*59.3*	*0.370*	*39.3*	*0.383*

Lastly, in cities of developing countries, the modal share of private motorized modes is higher in cities with a high economic level (Tripoli and Kuala Lumpur) compared to cities with a relatively low economic level (Managua, Nairobi, and Phnom Penh). As for the high growth

of economy, in developing countries, cities in high economic level were at 35% in the time period between 1991 and 95, similar to the 60s when motorization developed rapidly in Japan and the United States (Nakamura *et al*, 2004). Therefore, it is important to mention that the use of private motorized modes increases gradually due to the progress of motorization in the cities in high economic levels of developing countries.

Table 6 Modal Share in the World

	Top 15 Per Cent			Bottom 15 Per Cent		
	Private Modes	Public Modes	Non-Motorized Modes	Private Modes	Public Modes	Non-Motorized Modes
Asia	33.2	24.4	42.4	40.8	30.2	29.0
Europe	47.7	22.6	29.7	40.3	33.6	26.1
USA	82.8	5.1	12.1	89.6	2.4	8.0
Developing countries	56.2	22.3	21.5	39.8	26.9	33.3
Average	55.0	28.6	16.4	52.6	23.3	24.1

It is clear that economic level influences passenger car ownership and private modal share. Additionally, population density also plays a key role. The study by van de Coevering and Schwanen (2006) demonstrated that urban structure, determined by population density and job density, is the only variable to be statistically significantly related to commuting distance. A higher percentage of jobs in the inner city leads to a shorter average commuting distance and higher passenger car share. Moreover, population size is positively correlated with the average commuting distance. This may explain why the maximum distance between an individual's residence and workplace location can be longer in a larger city. Thus, it is important to consider the urban structure in the investigation of the difference between private modal share and economic level.

Figure 2 shows that the relationship between urban structure and daily trip number (excluding NMM) is related to differences in economic levels between cities. As population density increases, daily trip number decreases. Giuliano and Dhiraj (2003) determined that fewer trips occur within smaller density cities. We found that daily trip number in the United States (3.97 trips/day) was extremely high, and nearly two times that of European cities (2.18 trips/day) and Asian cities (2.3 trips/day). It seems that modal share of private motorized modes becomes highly inevitable since ownership of the individual transportation fleets allows people to move freely, which is needed in the cities of USA where population density is low (Table 6). Trips for the private purpose are high in the cities of the United States, and this could be due to the fact that urban structure associated with lower population density leads to higher trip frequency. Figure 2 appears to indicate that the higher economic level cities have the higher number of daily trip as well.

In the case of European cities, as shown in Table 5, the number of daily trips excluding non-motorized modes in cities with a high economic level (Munich, Oslo, Zurich, Hamburg, and Helsinki) is high and relative to the economic level of cities. Even though the population density of European cities with the same level (54.7 inhabitants/ha in average), the daily trip number increases relative to economic level. We can conjecture that higher trip generation is affected by both the economic level and population density of a city, meaning that people

have more opportunities taking private trips because they have a higher income, as is the case in Europe.

Figure 2 Relationship between Urban Density and Daily Trip Number Excluding Non-Motorized Modes

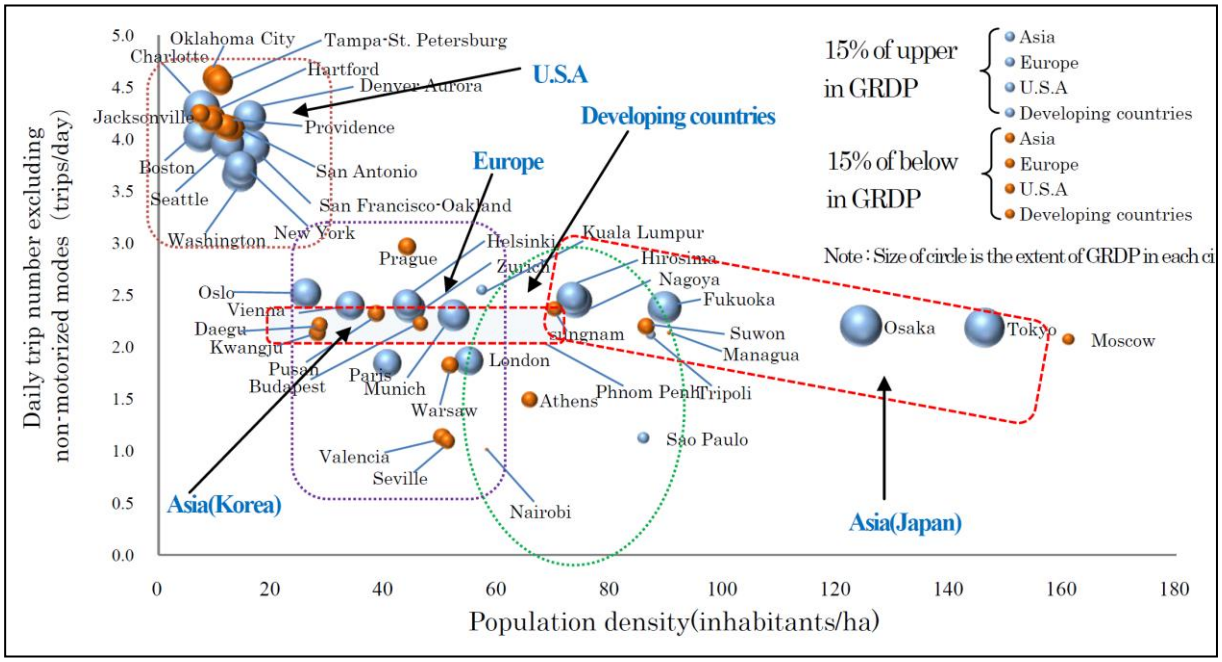


Table 5 Density and Daily Trip Number

	Top 15 Per Cent		Bottom 15 Per Cent	
	Urban density (person/ha)	Daily trip number excluding NMM (trips/day)	Urban density (person/ha)	Daily trip number excluding NMM (trips/day)
Asia	101.4	2.33	50.3	2.33
Europe	46.2	2.18	67.1	1.83
USA	12.7	3.97	10.3	4.28
Developing countries	76.7	1.93	72.4	1.72
Average	59.3	2.60	50.0	2.54

In the cities of Japan and Korea, a significant relationship between economic level and daily trip number is not seen. Daily trip number in Korean cities and Japanese cities is almost same. However, the important point here is the difference of modal share of NMM and population density in the two countries. Density of Japanese cities are approximately two times that of Korean, but modal share of NMM is much higher than Korean cities, likely due to population density in the city and high economic levels, which undoubtedly have contributed to improvements in infrastructure for pedestrians and bicycle riders. Moreover, shorter trips in inner area could be headed by NMM.

Table 6 Trip Purpose in Cities

	Top 15 Per Cent		Bottom 15 Per Cent	
	Commuting (%)	Private (%)	Commuting (%)	Private (%)
Asia	28.2	39.4	23.4	25.2
Europe	–	–	–	–
USA	5.7	71.4	5.1	70.6
Developing countries	24.4	18.1	17.5	13.8
Average	*19.4*	*43.0*	*15.3*	*36.5*

Note: Private trip means sightseeing, leisure, eating out, shopping and any private business.

In the case of developing countries, differences in daily trip number are related to economic level regardless of population density (Tables 3, 4, and 5). The number of passenger cars in cities with higher economic levels is higher and trips of working and private purpose are increased. Thus, in developing countries it is likely that the dependence on private motorized modes becomes higher and more trips for private purpose are generated in cities with higher economic levels.

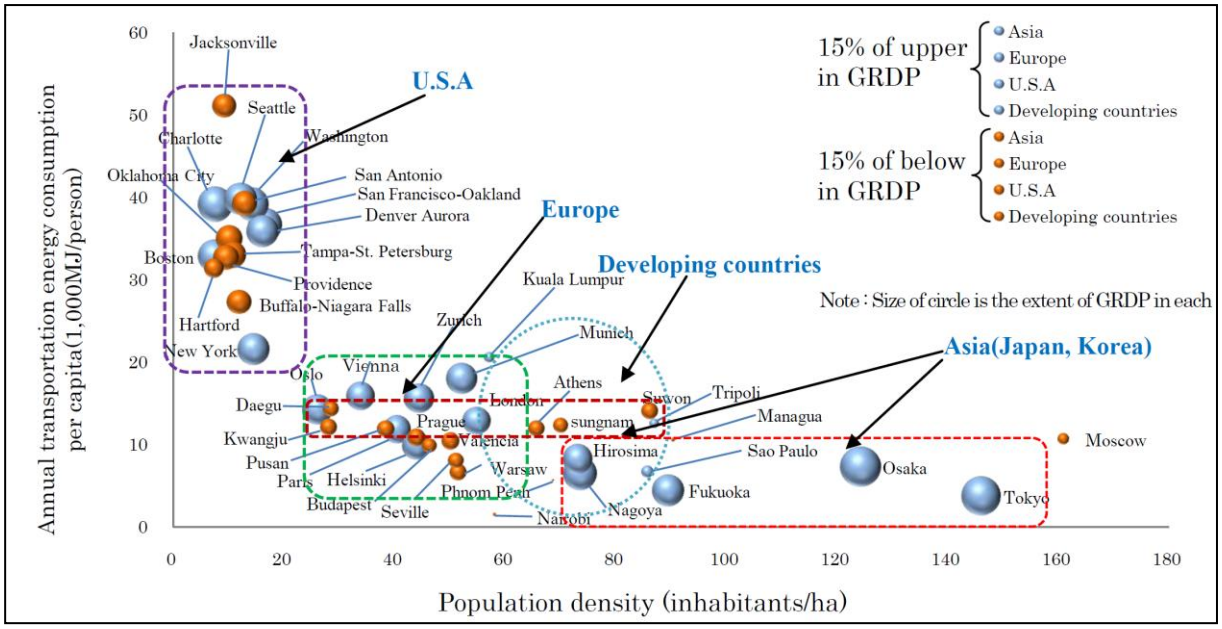
Figure 3 shows the relationship between urban structure and annual transportation energy consumption per capita. Similar to findings by Newman and Kenworthy (1989a, 1989b) and Kenworthy and Laube (1999a) we can ascertain that in denser cities lesser transportation energy is consumed. First, we can highlight the fact that transportation energy consumption is much larger than other target cities when we pay attention to growing cities. In terms of economic level, there is no significant difference in energy consumption in cities in the United States. However, transportation energy consumption of New York is visually lower than other cities in the United States; the average daily trip number (3.72 trips/day) and the average trip length (15.2 km/trip) is shorter in New York compared to other cities in the United States. In addition, modal share of public transport (10.5%) is the highest among the cities in the United States. New York is likely a very special case that has a high economic status, a high level of public transport, and relatively higher density compared to other cities in the United States. Overall, in cities in the United States with an extremely low population density and high ownership of passenger car, transportation energy consumption is extremely high regardless of economic level.

In the case of European cities, transportation energy consumption of Munich, Zurich, Oslo, and Vienna, which are cities in the high economic level, is somewhat higher than other cities in Europe. Although population density of European cities is similar, as shown in Figures 1 and 2, when economic level is higher so too are the modal share of private motorized modes and the number of daily trips. This is likely related to increased opportunities for going out. In addition, as mentioned above, shorter trips for commuting and high private modal share are influenced by urban structure, which can be explained by population density and job density.

Asian cities, such as Japanese cities with a high economic level, possess a more dense urban structure compared to Korean cities that have a lower population density; the amount of transportation energy consumption is smaller. Here, we identify an inverse relationship between urban density and transportation energy consumption per capita similar to the findings of Newman and Kenworthy (1989a, 1989b). In addition, the propensity of lower

private modal share and higher NMM results in a relatively low dependence of private modes. Meanwhile, lower population density and higher private modal share in Korean cities appear to interact with higher transportation energy consumption than Japanese cities, although there is no significant difference in public transit modal.

Figure 3 Relationship between Urban Structure and Transportation Energy Consumption



Lastly, in cities of developing countries, as the economic level of city increases so too does transportation energy consumption (approximately three times). As shown in Figure 1 and Table 5, if the economic level of a city is high, private modal share is higher and trips for private purpose increases. Based on this finding, we believe that economic level of city influences to modal choice or status of infrastructure development and inevitably impacts the management of traffic demand. Figures 1, 2, and 3 demonstrate that private mode share, daily trip number, and transportation energy consumption are affected both by urban structure and by the economic level of the city. Based on this research we can make a suggestion that economic level of the city impacts traffic demand, and that private motorized modes, public transport, and how urban structure (presented by population density) can be a criteria for under-standing how travel behaviours differ by population density.

CONCLUSION

This paper has analysed the relationship between urban structure, travel behaviours, and transportation energy consumption based on the economic level of the cities in the world. Based on this analysis, we can propose that despite similarities in urban structure, the economic level of the city influences modal choice and the level of infrastructure development impacts the control of traffic demand. Travel behaviour is the result of comprehensive urban-transport activities, making it difficult to determine the key factor impacting transportation energy consumption. However, it is certain that the traffic demand of private transportation modes parallels economic development worldwide, such that increases in economic levels leads to higher demands for private transportation modes. We, including researchers and planners, have to establish strategies that can improve the energy

consumption and improve urban-transport problems (from a traffic aspect) to mitigate the speed of motorization.

This research has showed that person trip data from around the world can be exploited to gain insight into detailed individual travel behaviours, which can in turn be used to estimate transportation energy consumption that takes into consideration type of vehicle, trip speed, and actual road traffic condition on the trip. Accordingly, we can get an objective result related to actual traffic situation. We showed that there is a relationship between the economic level of a city and urban structure, travel behaviours, and transportation energy consumption. The findings of this study suggests new questions regarding how urban-transport characteristics affect individual travel behaviours, and what is next step for energy consumption, not only estimating transportation energy consumption but also devising ways to reduce it.

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APPENDIX: DATABASE

Country	City	GRDP ($/person)	Urban density (person/ha)	Average trip length: private modes (km/trip)	Modal share of private modes (%)	Number of daily trip excluding walking, bicycle (trips/day)	Trip speed of private motorized modes (km/h)	Transportation energy consumption (MJ/person)
Asian Cities – Top 15 Per Cent by GRDP								
Japan	Osaka	79,573	124.3	13.8	20.6	2.20	25.6	5,023
Japan	Tokyo	71,052	146.1	14.4	12.3	2.18	25.4	2,869
Japan	Nagoya	54,184	73.6	8.2	46.4	2.44	21.7	4,836
Japan	Fukuoka	49,258	89.5	9.1	33.7	2.37	21.8	3,502
Japan	Hiroshima	41,868	73.2	10.3	53.0	2.47	23.6	6,088
	Average	*59,187*	*101.3*	*11.2*	*33.2*	*2.33*	*23.6*	*4,464*
Asian Cities – Bottom 15 Per Cent by GRDP								
Korea	Pusan	13,086	38.5	15.0	36.4	2.60	23.8	8,488
Korea	Kwangju	12,776	28.1	15.5	33.3	2.32	33.3	6,408
Korea	Suwon	12,595	86.2	13.3	47.8	2.19	28.5	9,781
Korea	Daegu	11,201	28.6	15.4	41.6	2.21	24.9	9,122
Korea	Sungnam	10,550	70.1	11.4	44.8	2.36	23.9	8,613
	Average	*12,042*	*50.3*	*14.1*	*40.8*	*2.33*	*26.9*	*8,482*
European Cities – Top 15 Per Cent by GRDP								
Germany	Munich	45,800	52.2	15.0	40.6	2.30	30.0	14,397
Norway	Oslo	42,900	26.1	9.0	59.1	2.51	36.0	10,908
Switzerland	Zurich	41,600	44.5	11.8	46.4	2.37	32.0	11,013
Austria	Vienna	34,300	66.9	8.3	36.0	1.97	22.0	6,483
France	Paris	37,200	40.5	8.2	46.4	1.84	33.0	9,187
Finland	Helsinki	36,500	52.2	15.0	44.0	2.41	23.0	7,851
UK	London	36,400	26.1	9.0	50.2	1.86	24.0	9,560
	Average	*39,886*	*39.4*	*11.1*	*47.7*	*2.18*	*28.6*	*1,1245*
European Cities – Bottom 15 Per Cent by GRDP								
Czech Republic	Prague	15,100	44.2	8.0	35.6	2.96	25.0	7,706
Spain	Valencia	14,300	50.2	11.5	41.3	1.13	24.0	7,965
Poland	Warsaw	13,200	51.5	10.0	28.6	1.82	25.0	5,077
Greece	Athens	11,600	65.7	10.0	63.9	1.49	20.0	9,169
Spain	Seville	11,000	51.1	8.0	48.0	1.09	21.0	6,670
Hungary	Budapest	9,840	46.3	9.0	33.1	2.22	20.0	8,197
Russia	Moscow	6,060	161.0	12.0	31.5	2.07	27.0	6,251
	Average	*11,586*	*67.1*	*9.8*	*40.3*	*1.83*	*23.1*	*7,291*
U.S. Cities – Top 15 Per Cent by GRDP								
USA	Charlotte	45,800	52.2	15.0	40.6	2.30	30.0	14,397
USA	San Francisco Oakland	42,900	26.1	9.0	59.1	2.51	36.0	10,908
USA	Washington	41,600	44.5	11.8	46.4	2.37	32.0	11,013
USA	Boston	34,300	66.9	8.3	36.0	1.97	22.0	6,483
USA	Seattle	37,200	40.5	8.2	46.4	1.84	33.0	9,187
USA	DenverAurora	36,500	52.2	15.0	44.0	2.41	23.0	7,851
USA	New York	36,400	26.1	9.0	50.2	1.86	24.0	9,560
	Average	*39,886*	*39.4*	*11.1*	*47.7*	*2.18*	*28.6*	*1,1245*

Country	City	GRDP ($/person)	Urban density (person/ha)	Average trip length: private modes (km/trip)	Modal share of private modes (%)	Number of daily trip excluding walking, bicycle (trips/day)	Trip speed of private motorized modes (km/h)	Transportation energy consumption (MJ/person)
U.S. Cities – Bottom 15 Per Cent by GRDP								
USA	Oklahoma City	32,439	10.2	14.5	91.5	4.59	49.1	21,429
USA	Tampa-St. Petersburg	31,663	10.8	13.9	89.5	4.54	45.2	25,971
USA	Providence	30,340	9.6	19.0	91.8	4.20	52.1	23,845
USA	San Antonio	30,005	12.9	31.2	90.6	4.09	59.4	24,669
USA	Buffalo-Niagara Falls	28,301	11.9	14.4	84.9	4.11	45.5	21,639
USA	Jacksonville	25,901	9.3	16.1	88.7	4.17	50.3	45,990
USA	Hartford	17,419	7.3	17.5	90.1	4.24	53.7	27,519
	Average	*28,010*	*10.3*	*18.1*	*89.6*	*4.28*	*50.8*	*27,295*
Cities in Developing Countries – Top 15 Per Cent by GRDP								
Brazil	Sao Paulo	6,420	85.8	9.1	33.6	1.12	18.2	4,428
Malaysia	Kuala Lumpur	4,816	57.2	9.8	62.5	2.55	18.0	13,948
Lebanon	Tripoli	3,990	87.1	9.5	72.4	2.11	29.6	6,898
	Average	*5,075*	*76.7*	*9.5*	*56.2*	*1.93*	*22.0*	*8,425*
Cities in Developing Countries – Bottom 15 Per Cent by GRDP								
Nicaragua	Managua	620	3.5	12.6	36.5	2.13	21.2	6,330
Kenya	Nairobi	421	58.1	28.8	15.7	1.01	34.7	1,455
Cambodia	Phnom Penh	215	26.2	8.3	67.1	2.02	23.5	1,397
	Average	*419*	*29.3*	*16.6*	*39.8*	*1.72*	*26.5*	*2,796*

Are You There God? It's Me, King Island

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ABSTRACT

Using Regional Development Platform theory as proposed by Cooke (2007), is it possible to envision an adaptive King Island: as stoic in the face of the current global agri-food paradigm as it is in the face of swells and storms? Having survived commodity rollercoaster rides through niche product branding and mining busts and booms resulting in a renewable energy and enviro-tourism focus, King Island is still there; home to approximately 1700 people; buffeted by sea, blown by gales, laden with both sunshine and rain. Presently it is also 'home' to an internationally recognised food brand, but for how long? And what may happen next? A preview of research conducted as part of PhD candidature, this paper explores the dilemma of a small, isolated, peripheral economy in the middle of Bass Strait.

INTRODUCTION

Using Regional Development Platform theory as proposed by Cooke (2007), is it possible to envision an adaptive King Island; as stoic in the face of the current global agri-food paradigm as it is in the face of swells and storms? It can claim some form of resilience, having survived commodity rollercoaster rides through niche product branding and mining busts and booms resulting in a renewable energy and enviro-tourism focus. Like Morpheus from the Matrix movies shouting to the machines "We Are Still Here!", King Island is still there; home to approximately 1700 people; buffeted by sea, blown by gales, laden with both sunshine and rain. Presently it is also 'home' to an internationally recognised food brand, but, given the current global food paradigm, for how long? And what may happen next? Is there evidence in situ that give confidence to proclaim an adaptable regional economy on King Island, prepared for the next 'shock'? If not, what policy platforms can regional development offer the community so that it may proactively shape a sustainable economic, environmental and social future?

A preview of research conducted as part of PhD candidature, this paper explores the dilemma of a small, isolated, peripheral economy in the middle of Bass Strait, dominated by two multinational food companies. Premising that the unimaginable may happen, and that both companies withdraw support for King Island, what institutional, infrastructural, social and political 'markers', or potential markers, need to be identified to label the King Island economy an adaptive one.

ADAPTABILITY VERSUS RESILIENCE

Is one man's adaptability another's resilience? One could argue that it is just semantics, or economic jargon used to profligate academic journals (see *Cambridge Journal of Regions,*

Economy and Society, 2010, p. 3); and such confusion and debate may be useful as practitioners and students determine their own definitions in support of their own agendas. Bristow's (2010, p. 155) use of resilience as

> the region's ability to experience positive economic success that is socially inclusive, works within environmental limits and which can ride global economic punches

is not dissimilar to Pike, Dawley and Tomaney's (2010, p. 62) adaptability:

> the dynamic capacity to effect and unfold multiple evolutionary trajectories, through loose and weak couplings between social agents in place, that enhance the overall responsiveness of the system to unforseen changes.

Both terms sit comfortably under the 'sustainability' umbrella, even though, or perhaps because, it too is a contested expression in the regional development literature. This paper concurs with Bristow (2010, p. 153) that the literature on resilience "clearly resonates" with current literature around sustainability, and that it is imbued with overtones from literature on localisation and diversification as well. Specifically, this paper sees resilient and adaptive as chronologically descriptive terms; resilience as a retrospective term with adaptive or adaptable couched in present or future scenarios, in line with Hasslink (2010, p. 55)who believes "the resilience framework seem to stress more the recovering of existing industrial structures (adjustment) rather than the promotion of adaption and renewal."

Christopherson, Michie and Tyler (2010, pp. 6-7) suggest six factors that assist in creating a platform for adaptability: A strong regional system of innovation; a solid base on which to build a 'learning region'; productive infrastructure, preferably modern; a workforce that is skilled, innovative and entrepreneurial; a strong capital base; and a diversified economic base, one that is not heavily reliant on one or two industries. Again, Bristow's (2010) resilient regions are similar; diverse in the number of types of businesses (preferably small scale), endogenous capacity to reorganise where necessary in the event of a 'shock', and a community of networked, collaborative, private and public actors delivering essential services.

The idea of regional systems promoting and supporting innovation (RIS) is strongly linked to the adaptability, resilient and sustainability discourses. Cooke and Swhartz (2007) believe this is because innovation systems formally connect the 'sub-systems' of knowledge exploration and generation to the knowledge exploitation 'sub-system', creating opportunities for development. The institutional support that enables RIS to evolve has often been termed 'constructed regional advantage' (Coenen and Moodysson, 2009).

COOKE'S POLICY PLATFORMS

Cooke (2007) argues that to construct regional advantage, policy platforms actively supporting regional development must first be in place. The four key areas that should be specifically targeted for policy levers are the economy, governance, knowledge infrastructure and community and culture. These policies must be cross-sectoral, and as the term 'platform' suggests, provide base-load support with the capacity to nurture innovative and/or entrepreneurial opportunities that may present in a region. This all sounds perfectly fabulous. There is also the suggestion that it can work, with evidence from the Lahti region in Finland touting success (Haarmakorpi, 2006). Haarmakorpi and Pekkarinen (2003) advocate however that not all perceived opportunities are robust enough to be acted upon, and advocate a thorough investigation of both pitfalls and potential. This leads to the question of who gets to decide the strategic investment trajectory to be followed (Uyarra 2010), and prompts memories of 'picking winners'. Proponents are similarly reminded by Uyarra (2010) and

Baldacchino and Bertram (2009) that breadth of industries, skills and infrastructure within a region allow for flexibility and greater capacity to respond to opportunities, although create headaches for policy makers who prefer the one-size-fits-all model . This is why the 'market' is often left to decide, enabling those charged with economic development tasks to take an 'all care, but no responsibility' approach.

King Island, having successfully promoted its products to supply niche markets for high end quality beef and dairy products, is nonetheless a region struggling to achieve a 'sustainable' agri-food future. It can be suggested that the product life-cycle, particularly for some dairy products, is in decline. Production has actually declined on site, and although two new lines are in the pipeline, it is not expected that this will require an increase in milk production. Beef production, in contrast, is on the rise; however there is a risk of it being constrained through a shortage of labour, housing and other amenities.

Godfrey Baldacchino (2011) suggests that islands cannot be "islands" and be sustainable. The romantic allure of a remote paradise must be weighed up against inconvenient truths such as the tyranny of distance, economic realities such as small local markets, and the changing and changeable nature of islands that leads Baldacchino (2011) to state that "islands are political projects in progress"; as they attempt to adapt to any and every policy change thrown their way. Islands, because they must export to survive, can never be true masters of their own destiny; however they can shape it.

Baldacchino (2008, p. 190) documents what this 'shaping' may look like. He has defined five measurable variables that in studies have been equated with success in small manufacturing firms located in smaller economic jurisdictions. They are: Local ownership; Small size, up to 50 employees; Manufacturing that adds value to production; Export orientation as the norm; Technology adaptation, where necessary customised, if not invented by the locals. The links between the adaptability, resilience and Island economies are drawn in Table 1:

Table 1 Literature Matrix Linking Baldacchino (2008), Christopherson *et al*. (2010) and Bristow (2010)

The Baldacchino 5	Christopherson *et al* Adaptability	Bristow's Resilience
Local ownership	Strong capital base	'community' of networked, collaborative private and public actors
Small size		Diverse small scale number and types of businesses
Manufacturing value add	Productive infrastructure	
Export orientation	Diversified economic base	
Technological innovation	A solid base for a 'learning region'; skilled, innovative workforce	Endogenous capacity to reorganise

Linking local ownership with a strong capital base in a small economy may seem counter intuitive for some. However literature around 'power' in value chains, suggests the presence of multinational corporations in small economies has led to some regions feeling less empowered when ownership is removed from local control. Having profits go off shore, or decisions affecting local communities being made extra-context hundreds or thousands of

miles away does not bode well for regional development. Pike and Pollard (2010) argue that the extent and scale of current global financial trading activities, calculations and engineering pressure corporations into delivering returns to shareholders, in effect privileging distant owners over other more embedded stakeholders. The investment of 'local' money on the other hand means most returns stay in the region.

Bristow's (2010) argument for small scale firms echoes older literature including Hansen (1990) that small-to-medium enterprises (SMEs) have greater adaptability, high capacity for innovation and creativity, with effective and efficient communications allowing for quick turnover of stock that responds to rapidly changing consumer demand. With the absence of competitive market conditions, such as a skilled, mobile workforce, given their isolation as Baldacchino (2011) suggests; island regions require policy support to assist SMEs in their quest for sustainability, and so offer a stronger economic base for their communities to grow.

The key of course is to identify the appropriate policies that drive the institutional support required specifically by the region in question. This requires research, and a benchmarking tool, to test for validity and robustness.

KING ISLAND AND COOKE

Cooke (2007) says knowledge based construction, or perhaps in King Island's case re-construction, of competitive advantage requires interfacing developments in the following areas:

Economy: for Cooke (2007, p. 186) this means "regionalization of economic development; 'open systems' of inter-firm interactions; integration of knowledge generation and commercialisation; smart infrastructures; strong local and global networks". King Island has a number of economic drivers. Along with the dairy and beef industries, there is a strong commercial fishing industry, kelp harvesting and value adding, environmental and sports tourism, silica mining and a possible re-start of scheelite mining, with owners presently processing the slag heap before a potential re-opening of the underground mines. Due to the export focus of King Island, global networks for trade are clearly evident, in some part due to foreign ownership, but also due to the hard work of King Island entrepreneurs, such as King Island Seafood, who export regularly to Asia. Networks are sectoral for the most part, although information flows are quite strong between sectors; most of it is of a social nature, making it difficult to quantify investment or commercial opportunities resulting from inter-firm interactions.

Governance: "multi-level governance of associational and stakeholder interests; strong policy support for innovators; enhanced budgets for research; vision-led policy leadership; global positioning of local assets" (Cooke 2007, p. 187). Local assets as mentioned above are globally positioned, however governance and leadership on King Island is noticeably absent. An interview with the local council's economic development officer brought to light that it was on the urging of residents that the council took on an economic development role. Discussions and consultation take place around such issues as a population strategy, affordable access to King Island, power price parity with mainland Tasmania, improving education and work skills, natural resource management, the King Island "Brand", and tourism. While high levels of foreign ownership are seen as a threat to King Island's sustainability, the council accepts that this is a result of free-market enterprise, and that governance in its present guise has little influence. While the economic development officer was happy to respond to any request for low-level support from the council, the 'community' is responsible for their own areas of interest, and unfortunately there is evidence of 'volunteer fatigue' impacting in this area.

Branding of King Island is looking to take back ownership of King Island for the community, rather than being 'owned' by the multi-national corporations that leverage it. The King Island Brand Management Group (KIBMG) has been formed and is looking to institute an 'umbrella' brand that smaller producers can use and leverage in the market place. This is not yet a clear picture of what the 'rules' of the brand will be, however most conversations on the subject suggest that at least some form of value-add must take place on King Island for it to be useful. For all the discussions taking place, there is little evidence of change to this point. Local government on King Island is not leading development, it is responding to community concerns, and while there are some excellent individuals working hard on King Island to grow their businesses and their community, there is no structured, systematic approach, nor 'champion' for the cause. One dairy farmer suggested that there needed to be more state or federal government control rather than council control because this would "get more things done".

Knowledge Infrastructure: for Cooke (2007) this means that universities, along with public sector research, intermediary agencies, professional consultancies and the like all need to be involved for their problem solving abilities in a structured way. There were few examples of this on King Island, but for one stand out – the King Island Beef Group. Originally designed to develop a rapport with the processor, the group has developed other relationships as well, which for one beef farmer interviewed had led to noticeable improvements on the ground. By bringing in their own 'experts' such as academics from the Tasmanian Institute for Agricultural Research (TIAR), the meat and livestock corporation (MLA) and others, farmers have been able to improve their grazing techniques and fertilizer utilization. The same beef farmer suggested that this now needed to be extended to a whole of food chain group to discuss issues across sectors.

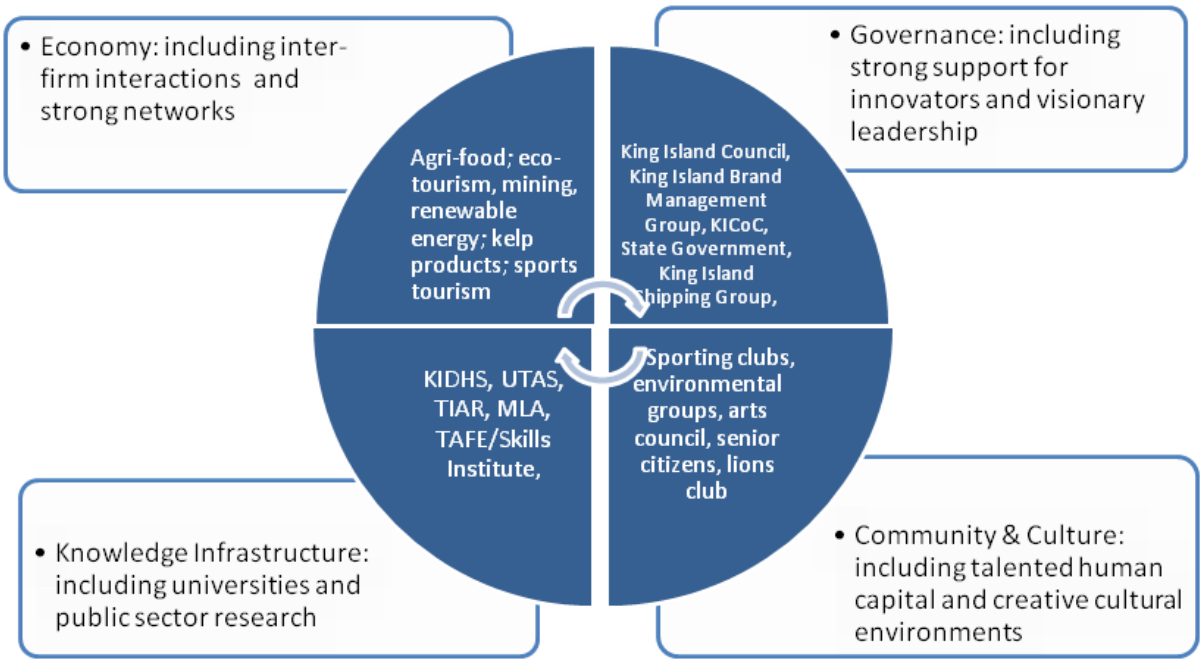
Movements toward this goal are evident, with the King Island shipping group being formed in response to a lack of communication with the current shipping operator. The group conducted research and has put the King Island 'run' out to tender. Negotiations are continuing, however there is an air of expectation around the island that freight movements on and off King Island will be improved in the near future.

Community and culture: "cosmopolitanism; sustainability; talented human capital; creative cultural environments; social tolerance" (Cooke 2007, p. 188). All need to be part of the conversations around regional development projects. Art for art's sake has its place, but it is under valued on King Island, and, as with much of the Australian psyche, there is a strong sporting culture. This has proved useful with an annual long distance run, the King Island Imperial, bringing in visitors every year. Advertising for this event also includes reference to the 'free willy' run, where men get together and sprint along a local beach, naked. Field naturalists and local bird watchers also support tourism with tours, as do historical icons, such as the Cape Wickham Lighthouse recently celebrating its 150th birthday and grand opening on the same day. Australia's Governor, Quentin Bryce cut the ribbon along with some local children. A fun run/walk/ride was conducted between Cape Wickham in the north, and Stokes Point lighthouse in the south as part of the celebrations, over a distance of more than 60 kilometres. King Island is unsurpassed in Tasmania for its level of volunteering for community organisations – King Island recorded more than 31% of the population volunteering for community organisations in 2006 compared with other Tasmanian regions averaging between 22 and 24% (ABS, 2008); however, as mentioned before, volunteer fatigue is obvious in some parts, with too few doing too much.

While there is some evidence of Cooke's (2007) platforms for development in situ on King Island, the question still remains as to what form of development should be supported by

these platforms, and who gets to choose. Is there an empirical way to shine the light on prospective paths? It just so happens there is.

Figure 1 Cooke's (2007) Platforms and King Island



THE TOOL MOST LIKELY

> Regional development strategies should be based on the sound assessment of regional resources, capabilities, competences and core competences, as well as on dynamic capabilities aiming to develop the resource configurations in order to form regional competitive advantage. (Harmaakorpi & Pekkarinen 2003)

At the European Regional Science Association Conference in 2003, Harmaakorpi and Pekkarinen presented their model, or tool, that attempted to design and manage RIS. Known as the Regional Development Platform Method (RDPM) it consists of eight phases:

i. benchmarking through the assessment of RIS theories;
ii. background study of the industries and areas of expertise in the region;
iii. expert panels;
iv. assessment of future scenarios;
v. analysis of statistical and empirical information;
vi. conceptualisation of the RIS;
vii. search of core processes of the RIS;
viii. definition of knowledge creation and management system.

Dr Tony McCall from the University of Tasmania analyses this method in a discussion paper about Tasmania's Innovation Strategy that holds agri-food at its core. He argues that the strength of RIS lies in how it converts knowledge into 'productive outcomes' (McCall, 2010), and recognises social capital as instrumental in this process. Similar to Jussuame and Kondoh (2008) who argue that it is the interactions of structure and agency that will determine the fate of local agri-food systems, McCall (2010) cites Pekkarinen and Harmaakorpi (2006) when suggesting that it is a challenge for RDPM to deliver successful innovative outcomes when harnessing social capital, and concurrently manage the instability and limitations it presents, particularly around the issues of self interest and trust. This can be facilitated by a 'shared vision', what Mc Call (2010) calls a 'knowledge vision' which he insists gives direction to the course of knowledge creation and resultant management system. Simply he says the knowledge vision is codified agreement on what the RIS could do, what it should do, how, why and in which direction it should be pointed.

Coenen and Moodysson (2009, p. 590) state that as an approach RIS "is regarded as the most comprehensive intellectual framework to guide policy action". The 'Swedish Practice' referred to in the title of the reference article by Coenen and Moodysson (2009) is a strategic vision developed by the Skane Food Innovation Network. This group was looking to increase the value-add in their region by targeting innovations that drew on existing competencies and knowledge within the region and combined them in specific ways enabling them to respond to new growth areas.

One example of collaboration in Skane is *Proviva*, a product line that consists mainly of fruit and dairy drinks to which a bacterial strain has been added to improve the level of bacterial flora in human bowel systems (such a product is referred to by the authors as a 'functional food'). Although owned by a large Swedish dairy company, it was developed by researchers at Lund University and biotechnology firm Probi AB. According to Coenen and Moodysson (2009), *Proviva* was not a one-off, and there remains in Skane a sustained cooperative effort in and around the functional food domain. While Coenen and Moodysson (2009) did not apply the RDPM to this example, their descriptions of the process reveal gaps where a preliminary scoping of the idea may have been a good idea. Phases three, four and five of the RDPM may have helped to better target support in the following example:

> functional food is still an emergent technology that has not yet proven its value in consumer markets. The two leading innovative companies...that seek to exploit functional foods on a commercial basis are still facing difficulties to become profitable. (Coenen and Moodysson, 2009, p. 601)

Additionally, phases seven and eight of the RDPM would have introduced shared norms, values and direction earlier, or as Mc Call (2010) suggests, created a 'knowledge vision, to answer the following:

> The challenge...is to induce a behavioural change among the food firms to internalize the need for constant innovation to remain competitive as a traditional industry in a globalizing knowledge economy. (Coenen and Moodysson, 2009, p. 602)

For McCall (2010, p. 24), in his analysis of the Tasmanian Innovation Strategy,

> RDPM approaches, having identified the RIS potential of agri-food, will in turn play a critical role in the implementation of such an ambitious strategy. RDPM will provide a platform methodology to harness and manage the social capital component of innovation and the inherent tensions present in diffusing knowledge within a commercial value-chain as tacit knowledge is codified for the benefit of the agri-food sector and Tasmania's 21st century 'hydro-industrialisation' approach to sustainable development.

THE CASE STUDY: KING ISLAND IN CONTEXT

The Place

King Island measures approximately 1,100 square kilometres. It lies in the western edge of Bass Strait, halfway between mainland Australia and Tasmania, on the forty degree parallel. It is often subject to the 'roaring forties', strong winds that have not seen land since South America (Khamis, 2007).

King Island is chosen as the case study for this research for four main reasons:

- It is geographically bound with clearly defined 'borders' allowing efficient identification of the community of interest and optimum sample;
- It has a relatively long agri-food history;
- King Island enterprises trade regionally, nationally and globally allowing for subsequent comparisons with other regions;
- It is a remote island geographically with a low population affecting it with particular constraints and opportunities for regional development.

Historically Speaking

King Island has close to 200 years of farming history. Early farm settlement on King Island was not overtly successful. Coastal areas became the graveyard for much of the imported stock, due to poisonous plants and 'coastiness' later found to be a copper deficiency (Edgecombe, 1993). According to Edgecombe (1993, p. 98) most of the soldier settlement blocks were too small to be viable, many of the settlers were inexperienced and under-capitalised, and some forced to abandon their land. Addison (1995) has recorded many 'old timers' who reminisced over their hard times, during and between both world wars;

> There was no work about. Dad used to do a bit of snaring, he'd get a bit of road work now and then. Most of the time there was no work; he never had any money.....Snow, Johno and Jim was out somewhere working, milking cows or whatever they could get. It was in depression time. I've never seen a depression since then. (Williams cited in Addison, 1995, p. 102)

The following abbreviated time line was taken from the King Island Council's website at www.kingisland.org.au/Default.asp?ID=2:

- Farming is first recognised on King Island in 1836, when a Captain Malcolm Laing Smith leased the island and established a home and farm in an area known as Yellow Rock
- Grazing leases were issued in 1855
- In 1862 the McLaine brothers were cutting and exporting timber
- 1878 is the first recording of attempts at commercial agriculture
- In 1888 the island was opened up for settlement and land selection and in 1889, a member of the Bowling family took up selections at Surprise Bay, Mantrap and Yellow Rock
- 1897 sees the first recorded use of fertilizer and trace elements
- 1902 Mrs Mary Bowling turned the first sod for the King Island dairy
- 1920 fifty new soldier settlement farms were created

- 1946 the land Division of the Agricultural bank of Tasmania bought a total of 20,000 hectares of land to provide 200 farms
- 1955 there were 10,000 dairy cattle, 8,000 beef cattle and 1,500 pigs

Dairying has been a mainstay. Cheese was being exported to Melbourne as early as 1914, and was prize winning even then (Edgecombe, 1993). The Abattoirs was not built until 1955, and once supported the biggest 'airlift' of meat in Australia (Edgecombe, 1993), although in recent history most beef has been exported by sea in refrigerated containers.

STATISTICALLY SPEAKING

According to the Australian Bureau of Statistics (ABS, 2011) in 2009, the population on King Island was 1700, made up of 932 males and 768 females, living in approximately 650 households. Only 22 persons were recorded as being unemployed. One third of the employed population described themselves as being labourers or related workers, and a quarter 'managers'. In 2006 there were 393 registered businesses, 270 of which were non-employing, and the assumption here is owner/operator, 87 employed between one and four people leaving 36, or less than 10%, employing five or more people.

In 2006 almost 69,000 hectares (more than half the island's land mass) was under agricultural production, only three hectares were recorded as being used for vegetables for human consumption. 46 hectares were used for non-cereal broad acre crops, for example tree plantations, and none was set aside for cereals/grain, orchards or fruit production. There were 20,000 lambs/sheep, 13,000 milk cattle, 79,000 meat cattle and 100 pigs. The estimated gross value of agricultural production was recorded as $30.7million, with half due to 'slaughterings' which is assumed to mean meat production, and 40% due to 'livestock products' the majority of which is assumed to be dairy. The ABS has not yet released agricultural figures for 2009.

Statistics can be presented in a number of ways, and can tell a number of stories. Being statistically insignificant from a national perspective, the ABS has not yet been able to present a large number of different statistical measures from King Island for analysis. However, relevant to this research the statistics of note were:

- 650 households and 357 small businesses suggest that more than half the households on King Island rely on income from self-employment.
- Estimated personal income in 2006 was $40.2m, estimated value of agricultural production $30.7m. It can be argued from these figures that most of the self-employed are involved in some sort of agricultural production.
- Estimated personal income has shown a decline, from $41.2m in 2007, to $38.2m in 2008. Most notably in that time income from own unincorporated businesses dropped from an average $17,244 in 2007 to on $7,883 in 2008 accounting for approximately $2.5m of the $3m lost, based on 270 non-employing businesses losing more than $9,300 each.

An outside perspective could make the broad assumption that the viability of small agricultural producers on King Island is waning, and perhaps unsustainable given these figures. The case for structured support is well argued. What might it look like based on Cooke's (2007) platforms for RIS and the RDPM as outline by Harmaakorpi and Pekkarinen (2003)?

VOILA! A RIS IS BORN?

Although still early in the analysis of data collected on King Island in July 2011, it is possible to imagine a King Island specific RIS based on the research so far, benchmarked against the phases outlined in the RDPM.

Phase one: benchmarking through the assessment of RIS theories; Constructed regional advantage, as outlined by Cooke (2007) and supported by Harmaakorpi and Pekkarinen (2003), McCall (2010) and Coenen and Moodysson (2009) is a well documented approach, with demonstrable outcomes, that will underpin an agri-food RIS on King Island.

Phase two: background study of the industries and areas of expertise in the region; This is a work in progress. Some research has been conducted as part of a PhD thesis on a sustainable agri-food future for King Island and is mentioned above. Most of the expertise required is in place on the island; however more is required, particularly in innovative technologies.

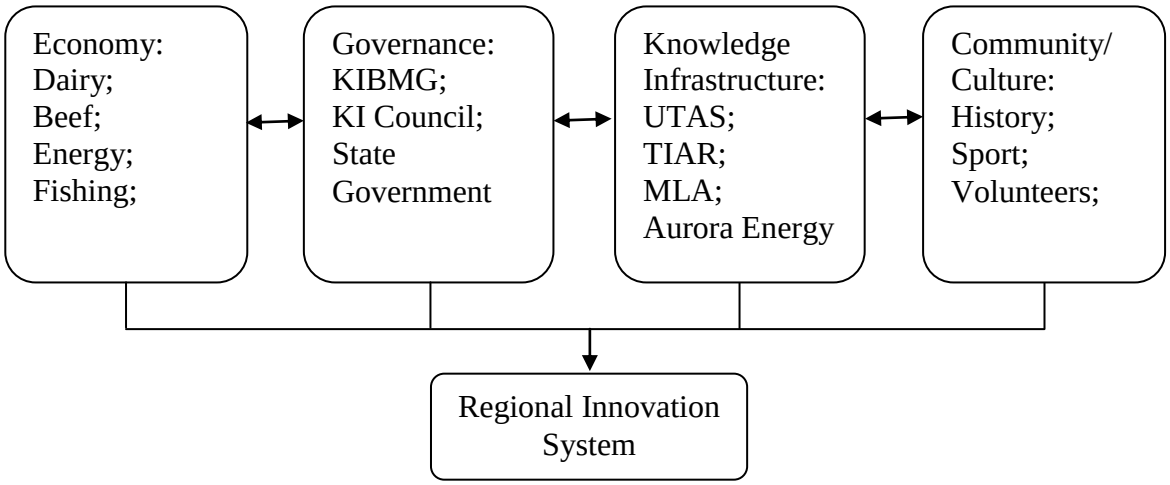
Phase three: expert panel; King Islanders can and will form part of the expert panel, many of whom interviewed in July come to mind, however to protect their privacy cannot be named at this time. Jonathon West from the Australian Innovation Research Centre (AIRC), Social Inclusion Commissioner for Tasmania David Adams, Innovation lecturer with the University of Tasmania, Colin Jones and economist Saul Eslake would also be invited to participate.

Phase four: assessment of future scenarios; the increasing wealth of Asian countries, particularly China, has seen an increased demand for protein, which bodes well for the beef industry on King Island. Media reports also suggest that some Japanese consumers, distrustful of government advice around radiation contamination, are also seeking Australian produce more and more. Environmental protection concerns are also able to be addressed on King Island, with most farmers interviewed in July this year believing environmental management is just part of doing business. The utilisation of game species, such as wallabies and possums, is also an option, for the short term at least, until the populations of such species become manageable. Alternative energy has a marked presence on King Island, so an expansion in regards to solar, wind and wave energy can also be considered. With reference to debate around 'peak oil', King Island may also have a place to contribute, given its isolation and subsequent exposure to the effects of rising fuel prices.

Phase five: analysis of statistical and empirical information; Given what is known using both codified and tacit knowledge, what is in place on the island in regards to infrastructure and economic drivers, and who is potentially involved in the process, stakeholders at this stage can analyse their options. It is at this point that the King Island community and others involved in the process need to identify what is missing from Cooke's (2007) platforms for constructed regional advantage, and how the gaps can be addressed.

Phase six: conceptualisation of the RIS; using Cooke's (2007) platforms, stakeholders are then able to visualise, perhaps even draw or diagram, what their RIS may look like (see Figure 2, for example). A RIS is first and foremost a social system. It is made up of people, and the skills, knowledge and context they bring. What they construct is necessarily inimitable because of the relationships embedded in the RIS, not the product(s) they sell. Leveraging the value created by improving and supporting regional relationships is key to successful RIS, because the value-add revealed in this circumstance is not transferable to other regions attempting similar moves. The milieu of infrastructural assets, with social capital and the bio-physical resource endowments present in a region are unique to that region, thus, the value leveraged from the milieu stays in the region.

Figure 2 Possible Regional Innovation System for King Island



Phase seven: search of core processes of the RIS; the goal of this RIS must be constructed regional advantage, not for the short term, but with an expectation of sustainability. Ensuring that the RIS is flexible and adaptable, and keeping in mind what was learnt from phase four, this phase measures the deliverables. Most RIS success (or failures) would be measured in terms of dollars and cents returned to the region, however given the extended role community is asked to play in region building, social enterprises that deliver greater social capital and improved skills in disadvantaged populations cannot be ignored.

Phase eight: definition of knowledge creation and management system; this may be the King Island 'brand', perhaps a new co-operative, or an innovative form of social enterprise to name but three of the possibilities. The design of management is to support and facilitate the relationships, ensure effective communications to expedite knowledge flows and capital transfers where necessary and, if applicable, own the intellectual property that results from the new relationships.

King Island is a unique place. It stands to reason that any development proposals should use that, along with the embedded cultural milieu, the tacit and codified knowledge of the people, and the environmental and physical infrastructural assets of the place upon which to construct regional advantage. The RDPM stands out as the tool most likely to ensure any development proposal is appropriate and effective because they are benchmarked first, before scarce investment dollars are lost on less robust projects.

CONCLUSION

Using Cooke's (2007) Regional Development Platforms, and similar literature on RIS and RDPM, it is possible to imagine an adaptable King Island. It is already resilient, and there is no doubt it always will be, however it is feasible to expect more than just survival for King Island. Applied, constructed regional advantage is a methodological, systematic and credible alternative to ad hoc opportunism that follows fads or rides commodity roller coasters. The cautionary tale told by Baldacchino (2008) is a reminder to policy makers that islands are different. For islands such as King Island to turn the constraints of distance, isolation etc into opportunities, local ownership of economic assets is very important. The risk King Island has with much of its economy tied to a global market place needs to be hedged with strong

alternatives. This does not need to be divine intervention, RIS can deliver this, because it is locally designed, owned and operated, particularly when developed using the RDPM. The next question is which opportunity should be tackled first?

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Evaluate or Bear the Burden: Regional Economic Development and the Roles of Infrastructure Investment Evaluation

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ABSTRACT

Empirical studies and economic growth theories identify public infrastructure as a key element in minimizing regional disparities and in achieving Local Economic Development (LED). However, it is questionable whether every infrastructure project assists LED. Following Kessides, economic benefits result from investments in infrastructure only to the extent that they generate a sustainable flow of services valued by users. Adequate ex-ante and ex-post evaluations of the economic impacts of infrastructure projects can highlight both potential benefits and failures in critical stages of the project and development life cycles. A review of the scope of formal evaluations of the impacts of fifty infrastructure projects reveals major limitations. Few studies consider costs, benefits, return, financial environment and linkages adequately. The level of evaluation differs by region, subject country's level of development and sector. While the current level of evaluation may be enough to demonstrate potential benefits to investors and contractors, the impacts on the local and national economy remain under-assessed. Specifically, debt obligations associated with infrastructure investments are little addressed along with potential burdens on the local, provincial and national economies.

1. INTRODUCTION

> Whether it is a problem of insufficient capability within the superannuation funds themselves or whether it's because there's something peculiar in the design of the infrastructure project that simply has the wrong risk characteristics, I'm not sure … we need to be asking that question with respect to a lot more infrastructure projects. (Wiggins, 2011, citing Henry)

While the Prime Minister's adviser ponders why superannuation funds find infrastructure investment unattractive, others essentially ignore a long list of failed infrastructure investments and prefer to simply ask why there is not more money: "The Canadians have funds of $100 billion. Why can't Australia?" (Wiggins, 2011, citing Shepherd). Each highlights the immaturity of infrastructure investment dialogues, including evaluations.

The position developed in this paper is that infrastructure investments need much more adequate evaluations, not just in terms of project specifics but also in terms of how contributions from infrastructure might be garnered in regional developments that amply repay the investments made by the disparate interests involved.

The development is presented in six parts:

1. **Introduction**. The supposed roles and characteristics of infrastructure are outlined.

2. **Characteristics of infrastructure investment**. Any investment needs to earn returns deemed adequate by the various involved interests. What makes infrastructure any different? An analytic framework is outlined.
3. **States of play: Ex ante evaluations of infrastructure investment**. Characteristics of, and some significant limitations in, fifty infrastructure evaluations from developing nations around the world are analysed
4. **The nature of the infrastructure evaluation challenge**. Balancing various interests adequately is a particularly difficult challenge with infrastructure investments for reasons that are discussed.
5. **Scoping infrastructure investment**. Locational, temporal and representational considerations that are particularly relevant to infrastructure are routinely omitted from analysis. It seems more sensible to build out analysis rather than to continue the current practice of simplifying or omitting realities.
6. **Conclusion**. Better evaluations can be built on several fronts to discern if investment returns appear to be adequate.

Investing in infrastructure is routinely supposed to assist economic development around the world and addressing but adequate explanations are surprisingly scarce. Much infrastructure investment receives only limited evaluation and unrealised expectation are all too common. It is not just local economic development that falters in such circumstances.

The Roles of Infrastructure in a Region's Economy

Infrastructure provides key parts of the physical basis for the life of a society and the maintenance of efficient functioning organizations that provide essential structures and associated goods and services in an economy (Gramlich, 1994). Many governments have placed emphasis on public infrastructure as a determinant of regional disparities and as a key element in achieving Local Economic Development (Pike, Rodriguez-Pose and Tomaney, 2010).

Conventionally, infrastructure investment supports development in the local economy and beyond by improving the efficiency of input-output flows of firms and goods and services flows of households (Underhill, 2010). For Porter, strategic regional infrastructure investments encourage innovation, improve competitiveness, minimize transaction costs and provide the basis for a high standard of living.

> The federal government has also failed to recognize and support the decentralization and regional specialization that drive our economy. Washington still acts as if the federal level is where the action is. Beltway bureaucrats spend many billions of dollars on top-down, highly fragmented federal economic development programs. Yet these programs are not designed to support regional clusters, nor do they send money where it will have the greatest impact in each region. For example, distressed urban communities, where poverty in America is concentrated, are starved of the infrastructure spending needed for job development. Again, no strategic thinking. (Porter, 2008)

The main line of analysis has been in terms of productivity gains. Aschauer (1989a, 1989b) considered the relationship between aggregate productivity and stock and flow of public capital. The importance of the public capital stock in supporting productivity is the key link. Increases in the public capital stock raise the return to private capital and encourage crowding in of further private capital.

Kessides (1993) studied the linkages between infrastructure and economic development and found its importance in industrial productivity enhancement and public welfare improvement. Accordingly infrastructure supports economic development by increasing productivity of firms and by providing services that enhance the quality of life of the public. Infrastructure contributes to firm productivity by facilitating the availability of intermediate inputs, reducing costs of production and distribution, and raising the productivity of other factors of production. Importantly, he noted four necessary conditions for the realization of expected impacts of infrastructure on economic development;

i. The basic macroeconomic climate should be conducive to an efficient allocation of resources

ii. An infrastructure project can only raise the returns to other resources when there is a sufficient complement (and productive capacity) of other resources. Infrastructure investments cannot create economic potential, only develop it.

iii. Infrastructure activities that have the most significant and durable benefits in terms of both production and consumption are those providing the degree of reliability and quality of services desired by users.

iv. Infrastructure is more likely to be economically efficient, and to have favorable impacts on the environment, when it is subject to user charges.

Following Aschauer's studies, Andrews and Swanson (1995) studied the impacts of public infrastructure on Regional (State) output. Their findings indicate that while investment in public capital may have a positive impact on the private sector, this impact will be much smaller than predicted by previous studies.

Fernald (1999) identified a positive correlation between road infrastructure and vehicle-intensive industrial development in the U.S.A. Productivity slowdowns and boosts in the 1950's and 1960's were explained using road infrastructure investments variations.

Historically, peaks of infrastructure development have coincided with the different waves of development, such as the post 1930s era of "Science and Technology" and the more recent "age of information and communication technology" (Grigg, 2010).

> The notion that economic growth occurs in a series of cycles or 'waves' goes back almost 100 years. One particular type of wave – usually know as a Kondratiev wave (K-wave) – is a long wave of more or less 50 years' duration. Four complete K-waves are identified; we are now in the early stages of a fifth. (Dicken, 2010)

Potentially this would be the wave of "Artificial intelligence and bio engineering". It would involve investments that help rebuild and reinvent infrastructure as more suitable for "a new era". Interestingly, however, much of the infrastructure investment analyzed is concerned with much more basic investments to provide more adequate transport, health and education infrastructure. Talk of "having to invest" in new infrastructure to prepare for "a new era" warrants critical scrutiny, whatever the envisaged era.

Evident in all studies is the position that private supply capability enhancement arises from public infrastructure investments. Evident in none is any attempt to gauge investment affordability. The link between investment and enhanced private productivity or capacity *is assumed to lead to* sufficient returns to the public sector to recoup investment costs. Failure to examine this assumption has seen many investors bearing unanticipated burdens.

2. CHARACTERISTICS OF INFRASTRUCTURE

Infrastructure can be considered as a public good with characteristics that include: high capital intensity; long gestation and operational periods; ill liquidity; monopolistic character; long asset life; uncertain operating margins; and high risks (Gramlich, 1994). Such characteristics are the antithesis of those assumed in market models, yet market approaches are frequently advanced as a basis of analysis of infrastructure investments and impacts. Use of a standard easily-tradeable product in a time and impact free setting as a proxy for specific, embedded investments with long lives and impacts presents all manner of problems. "Infrastructure services" models also face considerable problems of misspecification if mainstream market models are uncritically applied.

Infrastructure investment will involve different engagement of different partners with different interests over the investment lifecycle (Figure 1). The investors or banks would have an objective of earning profits while recouping advances and moving finance from one project to another. Return on investment depends on the repayment capacity of the local partner which is linked to cost-recovery aspects of the project. Arguably, current project evaluation processes also neglect the interests of the community despite satisfaction of community interests as being central to a successful project and to the generation of demand for project outputs. Contractors and consultants have an interest in profiting from project construction. All project partner interests are both specific and interdependent. Evaluations by each partner would ideally also recognise whether and how a proposed project can adequately advance the interests of all. Ways to promote common dialogues are needed.

Figure 1 – Focus, Interests and Evaluation Emphasis of Different Partners of an Infrastructure Project

Partner	Objective/reason for involvement	Interests	Ex-ante evaluation/focus
Private sector investors/ development banks	Profitable finance	Return on investment	Internal evaluation and borrower's evaluation
National/regional/local governments and statutory instructions	Economic development, public welfare, productive investment	Sustainable outputs Political advantages Cost recovery	Evaluation based on lender's requirements
Subject region/ community	Individual and community welfare	Jobs, increased income, increase in quality of life	Depend on other partner's evaluation
Design and building partners (contractors/ consultants)	Profitable, low-risk contracts	Profit from construction phase	Evaluations on individual profit

Note: Involvement of parties will vary over the life cycle of the investment as does the nature and distribution of impacts.

On the Need for Improved Evaluation

An **adequate** ex-ante evaluation of an infrastructure project would seem to be important in decision making and planning for not just the efficient and sustainable delivery of services but also for ensuring adequate returns on the investments made.

Such evaluation process would facilitate the identified regional priorities through project objectives and outputs assessment and direct the projects to address those issues in an economically sound manner through cost, return and risk evaluation. On the other hand inadequate evaluation of infrastructure projects would result in: project objectives not addressing the demands of the regional economic base; project outputs not sufficiently linked with industrial and domestic service demands of the region; late completion; corruption; insufficient budget; incomplete works; inadequate outputs; unsustainable activities; inappropriate cost recovery mechanisms (via incorrect selection of the party who pays for the service, be they tax payers, service users or others); inadequate or excessive returns on investment for particular project partners; and unanticipated debt obligations for the State or national government.

Much infrastructure requires large investments and long gestation period. Infrastructure investments often involve considerable uncertainties over the investment life. Yet the most popular financing instrument is debt financing channeled through development banks or commercial banks. This mode of finance appears particularly odd when the inherent uncertainties associated with infrastructure are considered: funds are repayable in an often rigorously defined manner while returns are conjectures. This question of how well the finance arrangements suit the characteristics of the project outcomes is a central but neglected one. There is a clear need for ways to more adequately link the impacts of an investment on various interests, including those in the local economy.

Empirical studies by Young *et al*. (2007), Escobar (1995) and Nolan (2002) have noted the absence of "thick" description of project events in development documentation and the attendant difficulties for development agencies in learning from experience. Detection and incorporation of local contextual details (such as the internal and external financial environment and project to local economy links) and evaluation of risk based on previous experiences appear vital in improving the success of infrastructure investments.

This appears particularly important in current circumstances as the funding situation worsens as a consequence of the global financial crisis. World infrastructure investment volume has decreased at an annual rate of 14.5 per cent between 2007 and 2010 despite a growing demand for credit from countries around the world (Emap limited, 2010). The challenging situation faced today is evident in recent statements from development banks.

> The global financial crisis has increased the enormous challenge of bridging this access gap by weakening countries' ability to fund infrastructure development. To meet client countries' needs, the Bank significantly scaled up its support for infrastructure this fiscal year and deployed a range of instruments to provide a coordinated and targeted response. The Bank's approach to infrastructure development continues to be guided by the Sustainable Infrastructure Action Plan, which provides a roadmap to scaled up investment in modern, cost effective infrastructure services that also support environmental sustainability and social inclusion. (World Bank, 2011)
>
> The negative impact of the global economic crisis on investments in infrastructure in Africa is therefore all the more serious. There has been a withdrawal of foreign investment; moreover the constraints in liquidity and credit in the financial markets have resulted in a scarcity of available funds at reasonable cost, and in the cancelation of credit lines by some financial institutions. In order to counterbalance the effects of the credit crunch, the Bank increased its commitment of

> resources to the infrastructure sector from both the ADF and ADB windows. (African Development Bank, 2011)
>
> Because of the crisis, some clients found they had too much short-term debt in 2009 and required refinancing support from the EBRD. In addition, the sharp decline in freight volumes and retreat of the commercial banks meant that the Bank was also needed to help finance smaller investment programmes and fill funding gaps left by other financiers. (European Bank for Reconstruction and Development, 2010).

It is not just the cost of credit but also the prospects of credit tightening or rationing that deserve attention. Both new and still-obligated projects will be impacted as the Global Financial Crisis plays out.

Factors Considered in an Evaluation

Factors that could be (expected to be) considered in *ex ante* evaluations are many. In the light of the previous consideration, these factors have been chosen as a basis for an initial evaluation of infrastructure investment projects:

- aspects of the **project** itself
    - **Costs.** In project documents the cost is provided for each sub component of the project as a lump sum amount. But in some cases, only the total cost is provided.
    - **Benefits.** The benefits include the social, economical, physical and environmental outcomes to the wider group of beneficiaries of the project. The level of evaluation varies based on depth of the assessment i.e. tangible, intangible, quantitative, qualitative, etc.
    - **Returns.** The return includes financial gain or cost saving due to the outcomes of the project to the investors.
    - **Risks.** The effects of uncertainties on objectives were generally provided descriptively in the project documents.
- **circumstances**
    - **Internal financial environment**

      The level of assessment in project documents on the local economic circumstances which could affect the project outcomes
    - **External financial environment**

      The level of assessment in project documents on the global economic circumstances which could affect the project outcomes
- envisaged **impacts** on the
    - **Local economy**

      The level of assessment in the project documents on impacts of project outcomes on the local economy and how those outcomes were linked to the local economy and its development

Clearly there are many more potential factors but these factors are seen as particularly relevant to this research. They are now used to profile a selection of fifty infrastructure project evaluations.

3. STATES OF PLAY

Ex Ante Evaluations of Infrastructure Investments

The fifty project cases of this study were selected from projects implemented and completed by the Asian Development Bank (15), World Bank (33), and African Development Bank (2) within the last decade across Asia, Oceania, Africa, America (South) and Europe (East). Project data bases were sorted by region and project numbers with sample cases then selected using a stratified random sampling method. To represent each of seven sectors in each of five regions, 35 completed project cases were selected. Fifteen cancelled projects were added to the sample by considering the percentage of cancelled projects in bank databases and following the same sampling method. An appendix showing a distribution map of the sampled projects and other details of the scoring system below is available from the authors. The sample contains only cases from developing nations as these are the focus of development bank activities.

Cases were reviewed using the seven attributes of: project costs, benefits, returns and risks, internal and external financial environments, and local economic impacts. The level of consideration of each attribute in the initial evaluation phase was ascertained. The current status of each project was also ascertained using later reports or database entries. As the review is meant to be broad, there are some projects included that were not implemented. Also while projects vary in size, just over half are for investments of under 50 million USD.

The measures used in classification are defined in Tables 1 and 2. Project cases were also grouped and analysed in terms of geographical region, incident sector of the project and project scale, as is next discussed.

Table 1 - Scalar Used to Measure the Level of Project Evaluation

0	No consideration
1	Mentioned but no evaluation
2	Qualitative consideration but did not lead to decisions
3	Quantitative consideration but did not lead to decisions
4	Qualitative consideration lead to decisions
5	Quantitative consideration which lead to decisions

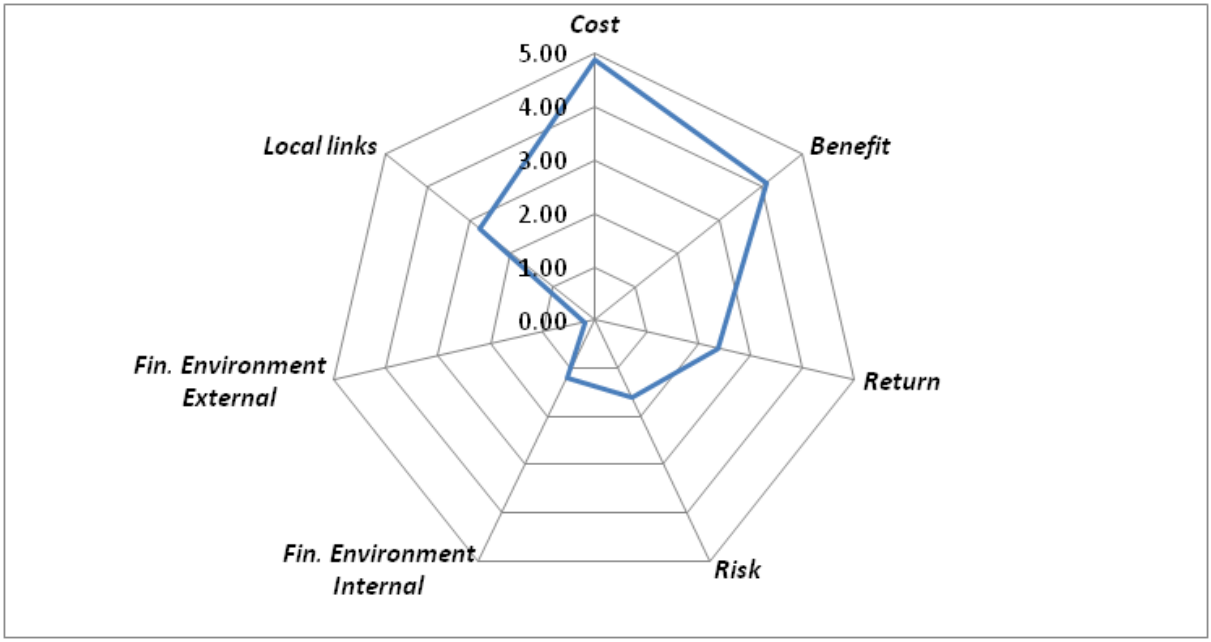
Table 2 - Scalar Used to Measure the Current Status of Projects

0	Not implemented
1	Implemented but not completed
2	Completed but failed
3	Partially success
4	Completed with minor issues
5	Successfully completed and apparent operational success

Results and Discussion

Different partners involved in an infrastructure project focus on evaluation factors differently. The public sector institution who implements the project ideally has concerns with cost, benefit, risk, internal and external financial environment and linking project to the local economy while an investor is more focussed on cost, return, risk, and financial environment. In the reports studied, there is very limited or no consideration of the external financial environment and minimal considerations of internal financial environment (Figure 2). Discussions are here in terms of descriptive statistics using averages. Details of the fifty cases are provided at the end of the paper.

Figure 2 - Level of Project Evaluation by Component of the Project



As can be seen in Figure 3, cost is nearly always quantified and explicitly considered in all regions. Typically, benefits are at least qualitatively considered. Both sets of considerations appear to influence decision making, but the five other factors appear markedly less influential. Projects in America and Europe show higher levels of return and risk evaluations than those in Oceania and Africa. There was a focus on return in Asian projects but low evaluation of risk. Interestingly local links were more often or more fully considered in Asian and Oceania. Recall that scores of "1" indicate "mention but no evaluation". Why such patterns should be evident deserves further research and explanation, as does the broader distribution of individual scores.

An interesting pattern is of higher levels of ex-ante evaluation in projects with "hard outputs" compared to "soft outputs". Evaluations in the Railway, Port and Power sectors are generally higher scored than those in Education, Water and Health (Figure 4). These patterns need further consideration, especially given the differing sizes of projects (Figure 5).

Modern Portfolio Theory (MPT) implies the expected return has a direct relationship with portfolio risk (Elton and Gruber, 1995). Accordingly one can argue that the investments with lower returns have low risk so that those projects could rely on traditional cost and benefits evaluations. But this study's findings show that 64% of the failed projects are less than 100 million USD investments. The level of evaluation appears to show a higher level of

evaluation of return, risk, internal financial environment and local links in medium scale (400-500 million USD) investments when compared to others (Figure 5). However, there is only one (well-evaluated) project in this size range.

Figure 3 - Level of Project Evaluation by Project Location

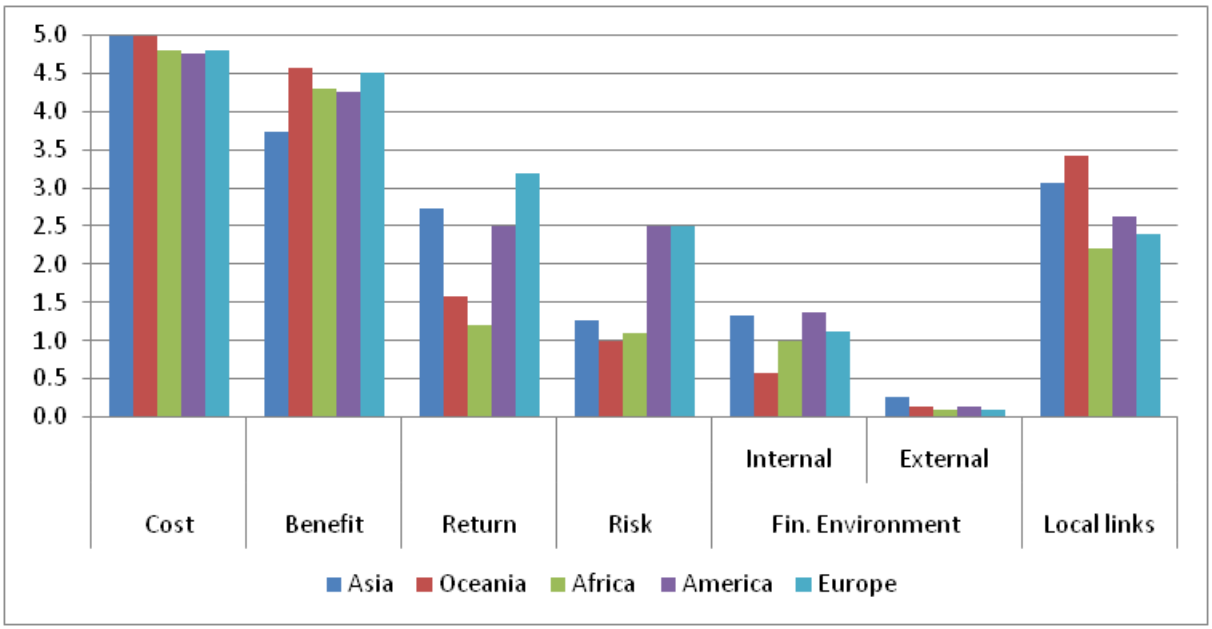
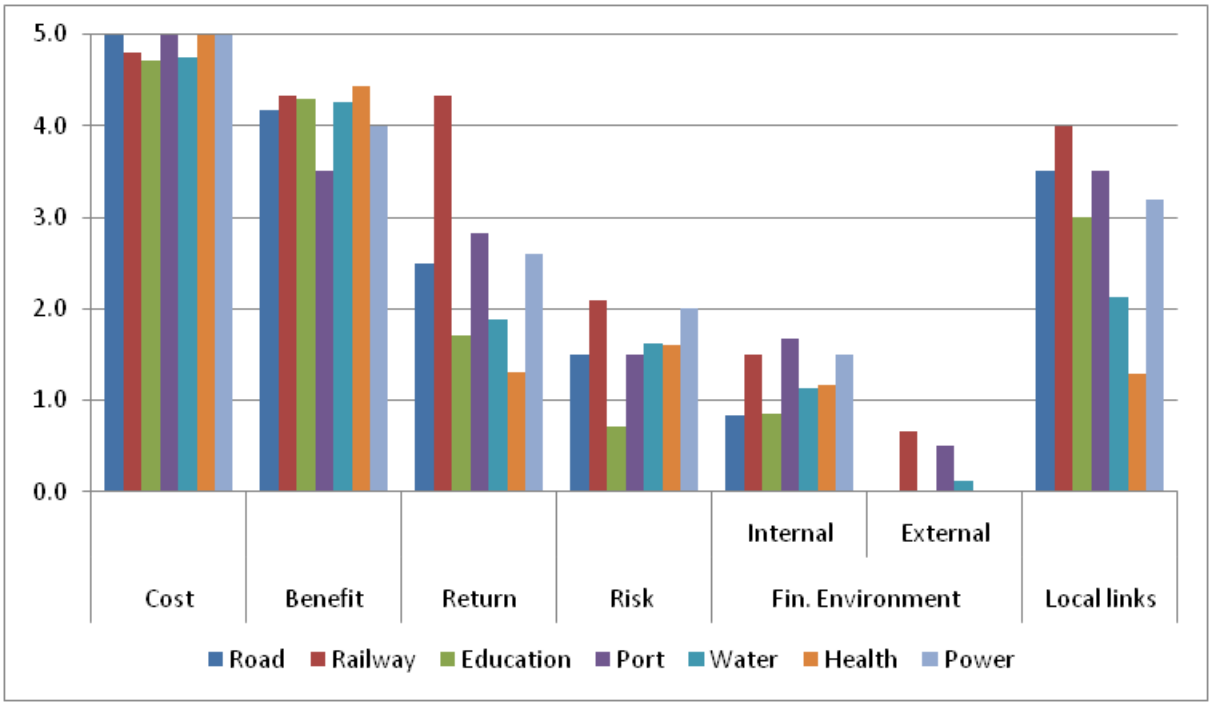


Figure 4 - Level of Project Evaluation by Sector



Although regional and national governments generally believe that infrastructure investments give a reasonable return on investment, the return is not assured. There is much that can happen between initiation and operation, and an "eventual result" may take years to

eventuate. Still, ex ante evaluations appear to play an important role. All successful project cases have higher scores in the ex-ante evaluation process than those that failed, as shown in Figure 6. The largest difference is for the return factor.

Figure 5 - Level of Project Evaluation by Scale of the Project

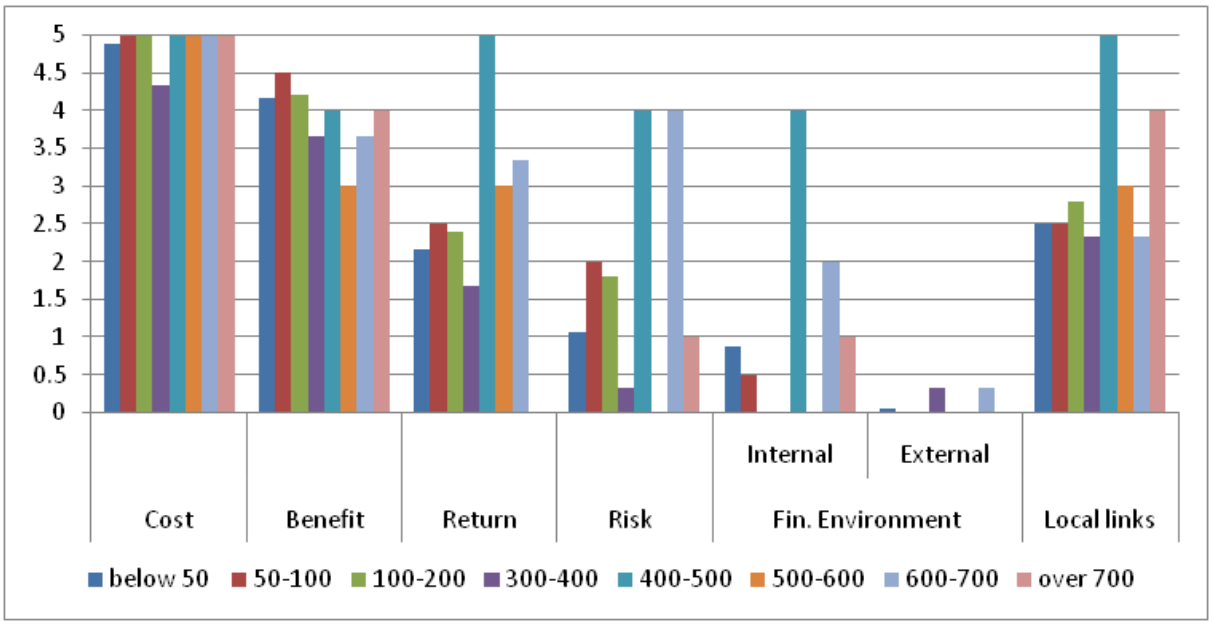
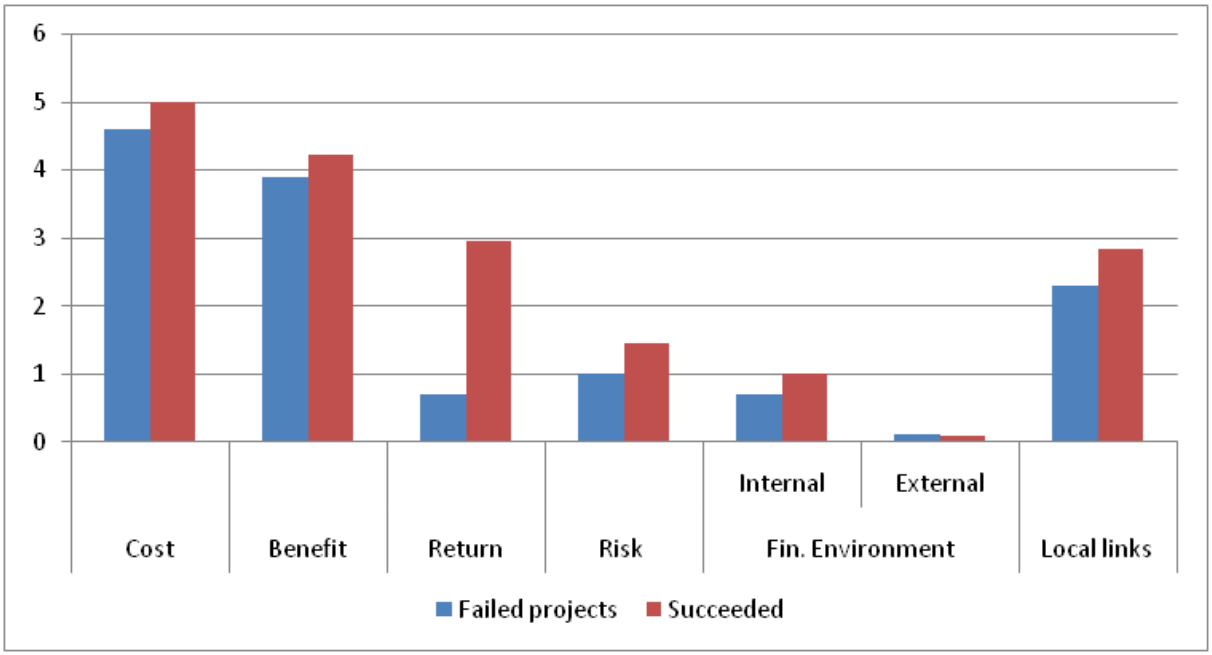


Figure 6 - Level of Project Evaluation by Current Status of the Project



Correlation Analysis

Size of the project was added to the list of seven factors with correlation analysis then undertaken. As detailed in Table 3, preliminary analysis shows thirteen significant correlations of the 36 possible with eight at the 0.01 level. It can be seen that:

1. The current status of the projects has a link with the level of evaluation of four factors: benefits, return, external financial environment and local links.
2. The level of evaluation of return factor is linked to the evaluation of four factors: risk, internal and external financial environment and local links.
3. The level of evaluation of risk factor links to internal and external financial environment factor evaluations.
4. The level of evaluation of internal financial environment is linked with external financial environment and local links evaluations.
5. The external financial environment has a link with local links evaluations.
6. The evaluation of return factor has the highest number of links with other evaluation factors and the current status of the projects, so it can be considered as the most influential factor in the ex-ante evaluation process, followed by risk evaluation factor.
7. Size and Cost evaluation factors appear unlinked to any other factors.

Table 3: Estimated Pearson Correlation Coefficients

Attribute	Size	Cost	Benefit	Return	Risk	In_FinEn	Ex_FinEn	Local_Lin	Current_Status
Size	1	.021	-.175	.102	.206	.116	.158	.105	.030
Cost		1	.056	.070	.186	-.035	-.119	.201	.207
Benefit			1	.227	.083	-.120	.146	.198	.372**
Return				1	.359*	.307*	.499**	.499**	.625**
Risk					1	.604**	.299*	.194	.264
In_FinEn						1	.393**	.337*	.153
Ex_FinEn							1	.435**	.336*
Local_Lin								1	.377**
Current_Status									1

Notes: ** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

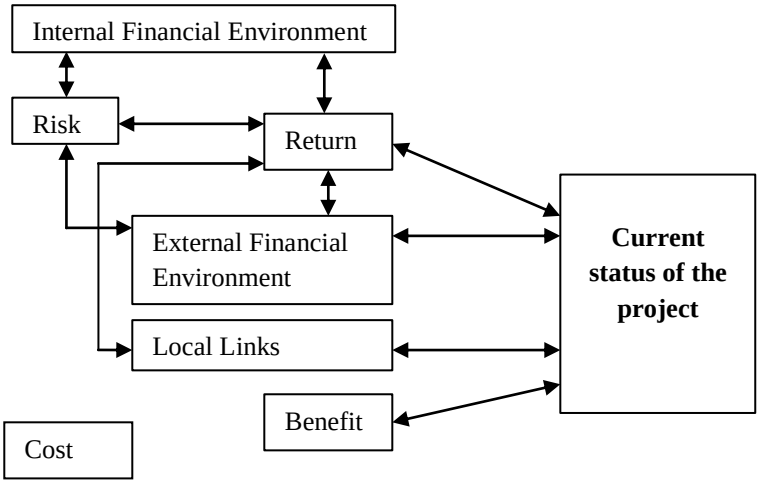
The links between the evaluation factors and the current status of the project are illustrated in Figure 7. Except for the cost factor, all other factors are directly or indirectly linked with the current status of the project. The return factor directly links to the risk, external and internal financial environment and local links factors while it and the risk factor show the highest number of links with other evaluation factors. The non-linkage of cost warrants further investigation: it may reflect actuality, the consistently high consideration of costs, sample issues or some other influence.

To recap, the central position in this paper is that due recognition of important but under-appreciated limitations in current infrastructure evaluations is a key first step towards greater project and program successes

- The identified **problem** is that many infrastructure projects fail to advance the interests of (at least some of) those involved in ways that were expected.

- Investigations have **revealed** considerable variations in considerations of factors in ex ante evaluations, and that successful projects have higher scores across all seven factors than unsuccessful ones.
- The posited **response** is that there is a general need for more adequate evaluation.

Figure 7 – Links between Evaluation of Factors and Current Status of the Projects



One way to improve evaluation would be a greater focus on quantifying returns. Extension of coverage to include all factors also appears worthwhile. Gains realisable from adopting either or both responses will depend on project specifics, and on the quality of analysis and analysts.

There is however a more general issue of the nature of the challenge faced in making infrastructure evaluations that necessarily involve multiple interests interacting over time in situations of often considerable uncertainty or information asymmetry.

The line of thought developed in the remainder of this paper is that:

- There needs to be **greater appreciation** of social decision making and dynamics when there are multiple distinct interests.
- There appears to be a **specific need** for greater understanding and balancing of interests associated with infrastructure developments.
- The key evaluative **question** scoped here is how different parties may be variously advantaged, or not, in such situations.
- A more direct **question** involves perceptual and analytical bias, specifically of how evaluations may be inclusive of particular considerations, or not, through the positions and framing adopted. The ways an evaluation is scoped can be highly significant.

Such considerations provide a wider perspective on infrastructure investments.

4. THE NATURE OF THE INFRASTRUCTURE EVALUATION CHALLENGE

A core planning challenge is to recognise adequately the *aspirations* present, interpretations of *development*, modulations of *success* and inherent *uncertainties*. A line of development to better acknowledge and link such realities is now presented with applications made in the following section.

Articulating Community and Societal Aspirations

Discerning, accommodating and delivering on a balancing of interests is a key challenge in any social situation. "Social" is used in the original Latin sense of "association" or "associating". Use of the noun places emphasis on the group ("the association") while the participle ("those associating") emphasises actions by interacting persons.

These distinctive positions are captured in considerations of "a community" and "a society". Each is comprised of multiple organisms with a range of life situations and *implicitly human* aspirations.

- In the community the nature of interactions and niches are typically known and appreciated in some ways.
- A society is one step more abstracted and alternately founded. Typically it deals with persons abstracted as parties in a larger, more generally described setting.

The emphasis in each is distinct: the community is "a group as engaged" while the society is "the group as attributed", typically against some chosen measures.

Groupings emerge from the engagements in a community:

- "The group" is the starting point for a society, and this formal objectification persists across the studies or field.
- Alternately, it is the particular organisms (people) and/or their niches (places) that persist in community studies.

Abstractly, in community analysis "this group" or "that" becomes evident in an a posteriori fashion as discussions and descriptors move from the specific to the more general. In society the move is *a priori*, from a posited generalisation to more specific "elements" of that whole with imputation of societal traits to those things actually observed.

"Development"

In development, each is "going somewhere" or "aspiring to something" somehow better but the ways such movements are perceived, communicated and facilitated will be imperfect and varied. Language, conventions, cultural and other models, individual traits and the like all play a part in the moulding of any message or planning.

While a common planning goal would be along the lines of *advancing human aspirations in communities and their society*, its realisation is complex. Successful resolutions are hybrid in the sense that they are "derived from heterogeneous sources and composed of elements of different or incongruous kind" (Delbridge, 1990). Such is the approach adopted in this research. There are many influences that need to be successfully appreciated and reconciled if the hybrid is to have vigour, or if the infrastructure investment is to succeed.

Studies are structured by choices of foundation and emphasis, including planning studies. Every study proceeds from a preferred analytical position with its associated perceptual and methodological biases. The analysis now offered explores this question of how associations may develop and how "associates associating" *might* contribute and be advantaged or rewarded. While this discussion is set in an association between multiple stakeholders and an infrastructure project, the approach is more generally specifiable and applicable.

A preference for the former is foundational to much of the "formal" social research in regional "science" while a preference for the latter underlies regional "practice" with its emphasis on case studies, action research and practitioner involvement. Ideally, planning

would accommodate both while also reflecting the desire to improve the lot of persons variously affected.

Designing for Infrastructure Investment Successes

Any infrastructure project links the distinct interests of various persons or parties in a group situation. These may be variously regarded: as active organisms in a community; as societal stakeholders; as representatives of separable interests; as particular personalities; and so on.

The essential policy questions facing any social planners can be cast as *"Can the lives of sufficient people be made better by this proposal, and how?"* As welfare economics has long acknowledged, some overall gain needs to be identified along with how it occurs and is distributed. Alternate formulations exist, including expressions in terms of:

A. *community advantage, CA*. Given their contributions, those in this community will be advantaged in these ways;

B. *societal progress, SP*. Society will be advanced if these elements are altered in these ways;

C. *beneficial project, BP*. This project is expected to involve these costs and benefits, with an overall positive outcome signalled; and

D. *impact scenario, IS*. In this situation, these parties bear these impacts.

E. *reconciliations of investments. RI*. Returns to various investments can be acceptably accommodated in these ways.

The focus and scope of analysis varies markedly as will the appropriate analytical techniques. Affinities also vary with community spokespersons, progressive advocates, cost-benefit authors and impact analysts respectively finding particularly favourable niches in each one.

Such issues while routinely acknowledged are typically of little concern in practice. After preliminary consultations, one formulation will be preferred with much then set. While such practice is understandable it can also be markedly deficient, especially where such thoroughgoing changes and ongoing interdependencies as accompany major infrastructure investments occur.

"Success" is modulated. Any message about outcomes is adapted, altered or regulated by the speaker for the listener with further modifications by any intermediaries. Outputs of a project or process are selectively portrayed as outcomes for persons. The "same event" can be portrayed as a success, failure and everything in between.

Dealing with Uncertainties

The modern preference is to assume certainty wherever and whenever possible so as to be able to come up with "an answer", or better still "the answer!" Our instruments of thought and analysis have been predicated upon the adequacy of such an approach. Aspects of an alternative approach are now briefly outlined in terms of uncertainties associated with *aligning interests and efforts of individuals interacting in groups*.

Building from the previous discussions, various social interests need to be effectively reconciled across the initiation and operational phases of any project. "Social interests" are identified and then attributed to an individual, group or society, or several. Attribution follows definition. Interests are formalised in this key first step and then become foundational to all that follows. Common, shared and idiosyncratic stereotypes play roles in initial and subsequent formalisations and in dialogues that build upon such practices and positions.

Just as those in global markets were blind sighted to developing financial crises by their formalisations and stereotypes, so also those associated with infrastructure investments express (often genuine?) surprise when a project falls short or an investment fails. Earlier quotes evidence both a longing to do better and sincere ignorance that is common when the divisions of labour drive a fragmentation of understanding and when (academic, professional or other) disciplines on thought limit thinking. Arguably, only modest improvements in infrastructure investment evaluations can be expected until this issue is addressed.

At this point we simply note the body of research associated with the "*Funding Transport Infrastructure in a Time of Heightened Economic and Financial Uncertainty*" project initially commissioned by the Queensland Department of Main Roads (McGovern, Kolsen, and Docwra, 2010). Subsequent applied (McGovern, 2010a, 2010b, 2011a, forthcoming-a) and conceptual works (McGovern, 2010c, 2011b, forthcoming-b) as well as policy works being finalised examine many of these issues as part of the development of more adequate evaluations of transport infrastructure investments.

5. SCOPING ROAD INFRASTRUCTURE INVESTMENT

Any project can be scoped in locational, temporal and representational terms. Each of these provides a setting while also excluding some considerations. Situations become complex when multiple parties with distinct interests variously expressed are involved. Past preferences for filtering and homogenising expressions are posited as being contributory to flawed evaluations and failed investments. For ease of exposition, a road project is considered in this section but ideas and the approach are generalizable.

Setting the Scene

Identifiable parties affected by a road development project include those ***located***:

- in the immediate *locale*, typically lands and local settlements that physically accommodate and host the road;
- in the wider *district* which is now better internally connected by the road;
- in the larger *society* (and "its economy") which is now able to take advantage of resources that were previously less-accessible in that region; and
- *beyond* this society, but somehow affected by activities associated with the development and/or operation of the road.

This locational context provides a setting for analysis of the different *types* of impacts that can arise. While some effects may attenuate with distance or loss of proximity, others need not.

There is also a **temporal** context that is peculiar, complex and important for roads and other infrastructure. Classically, in economic terms, roads *in operation* improve resource access – so allowing gains from trade, investments and specialisation "over time". Roads *under construction* increase demand for "a time" for construction services and refashion physical resources for "all time". Construction requires investment: expenditures (of monies, resources, time) are made to shape the terrain *in anticipation of* returns "in the fullness of time" from activities now enabled or facilitated.

If location is one thing, **representation** is another – including over time. Affected persons can be identified as parties with particular interests. Needs, wants and impacts need to be somehow conveyed so representation is made both personally and abstractly. The person or trait seen as representative is a message ("this particularly matters"), medium (how "it" is related) and filter (omitting some things for some reasons). Various representations will need

to be not only adequately appreciated but also reconciled if some informed agreements are to be reached.

Such comments may be seen as stating the obvious but they enable present limitations in evaluation to be more fully appreciated. Preferences may be for:

- the nature and intent of *dialogues*. "Consultation" may be applied to all manner of dialogues: information gathering; initiative development; proposal marketing;
- the preferential use of technical *analysis*, which by its nature signals some factors or issues more strongly than others while preferentially positioning those with the requisite vocabulary. Typically, "quantities of select measurables" are the focus with qualities and temporalities assumed constant or ignored;
- peer *selection* of representatives, with some of those "elected" as representatives given distinctive preferencing within any group or discussions;
- selective *focus*, whereby "the agenda" may become what can be comfortably considered rather that what might challenge or confront;
- simplistic *argument* which supports "timely" common agreement by removing complexities.

Even the best "meeting of interests" (or minds) is always limited, but significant problems may arise when limitations go unappreciated. Standard procedures and conventional practices run the risk of *in-built* locational, temporal or other insensitivities. With such things in mind, we can now develop some illustrative schema that can provide a basis for planning more adequate evaluations.

Illustrative Lines of Evaluation Development.

There are many ways to demonstrate the links between the different impacts of an infrastructure investment. Two points of contrast are considered here:

- Contrasting formulations and how these might be related *via* an interpretable "*hands*" approach.
- Accounting for elements of a project via a formal *flows* approach.

Distinctive but complementary insights can be captured in each. Either can be used to position and extend existing analyses. Each illustrates potential lines of evaluation development, and each might be part of more adequate dialogues, a more adequate analytic toolbox and more adequate evaluations. Illustrations are simple and simply discussed.

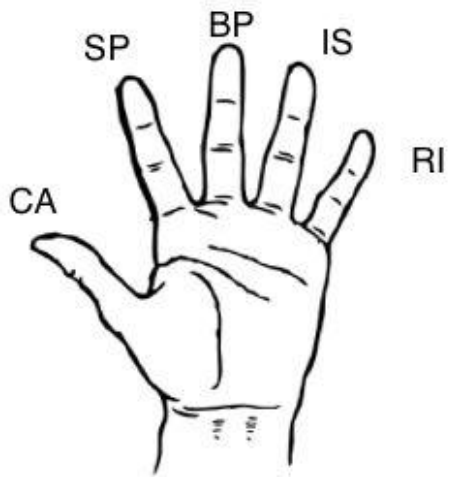
Casting and Interrelating Formulations

The representations in Figure 8 provide four perspectives on how the five distinctive formulations discussed in the previous section might be cast and inter-related.

- ***An expressive hand.*** The "hand model" shown *in part a* identifies formulations as fingers. These must be linked via the palm in an "open hand" representation. An alternate might use a "closed fist" with all formulations jumbled together with unclear demarcations and interrelations.
- ***Actors in dialogue.*** Ways formulations might be positioned and related as illustrated by the finger puppets (*part b*). Each actor will engage in dialogues, stereotypically at times and idiosyncratically at other times. This duality of characters can be involved in complex plots as various groups of actors proclaim across the stage.

- ***Bejewelled fingers.*** A star for each evaluation attribute is assigned to a relevant finger of the hand model (*part c*). Fill indicates the emphasis apparent in the fifty reviewed projects. The constellation around BP "beneficial project" highlights its centrality in evaluations, though the peculiarities of any particular interpretation go unconsidered.
- ***Cartesian tabulation.*** Finally (*in part d*) a two dimensional table shows a conventional Cartesian representation with summary numerical measures carrying the messages. The seven evaluation attributes are clustered: four under "beneficial projects", two under "reconciliations of investments" and one under 'community advantage" while the values indicate the level of consideration. The left most column N_r presents the number of significant correlations involving the attribute.

Figure 8: Building Dialogues Between Formulations



a. A template

b. A tale, configured by representatives

c. As in the 50 cases

N_r	Attribute	CA	SP	BP	IS	RI
	cost			5		
1	benefit			4		
5	return			2		
2	risk			1		
2	internal FE					1
2	external FE					0
1	local links	2				

d. As Descartes would prefer

Each representation brings selective biases and expressive capabilities. How the various formulations might be melded in dialogues and planning is alternately suggested in parts a and b but essentially omitted in c and d. The palm provides both undifferentiated common ground and a basis in part a. Each finger puppet is an identified representative in configured dialogues. Note the prominence of knight (SP), queen (BP) and wizard (IS) along with command position of the frog (SP assessor on the second hand). The subservient unicorn (CA, thumb) and a currently peripheral and docile "green dragon" (RI) complete the picture.

Such representations can be developed to be reasonably informative of particular stakeholder positioning and evaluations. Evident also are possible reconfigurations and alternative tales that might be told. "Alice in Planning Land", for example, could cast the Red Queen as a central planner decreeing the ways that impacts should only be BP-regarded in a regularised but largely uninformative script. Narrowness of analytic focus is evident in both parts c and d. The queen of b is shown as receiving most extensive attentions from the evaluations in c.

Such "games" can help in the important first-stage of thinking where flawed perceptions can lead to extensive failures and critical omissions (De Bono, 1986, 1991a, 1991b). If such things seem frivolous, recall many expensive infrastructure investments fail. Many failures are evident in formal evaluations, notably those using the Cartesian "sophistication" of Key Performance Indicator measurements set in external transcendent frames.

A Structured Flows Diagram

As an alternative approach to the interpretable "hands" approach we might consider the project elements as illustrated in a technical flow diagram, as in Figure 9. Multiple places where costs, returns and risk occur are indicated with costs here linked to risks. Note the bias against "return risks". That is, risks associated with cost overruns and the like are explicitly included but those associated with return shortfalls are not. Benefits are ascribed only to the end user. Other factors are not explicitly included. Such a representation has an overall bias towards the construction phase and the question of "can we build it on budget?"

"Project core partners", private and public, are placed in the third segment from the top of the Figure. A representation of the financial environment is shown via links to the "own" and "debt" financing segments in the second and top segments respectively. The wider external financial environment is not represented. The lower three segments join the partners to contractors and operations with all links to users via the operator. "Benefits" are assigned to users in an unspecified manner. Links to the local economy or to local economic development are not specified.

The positioning and linking of all parties are both clearly selective. Such an illustration highlights *by design* the interests of some parties over others. How to design representations and planning scheme to more fully accommodate all interests is an open question that deserves further research.

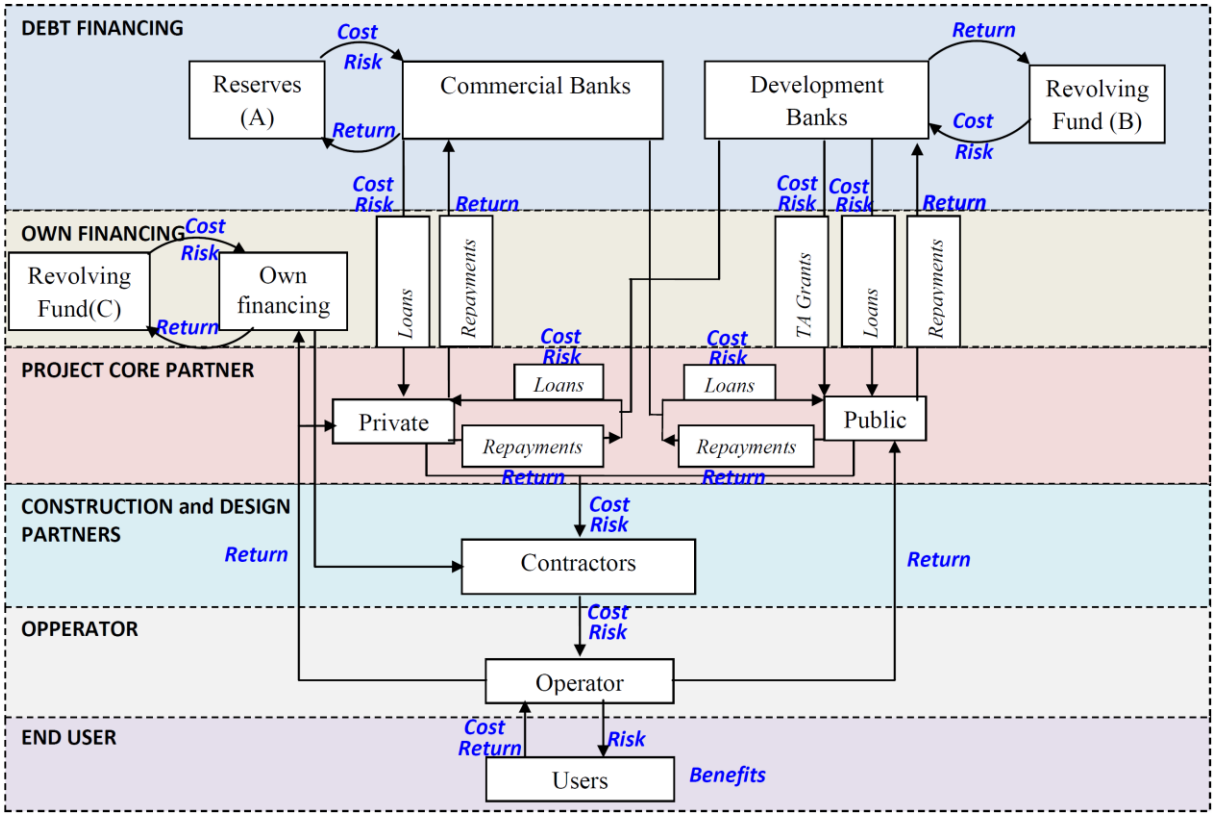
6. CONCLUSIONS

Infrastructure can be a critical part of economic development but this is not assured. Limitations in current infrastructure evaluations have been analysed. Improving the current evaluation process to identify and suitably accommodate the interests of all partners engaged in a project could benefit all, prevent losses and facilitate the development of local economies. How to design more adequate frameworks, analysis and planning schemes is a key question.

The scope of project evaluations varies markedly as is event from a review of factors considered in a sample of infrastructure investment projects. Limited consideration of the

influences of internal and external financial environments, uncertainties and returns is evident, especially in projects in the Oceania, Asia and Africa regions. "Soft" infrastructure projects (in the education, water and health sectors) received more limited evaluation than "hard" projects in the transport and power sectors.

Figure 9 An Infrastructure Investment Cycle?



Illustrative formulations that could more adequately include societal progress, impacts and community advantage were conceptualized. These helped make the biases in existing approaches more evident. Investment project desirability in a wider setting and affordability both need to be explicitly demonstrated, not just conveniently assumed. The sustainability of both bank reserves and regional and national infrastructure development funds will be at risk if the infrastructure investments are not able to make sufficient returns or impacts on the economy. It is time to improve infrastructure investment evaluation processes.

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Economic Transformation and Creative Industries: A Case Study of Metropolitan Beijing

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ABSTRACT

A recent development in Beijing's economic transformation for the past decade or so has focused on the 'Cultural and Creative Industries' (CCI or Wenhua Chuangyi Chanye in Chinese). How has the CCI evolved in Beijing and how is it compared with that in the non-Chinese counterparts? This paper discusses the role of CCI and examines its development process in Beijing. Data are collected from field reconnaissance, interviews and secondary sources including statistic publications and government policy documents. The findings reveal that a Beijing model of creative industrial development, which is different from that observed in Western metropolises, has been evolving. This model, learning from the development experience of China's manufacturing, emphasizes economic contribution, industrial clusters, investments and market improvement in terms of intensive promotion of governments. Meanwhile, policy innovations for creative industries are proposed, from current simple pursuit of economic growth into the shaping of cultural and creative capital.

1. INTRODUCTION

The creative industries have been among the most dynamic sectors in the world trade, with exports reaching US$ 424.4 billion in 2005 and an average annual growth rate of 8.7% during 2000 to 2005 (UNCTAD and UNDP, 2008). The creative industries strategy as well has been widely launched in many countries and regions since 1990s, such as Europe, Australia, New Zealand, Canada and Eastern Asia, to promote economic growth and transformation (DCMS, 2001; Costa *et al*, 2008; Scott, 2006). Essentially creative industries strategy assimilates two kinds of the worldwide economic streams since the latter part of the 20th century: cultural economy and knowledge economy.

A recent development in Beijing's economic transformation for the past decade or so has focused on the 'Cultural and Creative Industries' (CCI or Wenhua Chuangyi Chanye in Chinese).[1] The CCI in Beijing is based on art and cultural industries and involves many other creative productions as well, like software and network services and design. How has the CCI evolved in Beijing and how is it compared with that in the non-Chinese counterparts? This paper discusses the role of CCI and examines its development process in Beijing. A distinctive development model of CCI is developed, which learns from the development

[1] As for the term Cultural and Creative Industries (CCI), the more Chinese socialist approach favoured cultural, with its evocation of 'the people', while the business approach advocated creative. In the end the compromise "Cultural and Creative Industries" came into being, into which the myriad elements associated with culture and creativity were diced, mixed and enfolded (Keane, 2009).

experience of China's manufacturing and emphasizes economic contribution, industrial clusters, investments and market improvement in terms of intensive promotion of governments.

The data in this paper are collected from field reconnaissance, limited 10 interviews with workers in the CCI, governors of CCI Districts (Wenhua Chuangyi Chanye Jijuqu) and academics, and secondary sources including statistic publications and government policy documents. The analysis explores Beijing's economic transformation after the 1978 and the evolvement of cultural industries and CCI from the middle 1990s. The sections following begin with a brief literature review on economic transformation and creative industries in Western and some other Asian countries. Then Beijing's economic transformation and policies for CCI will be overviewed, followed by the analysis of the sectoral and spatial characteristics of CCI in Beijing. Section 5 will explore the development model of Beijing's CCI. After that the issues on Beijing's model will be discussed and policy innovation will be proposed. Section 7 will make conclusions.

2. ECONOMIC TRANSFORMATION AND CREATIVE INDUSTRIES

As far back as the early 1960s, art facilities were recommended in a special report for President Kennedy to be included in urban renewal projects and federal buildings in the USA (Whitt, 1987; Zukin, 1982). In the 1970s and 1980s, the role of arts as an urban development strategy started to be widely acknowledged in the USA, which was mainly utilized to promote downtown redevelopment in terms of downtown declined competitiveness compared with suburbs and hinterlands owing to the suburbanization and the dispersion of middle classes. The Western Europe witnessed the similar strategy as well (Bianchini and Parkinson, 1993). With the pressure caused by the two recessions of the 1970s, plus the shift of unskilled and semi-skilled production process to newly industrializing countries, the decline of traditional manufacturing employment force European cities to develop new strategies to resolve issues engendered by the economic restructuring. Cultural policy which shifted from social and political to economic priorities emerges as one of these new strategies in the 1980s. The European foregoers include Glasgow, Birmingham, Liverpool, Bilbao, Frankfurt, Hamburg, Rotterdam, Bradford, etc. (Bianchini and Parkinson, 1993; Paddison and Miles, 2007). In these cities, the main contribution of cultural industries strategy is to serve for urban regeneration by establishing urban image to attract tourists and investors and to diversify and reinforce local economy. But the direct effect of this strategy on the creation of wealth and employment was comparatively small (Bianchini and Parkinson, 1993, p. 15).

During the 1990s, the idea of creative industries emerged and attracted global academic and policy attention. It was originally shown in Australian report *Creative Nation* in 1994 and was systematically developed in the UK in 1998, followed by several other countries, such as New Zealand, Canada and elsewhere in Europe and Eastern Asia (DCMS, 2001; Costa *et al*, 2008; Scott, 2006). The designation of creative industries essentially assimilates two kinds of the worldwide economic streams since the latter part of the 20th century: cultural economy and knowledge economy. The creative industries have broadened the scope of cultural industries beyond the arts sector and have marked a shift in approach to potential commercial activities that were regarded purely or predominantly in non-economic terms until recently; hence, they are increasingly considered as providing a new momentum of economic growth in national and local development (UNCTAD and UNDP, 2008, p. 11).

Creativity and innovation has been regarded as the core power for further economic growth. Creative industries strategy is developed to motivate economic growth in Western countries and the Western local governments are keen to utilize the creativity strategy for regeneration

and local economic development. UK's policies for creative industries focus on skills and training, finance for creative venture, intellectual property rights and export promotion and its local authorities actively motivate creative industries for economic development, regeneration and social inclusion with many successful local cases of creative industries' districts (DCMS, 2001). Although Australia has no national policy for creative industries, many Australian local governments developed creativity strategies to prosper local development. In Brisbane, for example, Creative City strategy shapes integrated creativity-led urban development plans, which are not only for economic growth but also includes embracing history, building a cultural capital, ensuring access and equity, encouraging innovation, investing in culture and providing leadership (Atkinson and Easthope, 2009).

Meanwhile, many Asian countries, such as Singapore, Hong Kong and Korea, plan creative industries more for economic growth and restructuring than Western countries. For instance, Singapore launched Creative Industries Development Strategy for moving beyond the traditional manufacturing and services industries and transiting into the innovation-driven new economy (Ministry of Information, Communications and the Arts, 2002). However, the policies for creative industries in some Asian countries as well are not limited in economic growth. To establish Singapore as a new Asia creative hub, the policies for Singapore are comprehensive and emphasize the education for nurturing creative capabilities, the simulation of sophisticated demand, the advance of media and design industries and the promotion of arts and cultural entrepreneurship (Gwee, 2009).

Overall, in the past several decades, the cultural industries or creative industries strategy in Western countries have been involved from the original single contribution to the urban redevelopment and economic growth into the recent creativity-led comprehensive development plans with the formation of cultural and creative capital. Thus, the impact of this strategy on nations and regions has been updated and enlarged on the variety of aspects during urban and regional development. As an emerging global Asian city, metropolitan Beijing is implementing CCI strategy. However, due to the pressure of economic growth and economic transformation, from an industrial to post-industrial metropolis, Beijing's CCI is launched for a single objective, a new economic growth pillar, and shapes a distinctive Chinese development model (Keane, 2009; Rossiter, 2006).

3. BEIJING'S ECONOMIC TRANSFORMATION AND POLICIES FOR CCI

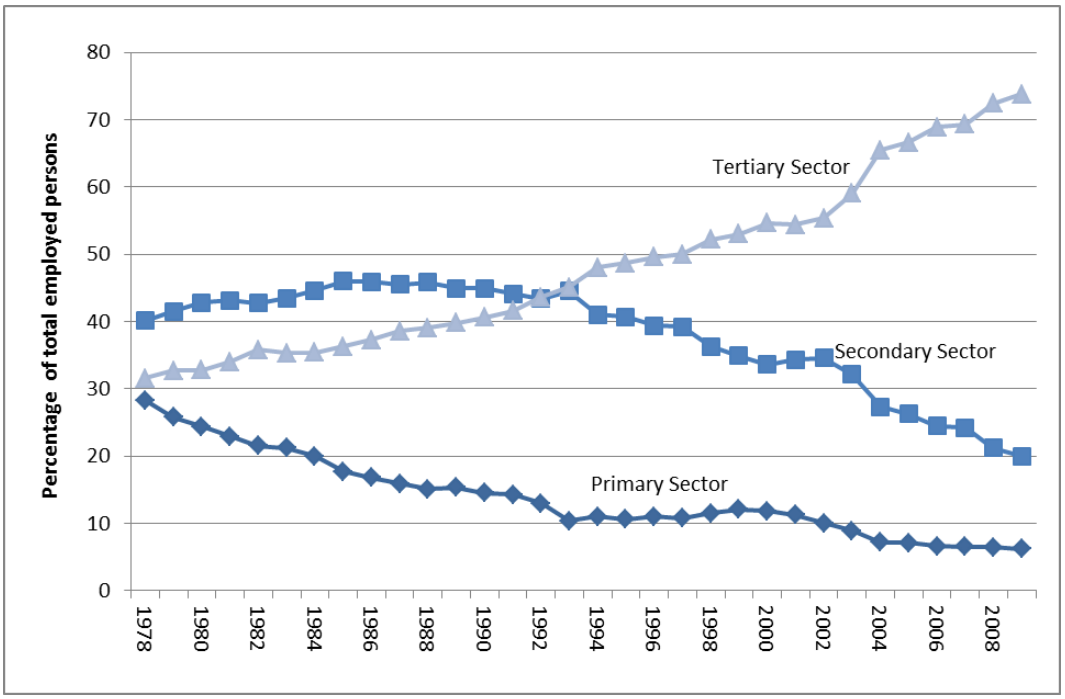
Since China's reform and open policy started in 1978, Beijing has kept a rapid economic growth with an average annual growth rate of GDP per capita, 8.2% in the last three decades (Beijing Municipal Bureau of Statistics, 2010). The nominal GDP per capita of Beijing was US$797 in 1978, which surpassed World Bank's upper middle income level in 2001 and arrived at US$10,314 in 2009, considerably close to World Bank's High-income group level.[2]

Meanwhile, the economic restructuring accompanied this rapid economic growth. The economy was diversified into light and labour-intensive manufacturing and consumer services to meet the living needs of the residents in 1980s, which was neglected in Soviet-style 'catch-up' industrialization concentrated on heavy industry before 1978 (Naughton, 2007, pp. 330-332). After the early 1990s the manufacturing reduced to focus on the newly emerging industries with higher technological content, such as electronics and telecommunications equipment, medical equipment and medical production, while the development of tertiary sector accelerated, especially producer services, like finance and business services. As Figure

[2] The World Bank's High-income group level is above US$12,195 in 2009; see Word Bank site, http://data.worldbank.org/about/country-classifications/a-short-history.

1 shows, the labour force in primary sector considerably declined after 1978; the labour force in secondary sector increased slightly in1980s but evidently declined after the early 1990s; the labour force in tertiary sector kept growing in the three decades. The percentage of total employed persons in the three sectors changed from 28:40:32 in 1978 to 6:20:74 in 2009. It is witnessed that Beijing started to transfer from an industrial to post-industrial economy after the early 1990s and to step into a post-industrial economy after the middle of 2000s when the labour force in tertiary sector surpass 65%.[3]

Figure 1 The Change of Beijing's Employment Structure from 1978 to 2009

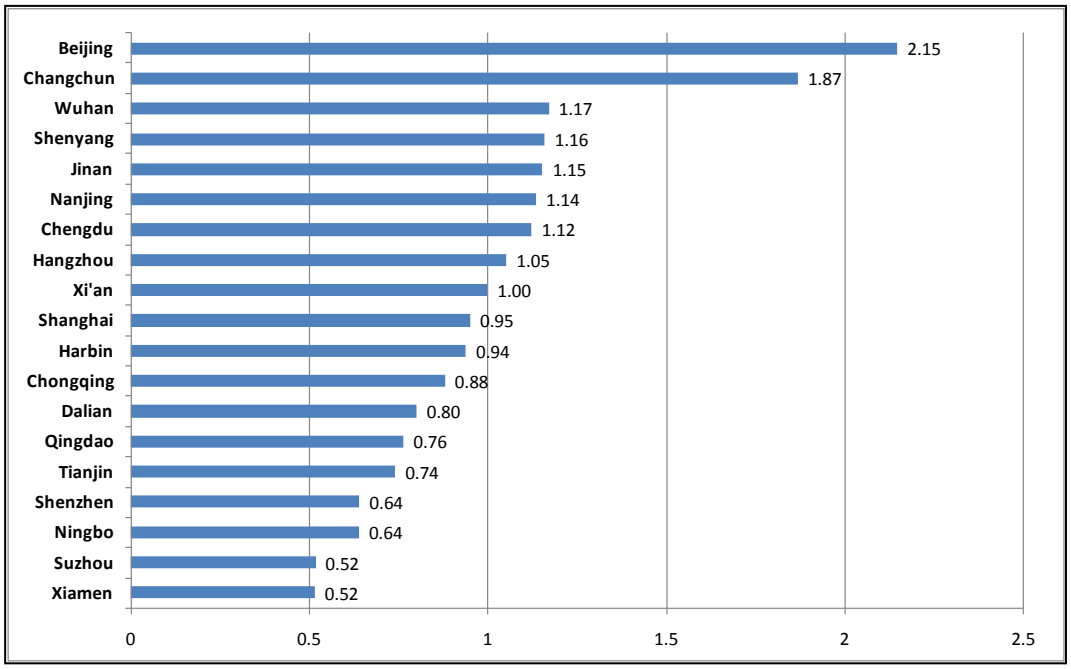


Source: Beijing Municipal Bureau of Statistics, 2010.

In terms of the economic transformation, new economic growth pillars are needed to keep the economic rapid growth. The cultural and creative industries emerged to take one position for Beijing's transformation. As the capital city and national cultural centre, Beijing accommodates China's leading state-owned cultural enterprises, media, theatre and exhibition centres, national art institutions and national cultural and media departments. Beijing's status as China's leader in cultural capital and cultural industries is unquestioned. As Figure 2 shows, the location quotient of cultural industries arrives at 2.15 in Beijing, which is considerably larger than in other China's major metropolises. In terms of the specific data of 2009, 48% of Chinese books and 31% of Chinese journals were published in Beijing; half of the Chinese feature films were produced in Beijing; and Beijing was ranked No.1 in the number of spectators of art performances in China (National Bureau of Statistics of China, 2010).

[3] According to the *Report on Chinese Industrialization*, Beijing entered into the post-industrial city in 2005 in terms of industrialization index made by this report.

Figure 2 The Location Quotient of Cultural Industries in China's Major Metropolises, 2007



Source: National Bureau of Statistics of China (2009).

Note: The LQ is computed in terms of employed persons and "LQ=1" means the average level of all China's cities. These major metropolises include 4 provincial level cities and 15 sub-provincial level cities; these two level cities have much more autonomous administrative power on society and economy than other ordinary cities.

As the reform of cultural system lagged in the first two decades of China's economic reform, all of the cultural products and services were public goods and Cultural Industries was not an industrial department in national policies (Cao, 2007). However, Beijing municipal government originally regarded Cultural Industries as a significant urban development strategy in 1996 and Cultural Industries was planned to become 'new source of economic growth' in Beijing's Tenth Five-year Plan (2001-2005) in 2001.[4] Further reform of Chinese cultural system, like the distinction of Cultural Industries (Wenhua Chanye) from Cultural Undertakings (Wenhua Shiye), and the rise of the worldwide creative economy led to Beijing municipal government launching CCI strategy in the end of 2005. Key policies were as well established promptly by administrative district governments in order to promote local development. Hereafter, the development of CCI began to accelerate in terms of governmental intensive promotion.

The CCI is defined by Beijing government as a cluster of interrelated industries, which is based on creation and innovation, concentrates on the value of cultural content and creative production, is characterized by the achievement and consumption of intellectual property, and aims at supplying cultural experience for the public.[5] It consists of nine subgroups: cultural services and arts; journalism and publication; broadcast, TV and film; software, network and computer services; advertising, conference and exhibition services; artwork auction and transaction; design services; tourism and leisure services; other auxiliary services. Except the

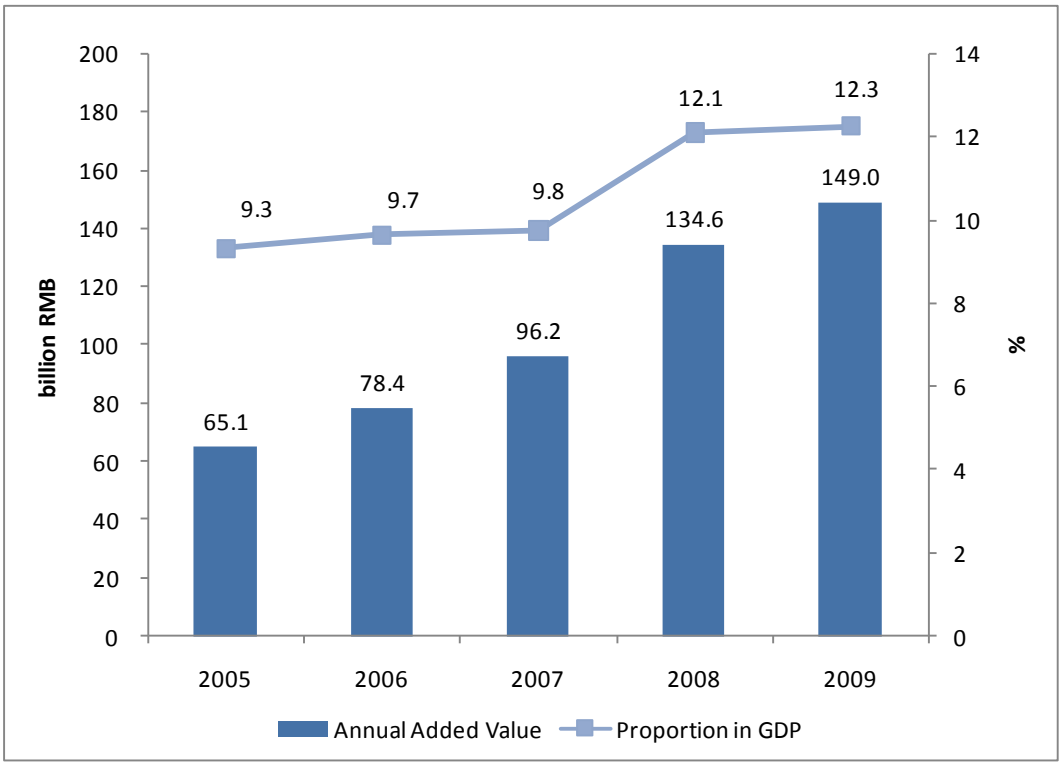
[4] See Beijing's Tenth Five-year Plan, http://www.beijing.gov.cn/zfzx/ghxx/swjh/t359293.htm.

[5] See the definition and classification by Beijing Statistic Bureau in 2006, http://www.bjstats.gov.cn/zdybz/tjbz/hyhcyfl/cyfl/200804/t20080415_109912.htm.

software, computer services and design services, other seven subgroups coincide with the classification of cultural industries defined by China National Statistic Bureau. Thus, the CCI in Beijing is based on art and cultural industries and as well involves many other creative productions.

The development of Beijing's CCI is intensively guided by the municipal government as a new economic growth pillar. The special municipal committee Beijing CCI Leading Group (its head is the Secretary of Municipal Party Committee and vice head is the Mayer) and its permanent institution Beijing CCI Promotion Centre are established in 2006 to be in charge of planning and administrating Beijing's CCI. The action plan Policies on Promoting the Development of CCI in Beijing was issued by the Leading Group in 2006 as well. This plan covers nearly every aspects of industrial development, including market, creation and innovation, copyright protection, investment, demand and trade, infrastructure, labour force and management. Hereafter some detailed actions for this plan were issued respectively in the following three years, such as Investment Guidance Catalogue for CCI, Measures for the Management of Special Funds, Measures for the Identification and Administration of CCI Districts, Measures for the Management of Special Funds for Infrastructure in CCI Districts, and Measures on the Administration of Loan Discount. Meanwhile, the Development Plan of CCI during Beijing's Eleventh Five-Year (2006-2010) which was issued in 2007 guides the strategic development of Beijing's CCI in the recent years. These systematic policies and actions are intensively issued and the impact of CCI on economic transformation is rapidly established and enforced.

Figure 3 Annual Added Value of Beijing's CCI and its Proportion in GDP, 2005-2009



Source: Beijing Municipal Bureau of Statistics, 2010

4. SECTORAL AND SPATIAL CHARACTERISTICS OF CCI IN BEIJING

After launching the CCI strategy, CCI in Beijing kept a fast growth with an average annual growth rate of output, 17% in 2005-2009, compared to the 12% for the economy as a whole. As figure 4 shows, its output (added value) proportion in GDP arrived at 12.3% in 2009 from 9.3% in 2005. The CCI had 149 billion RMB output in 2009 and has become the fourth largest industry after manufacturing, finance, and wholesale and retail trade.

As for the subgroup characteristics, software, network and computer services is not only the largest subgroup in Beijing's CCI , which contributes 40.2% of the total output in 2005, but also the subgroup with the fastest growth, as its proportion in GDP increased by 7.5% and arrived at 47.7% in 2009 (see Table 1). It witnesses the leading position and the fast development of the high-tech creative production in Beijing's CCI. The media sectors, journalism and publication and Broadcast, TV and film, have respectively the second and third largest output proportion in 2005, but their percentages considerably declined in the following years. The same decrease in output proportion as well happened in cultural service and arts subgroup. Thus, as a matter of fact, the traditional cultural industries actually have a relatively slow growth, except the artwork auction and transaction whose output grew four times. Meanwhile, the other auxiliary services have a comparatively fast growth, but these auxiliary services mainly include some low-profit reproduction and trade, like the production and trade of stationery commodity and cultural equipments. Other subgroups have a similar growth rapid with the CCI as a whole.

Table 1 The Production (Added Value) of CCI Subgroups in Beijing, 2005 and 2009

Subgroups	2005		2009	
	Billion RMB	%	Billion RMB	%
Software, network and computer services	261.4	40.2	710.5	47.7
Journalism and publication	106.8	16.4	159.8	10.7
Broadcast, TV and film	78.0	12.0	124.5	8.4
Advertising, conference and exhibition services	51.0	7.8	98.5	6.6
Other auxiliary services	45.3	7.0	179.8	12.1
Tourism and leisure services	37.6	5.8	60.7	4.1
Cultural services and arts	32.2	4.9	48.8	3.3
Design services	31.6	4.9	76.4	5.1
Artwork auction and transaction	7.1	1.1	30.9	2.1
Total	651.0	100	1489.9	100

Source: Beijing Municipal Bureau of Statistics (2010).

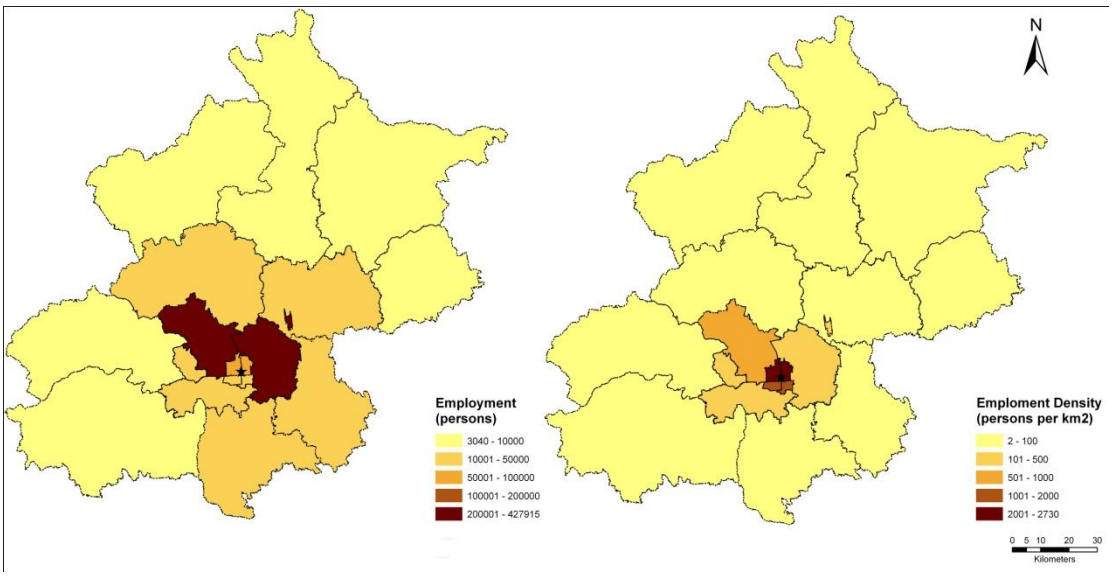
The spatial distribution of CCI shows a high concentration in central city including inner city and outer city.[6] Outer city's Haidian and Chaoyang administrative districts have the largest CCI employment, respectively with 428 thousands and 228 thousands employed persons in

[6] Beijing has 18 administrative districts. The inner city includes 4 districts, Xicheng, Dongcheng, Xuanwu, Chongwen; the outer city includes 4 districts, Chaoyang, Haidian, Fengtai, Shijingshan; and the other 10 districts belong to new town area (see Figure 5).

CCI (see Figure 4). The two districts account for around two third of employment in Beijing's CCI. Meanwhile, inner city's Xicheng and Dongcheng have more than 50 thousands employed persons in CCI. Furthermore, the agglomeration is witnessed by the employment density. Inner city's Xicheng and Dongcheng have respectively 2,700 and 2,600 persons per km^2 employed in CCI, and inner city's Xuanwu and Chongwen as well have more than 1000 employed persons per km^2. It is in sharp contrast that all of the districts in new town area have employed person per km^2 less than 100. Thus, the clustering feature of CCI is evident and the plan and policies for CCI should coincide with the spatial characteristics and local resources.

In terms of the background about the sectoral and spatial characteristics, the development model of Beijing's CCI and its issues will be explored and discussed in the following sections.

Figure 4 The Distribution of Employment and Employment Density of CCI in Beijing, 2008



Source: Beijing Economic Census, 2008.

5. DEVELOPMENT MODEL OF BEIJING'S CREATIVE AND CULTURAL INDUSTRIES

A development model of CCI, distinctive from that in Western metropolises, has been shaped in Beijing. This model, learning from the development experience of China's manufacturing, emphasizes economic contribution, industrial clusters, investments and market improvement in terms of intensive promotion of governments.

Economic Contribution

Accompanied with the rapid economic growth and economic restructuring, the economic contribution of CCI is emphasized as the sole objective, a new growth pillar for the economic transformation. Although the CCI strategy is considered as a way to promote the innovation-led development, the actual development process of Beijing's CCI concentrates on the maximum of added value of the output, which considers investments and large projects still as the primary position. As an academic interviewee said,

> Beijing launching the CCI strategy is an adjustment of development idea and a transformation of growth model, into the endogenous economic growth. The GDP contribution is important for CCI, but idea change on development model is much more crucial.

In terms of the definition, besides traditional cultural industries, Beijing's CCI includes the emerging high-added-value industries related to creative goods, like software and computer services, and tourism and leisure services which are excluded by some other countries. Meanwhile, some auxiliary services about the production and trade of stationery commodity and cultural equipments are involved as well and kept a fast growth. A large coverage of Beijing's CCI considers the whole industry circulation, from production, distribution and exchange, eventually to consumption, on the one hand; this complex coverage make Beijing's CCI a leading position at the beginning of its emergence in terms of its high output percentage in GDP, on the other hand. Moreover, the economic contribution as the sole objective is likely to neglect the different features of CCI compared with the traditional manufacturing and impose restrictions on its sustainable development, which will be discussed in the next section.

Industry Clusters

The planning of promoting industry clusters is emphasized and implemented by municipal government as a primary policy. The total 30 CCI Districts were identified and planned by municipal government from 2006 to 2010 (see Figure 3). These CCI Districts involve all the nine subgroups, and nearly two thirds of them locate in central city, and one third of them are in new town area. Meanwhile, nearly one third of them are concerning tourism, leisure services, and software, network and computer services and broadcast, TV and film respectively occupy one fifth. In order to balance the benefit of local governments the planned CCI Districts cover all of Beijing's 18 administrative districts; thus many tourism resources are utilized by the governments in the new town area for planning CCI District, which make them accounting for the largest proportion.

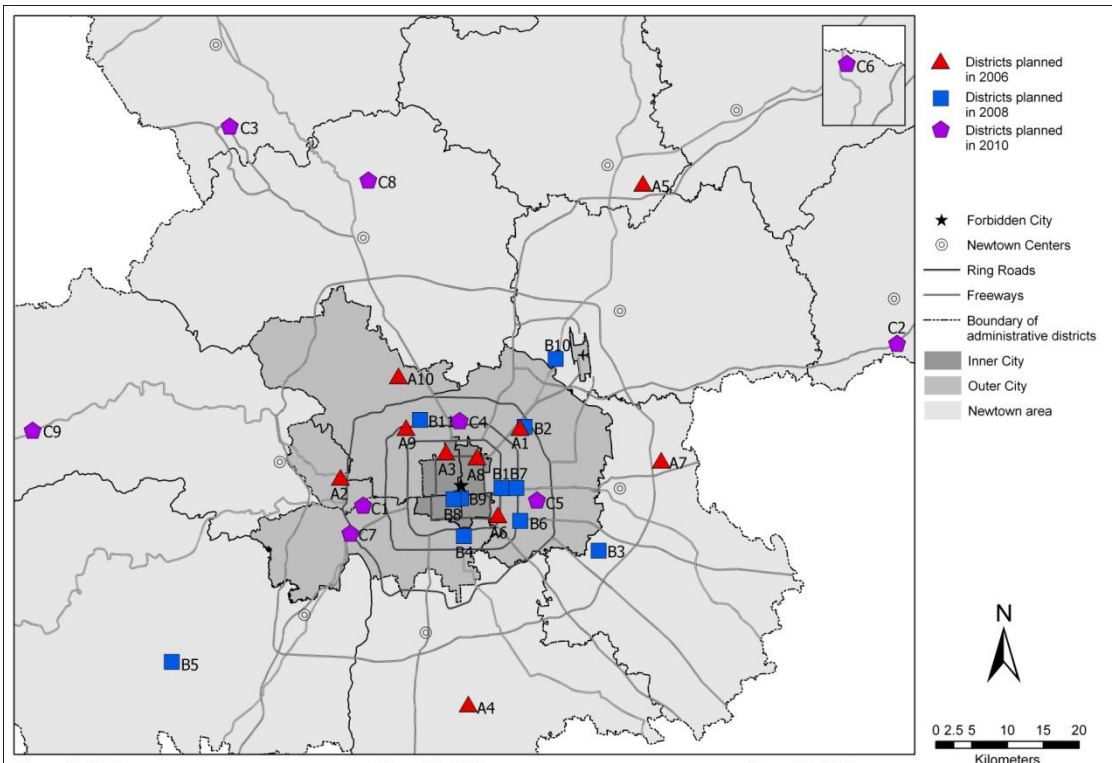
This cluster idea actually follows the former planning model of manufacturing zones and science and technology parks. A small part of CCI Districts is shaped by the spontaneous agglomeration of cultural and creative activities, such as 798 Art Zone, Songzhuang Original Art and Cartoon Cluster Area, Panjiayuan Curio and Artwork Trade Park and CBD International Media District, whilst most of them are planned by governments or developers in the beginning. For instance, there are many planned parks for digital content production named CCI Districts, such as China New Media Development Zone, Yonghe Science and Technology Park, Zhongguancun Software Park and China Animation and Game Park; and some planned zones for creative services, like Huitong Times Square and Beijing Design Resource Cooperation. The infrastructure, projects and enterprises in these CCI Districts are supported by municipal government with public funds; thus, the CCI District is a significant way to promote the agglomeration of cultural and creative activities and as well are regarded as brands to attract investment.

Investment

Investment is the core power for China's rapid growth. Although the CCI strategy is a way to change this investment-led into innovation-led development, the direct investment is still highlighted in policies for the CCI in Beijing. The issued Investment Guidance Catalogue for CCI aims to enlarge the investment field of private and foreign capital, as most enterprises of cultural industries were state-owned before. The variety of tax exemption to enterprises in CCI as well is implemented by governments to attract private and foreign investment on establishing new firms. Meanwhile, the annual China Beijing International Cultural &

Creative Industries Expo (ICCIE) operated by municipal government from 2006 provides a project platform for investment on CCI. It was reported that the total amount of project cooperative agreement arrived at US$177.9 in the first four sessions of this Expo from 2006 to 2009.[7]

Figure 5 Beijing's CCI Districts Identified and Planned by Municipal Government



Source: Created by the authors.

Furthermore, the governments increase public investment on CCI as well. The Special Funds on the development of CCI, 500 million RMB per year since 2006, has been supplied by municipal government for major projects and products of CCI by means of interest subsidy on loans, direct subsidy for projects, subsidy for loan security and government procurement; meanwhile, the public infrastructure investment, Special Funds for Infrastructure in CCI Districts, 500 million RMB in three years, were supported for the construction of the planned CCI Districts. The huge investment stimulates and accelerates the development of this emerging industry.

Market Bodies and Market

The new market bodies emerge in Beijing's CCI in terms of the reform of China's cultural system. Beijing is one of China's original nine experimental regions of the reform of cultural system, and the profit public institutions of cultural activities, such as profit publishing and

[7] See http://www.bj.xinhuanet.com/bjpd-zhuanti/2011-04/21/content_22585961.htm.

printed media, audiovisual media and institutions of performing arts, have gradually transformed from the state-owned to private firms with marketing operation since 2003 (Kong, 2011). The famous newspaper Beijing Youth Daily and the Beijing Children's Art Theatre are two of the forerunners. The reform of cultural system as well engenders the boost of variety of new-built cultural firms, for instance, the organization number of performing arts soared to 341 in 2009 from 63 in 2005 (Beijing Culture Bureau, 2010). Meanwhile, the consolidation and regrouping of enterprises in CCI are encouraged by governments to establish leading groups and attract investment. In terms of the tax exemption and public and private investments, the private firms and groups of cultural activities become new active bodies in cultural industries and promote the development of Beijing's CCI.

Moreover, guided by governments, the market of CCI is further improved. The industrial Catalogue enlarges the market field and advances the market of CCI. The annual ICCIE supplies a concentrated trading platform for CCI. Beijing International Copyright Trade Centre was established in 2009 for copyright exchange and communication of original works in CCI. Meanwhile, the industrial and regional associations, like Beijing Trade Association for Performances and Haidian Association of Creative Industries, are set up to promote the industrial development and market improvement.

6. DISCUSSION

The development model replying on investment was successful for China's rapid growth in the past three decades. Due to high fixed costs and low variable costs, like performing arts, and the unknown outcome of creative work, the CCI needs investment as well (Cave, 2000). However, the funds, investments and large projects in the development of Beijing's CCI are earnestly pursued by municipal and local governments, which is liable to cause the unreasoning of the industrial funds and investment. For instance, some projects are established for achieving public funds and investments and ignore the quality production.

Meanwhile, the municipal and local governments are ready to identify and plan CCI Districts, as the credit of CCI Districts could help to attract investment and achieve public funds and land-use permission for promoting local development. However, some CCI Districts merely become a brand or tool to attract investment and projects and neglect the anticipated clustering function for cultural and creative activities. For instance, some CCI Districts have no a definite geographic range, like Zhongguancun Creative Industry Leading Base and Beijing Cyber Recreation District, which shorten the deserved agglomeration economy. As one interviewed governor of CCI Districts said,

> The enterprises in our district are scattered in several buildings. The governor's job is to help the enterprises registered in the district to apply for project permission and fund.

Moreover, as mentioned above, in order to balance the benefits of local governments, the municipal governments have to consider the balance of public funds and investment and thus plan CCI districts for every administrative district, which engenders the immoderate number of CCI Districts on traditional tourism in new town area.

Furthermore, some sub-groups, such as the emerging animation and game industry and digital content industries, are encouraged by municipal governments with intensive political support, which could be witnessed by the fast growth of software and network services. The administrative district governments as well promptly establish policies for CCI or specific subgroups and local CCI Districts since the middle of 2000s. However, the local governments intensively compete for the sub-groups considerably supported by municipal and even national governments, which causes an excessive overlap of choosing CCI' subgroups

between administrative districts. For instance, animation and game industry are developed by most of administrative district governments with little concern on local resource condition. Some local governments use the emerging industries to plan CCI as well, whilst the lack of industrial resources in these areas obstructs their development. For instance, the planned China New Media Development Zone in new town Fengtai went forward slowly as a result of its remote location and lack of the media environment to a large extent.

More importantly, Beijing's model emphasizing investment and industrial clusters overlooks some different futures of CCI from other industries and thus practically neglects some significant demand of cultural and creative activities. The core difference should be original creations, while the lack of high-profit original creation, as a matter of fact, causes a low-profit status of Beijing's CCI. They still stand at the low end of creative industry chain with many outsourced services and large-scale reproduction. How to advance original creations? Some determinants, such as creative labours, self-employments and small firms, and 'vulnerable subgroups', could jointly shape creative environment or creative capital for cultivating original creations and need serious concerns for the CCI' sustainable development.

Firstly, as national centre for culture, education and scientific and technological innovation, Beijing has incomparable advantage and resource to cultivate, attract and accommodate creative labours or creative class. Nonetheless, the shortage of creative labours and managerial labours is a critical issue. On the one hand, Beijing lacks the core creative labours: the graduates from higher education institutions have not professional skills, while the professional training institutions do not supply sufficient theoretical education. The communication and cooperation between the two types of institutions needs to be increased and a better system for cultivating creative labours should be established. On the other hand, as the cultural and creative activities are normally conducted by projects, the project managers need not only the professional management skills but also knowing about the specialized technology. One interviewed worker in game industry stated,

> The manager with compound ability and sufficient project experience is extremely deficient in our industry. The international advanced enterprises are of deficiency in Beijing as well. Their project experience could help to improve our management and the ability of original creations. The cooperation with international enterprises or to attract them to establish branches is urgent.

Secondly, the self-employment and small firms are common in CCI. They could supply the variety of creative goods to satisfy different groups of consumers and are essential to creation. However, Beijing's policies for CCI neglect their significance. The specific policies, such as tax exemption, rent subsidy and business registration assistance, could be implemented to encourage the development of self-employments and small firms. Meanwhile, the outsourced service for big companies is their main work as well and the management for outsourced projects needs to be improved. For instance, a public outsource-project platform for CCI could be established, whose database of not only the projects but also of the self-employment and small firms could stimulate market and improve the quality of creative goods.

Thirdly, some cultural and creative goods, such as publications, artworks and performances, have a semi-public property. Although the enterprises of CCI achieve the political support during China's reform of cultural system, the further support after the reform should be concerned to prosper these semi-public subgroups. Meanwhile, some low-capital-input activities like art creation, is vulnerable to metropolitan land and housing market (Hee *et al*, 2008; Liu and Han, 2010). The protection of these activities does not achieve enough support in terms of the rapid urban development. For instance, Beijing accommodates the most artists in China and many artists' communities or art villages emerged in the past two decades.

However, these art villages are threatened or have been destroyed by urban expansion. As one interviewed artist said,

> Recently art villages in the outskirt of Chaoyang District are destroyed one after another for the new urban expansion. The artists have to move to more remote areas. These areas are safe now, but I do not know whether they are in the future.

These vulnerable subgroups are fundamental components of metropolitan cultural and creative milieu and needs to further protect and support.

7. CONCLUSION

Beijing launches the CCI strategy as new economic growth pillar for economic transformation. Following China' successful experience of developing manufacturing, the development of CCI in Beijing focus on the economic contribution, industrial clusters, investments and market improvement in terms of intensive promotion of governments. The industrial clusters and large investments and projects accelerate the involvement of CCI in Beijing, whilst the unreasoning investment and the neglect of original creation and creative capital hinder the sustainable development of Beijing's CCI.

Creative industries have the common industrial features and needs investment motivation. However, creation and creative capital are the truly core for advancing this new economy. Although creation and innovation has been regarded as the power to promote China's new growth, the former investment-led model still dominates China's development (Keane, 2009). As China's leading cultural and creative city and an emerging global city, Beijing needs to earnestly shake off from the former model and update its CCI strategy by cultivating creative class, supporting self-employment and small firms, protecting vulnerable creative subgroups and eventually shaping cultural and creative capital.

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A Comparative Study of Population Change in Regional and Metropolitan Australia via Clustering Statistical Local Areas

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ABSTRACT

Clustering regional towns and urban cities in Australia based on their economic functions could reveal the role of socio-economic factors in determining population growth. For many years researchers have examined the growth and characteristics of regional cities in Australia. Beer and Clower (2009) conducted cluster analysis to group regional areas according to industry structure. This current study adopts clustering technique using k-means algorithm and attempts to investigate and compare the impact of some socio-economic factors on population growth in regional and metropolitan Australia. The resulting analysis suggests that the impact of socio-economic factors on population growth is different in regional compared to metropolitan areas.

INTRODUCTION

The current comparative study examines the impact of some socio-economic factors including industry of employment, occupation type, employment status, individual weekly income, age group and the education level on population growth in regional and metropolitan Australia. Studies that have explored the impact of these factors on population growth in Australia remain limited. This study strives to address this shortage by building upon previous clustering studies (e.g. Beer and Clower, 2009) and adopting a clustering approach using k-means clustering algorithm. This approach uses multiple regression analysis to determine the impact of the generated optimal clusters on population growth.

O'Connor, Stimson, and Daly (2001, p. 17) have indicated that "in order to understand the change in contemporary Australian society, it is necessary to understand the structural changes in the economy". As a result of new technologies, new products and the evolution of new social attitudes, the economic character of Australia have changed. Investigation into metropolitan areas mainly is directed to urban functions and performance. In mid 1990s Federal government reengaged with urban and regional issues at the policy and program levels and research into Australia's urban system was a part of this engagement. As a result some of the research have been focused on factors affecting economic, social, and environmental development of regional and metropolitan areas in Australia (Beer, 1999).

Much of the attention from the government and research in recent years has been in response to the population migration from rural and regional areas to metropolitan areas, with over two-thirds of Australia's population now residing in a metropolitan areas statistical local area (SLAs; Australian Bureau of Statistics; ABS, 2010). Australia is one of the most urbanised nations in the world with a high concentration of population in metropolitan areas (Beer 1995) over 50% of population residing in five big cities (ABS, 2006). There are many factors that

contributed to the metropolitan primacy in Australia including the role of international links within the Australian economy and the role of metropolitan areas as an intermediary in internal commerce, the most important destination of migrants, centralisation of political and administrative institutions, persistence of the initial patterns of settlement, and circular and cumulative patterns of growth. This type of development reflects the growing urbanisation of the population. In 2008-09 population growth rates in Australian metropolitan statistical divisions was 2.3% which exceeded the growth rate of the remainder of Australia (1.9%). Conversely, rural Australia is experiencing population losses, especially in the north-eastern and south-eastern Australia (ABS, 2010). This pattern can be observed in the regional west of Victoria, for instance, where there is a clear decline in population which is most apparent in LGAs located farthest from Melbourne, and where LGA populations are declining and are characterised by a large and growing ageing population.

Different parts of the country show different population change patterns. For example the rural-urban population shift in Victoria has mainly occurred within the last thirty years. Prior to this, during the 1970s and 1980s, population increase was the norm in country Victoria, which had markedly higher population growth rates than Melbourne (McKenzie and Frieden, 2010). Thereafter the trend reversed and between 2001 and 2006 Melbourne's average annual growth rate of 1.5% was nearly double the 0.8% of regional Victoria (idem).

Indeed, regional Australia's economic contribution is essential to the nation's prosperity, both currently and into the future, while regional cities play a dynamic role in the Australian urban system (Beer and Maude, 1995). Approximately two thirds of Australian export earnings come from Australian regional industries such as agriculture and manufacturing, as well as tourism and the retail sector, service and manufacturing (Australian Government Department of Regional Australia, Regional Development and Local Government, 2010). Thus, both Federal and State governments are strongly committed to supporting regional Australia through a myriad of government policies and strategies.

Regional Development Australia (2010) reports on an OECD study which discusses in particular the need to grow regions and to encourage their economic competitiveness by focusing on the development of underutilised resources. Strategies for doing this in regional Australia are investing in infrastructure, people and jobs, promoting regional innovation, and harnessing innovations through tertiary (vocational and higher) education. Courvisanos (2009) likewise identifies the crucial role of innovation and learning for sustainable development in regional Australia, a crucial factor in limiting decline in some regions and encouraging population growth in stronger regions.

The importance of sustaining and developing regional economies is a strong focus of a number of local, regional and national government agencies. The recent 'Ready for Tomorrow: A Blueprint for Regional and Rural Victoria' (RDV, 2010) is one such example of a government agency contributing significant funds to strengthen regional Victoria through a range of programs aimed at building stronger economies and communities and encouraging new and more diverse businesses. This report states that the population growth management needs to recognise different growth rates in different locations as well as the change in population composition. As an example 12 percent of the population in regional Victoria is over the age of 70 and this will increase to 21 percent by 2036.

The range of diverse economic factors associated with the sustainability or decline of regional cities and areas hinge on factors such as transportation, environmental policy, housing and investment (Calthorpe and Fulton, 2001). Such factors are closely associated with population shifts and these have a strong economic focus, including housing, location of business and jobs, business and commercial construction, and corporate activity (O'Connor *et al*, 2001).

The research into the economic functions of rural Australia extends to when Smith (1965) used industry of employment data to establish towns with similar functional specialisation. In more recent years similar research has been conducted by Beer and colleagues (Beer *et al*, 2003; Beer and Keane, 2000). Beer and Maude (1995) examine growth rates in Australia's regional cities (defined as all urban centres with a population of 10,000 or more) which are independent of the capital cities. They also compare population and the labour force growth rates with national trends using cluster analysis to examine changes in their economic functions between 1961 and 1991.

Beer and Clower (2009) in their recent work adopt cluster analysis and examine the impact of industrial specialisation on regional performance. They also used regression analysis to examine the drivers of growth. They found that industrial specialisation contributes to higher rates of growth and that becoming more specialised is positively related to population change and labour force change. The regression analysis shows that increasing economic specialisation results in predictable development. Thus, regression analysis on clusters provides a research path to better understanding of population growth and decline in Australia.

OBJECTIVE AND METHODOLOGY

Examining population growth and characteristics of regional and metropolitan cities provides valuable information. To do this, researchers have adopted different research approaches. For example Brown (1968) suggests using the Delphi process which involves reliance on judgement of experts. This method seeks a group solution to a problem or a group estimate of some unknown numerical quantity. Sorensen and Weinand (1991) use factor analysis and Ward's clustering algorithm to study regional well-being in Australia. They suggest that cluster analysis shows complexity of differentiation in intra-rural well-being and index analysis enables differentiation in socio-economic conditions in rural areas. The demographic model and time series is used by Lee and Carter (1992). They propose a new method to forecast mortality. The method combines demographic model with statistical time series methods and is based on long-term historical patterns and trends. Sanderson (1998) used the Wheeler forecasting model. The model uses international data in forecasting fertility. He suggests that Wheeler's model has the simplest demographic structure.

Classification and cluster analysis of demographic and economic elements has been largely used by researchers for pattern recognition in data comprising large numbers of observations (e.g., Freestone *et al*, 2003; Beer and Clower, 2009; Beer and Maude, 1995). Cluster analysis is also the general methodological philosophy adopted in this paper.

The contribution of this current study is to address the impact of some socio-economic factors on population growth in regional and metropolitan Australia. The study adopts clustering technique and uses *k*-means algorithm to build upon previous studies and to cluster SLAs. The generated clusters are then used for two purposes, specifically to (a) examine the impact of the clusters on population growth on both regional and metropolitan areas using regression analysis and (b) examine each cluster separately to explore how population change trend within each cluster relates to the results of the regression analysis for the same cluster.

Beer and Clower (2009) show that cluster analysis has the potential to produce worthwhile results and it can contribute to the development of deeper insights into change within Australia's regional cities. Clustering deals with the problem of organising a collection of patterns into clusters based on similarities. Depending on the type of the data set, different clustering algorithms might be utilised. Only a few algorithms could be applied when there is large number of samples in a data set; *k*-means and its variations are among algorithms that

are applicable to large data sets. The *k*-means algorithm chooses *k* centres (also called centroids) and assigns each point to the cluster nearest the centre. The centre is the average of all the points in the cluster, that is, its coordinates are the arithmetic mean for each dimension separately over all the points in the cluster. The limitation with *k*-means algorithm is that although it is known to be an efficient clustering algorithm, it is sensitive to the choice of starting points. It can converge to local minima and these local minima may be significantly different from global solutions as the number of clusters increases (Bagirov, 2008; Bagirov and Mardaneh, 2006).

DATA COLLECTION

The data used for this paper was collected and prepared from the Australian Bureau of Statistics (ABS, 2010). This includes categories of data for industry of employment, occupation type, employment status, individual weekly income, education level and age group as shown in Table 1.

Table 1 Socio-economic Factors for Analysis

Industry of employment	**Occupation type**	**Employment status**
Agriculture, Forestry and Fishing; Mining; Manufacturing; Electricity, Gas, Water and Waster Services; Construction; Wholesale Trade; Retail Trade; Accommodation and Food Services; Transport, Postal and Warehousing; Information, Media and Telecommunications; Financial and Insurance Services; Rental, Hiring and Real Estate Services; Professional, Scientific and Technical Services; Administrative and Support Services; Public Administration and Safety; Education and Training; Health Care and Social Assistance; Arts and Recreation Services; Other Services.	Managers; Professionals; Technicians and Trades Workers; Community and Personal Service Workers; Clerical and Administrative Workers; Sales Workers; Machinery Operators and Drivers; Labourers.	Employed, worked full-time; Employed, worked part-time; Employed, away from work; Unemployed looking for full-time work; Unemployed looking for part-time work; Not in the labour force.
Individual weekly income	**Education level**	**Age group**
$1-$149; $150-$349 (sets of $100); $350-$799 (sets of $150); $800-$1399 (sets of $200); $1400-$1999 (sets of $300); $2000-$3999 (sets of $500); $4000 or more.	Postgraduate Degree Level; Graduate Diploma and Graduate Certificate Level; Bachelor Degree Level; Advanced Diploma and Diploma Level; Certificate Level.	In sets of 5 years as: 0-4 years; 5-9 years; …; 95-99 years; 100 and over.

The above data is provided in a database (ABS, 2006) including all SLAs in Australia (not separated based on location). Since there is no clear definition of the regional and metropolitan areas, a methodology was set up to establish the definition. The Australian Standard Geographical Classification (ASGC-2006), categorises "Major urban" as areas having more than 100,000 population. Based upon this, in the first stage SLAs having more than 100,000 in population were considered as metropolitan. Additionally the map of the ASGC (2009) was used to identify SLAs with less than 100,000 population but still adjacent to the metropolitan areas. These nearby SLAs were also allocated to the metropolitan group of SLAs.

From this, 726 SLAs for regional and 691 SLAs for metropolitan areas were emerged and after eliminating outliers (extreme population growth or decline values) 689 regional SLAs and 659 metropolitan SLAs were used for the analysis. See Tables 2 and 3 for a breakdown of these SLAs in terms of categories of population change.

REGIONAL AND METROPOLITAN SLAS GROWTH AND DECLINE

Comparison of population change data between 2001 and 2006 for regional and metropolitan SLAs suggest that SLA population change rate varies. As presented in Tables 2 and 3, some SLAs have gained population and others have lost population at different rates.

As reflected in these two tables, population growth and decline rates are presented in 6 categories encompassing all growth and decline rates. In terms of decline regional areas are ahead of metropolitan areas and when it comes to increase, regional areas are notably behind metropolitan areas. In total 38% of regional SLAs fall in the category of population decline whereas this rate for metropolitan areas is only 20%. In regional areas 62% of SLAs fall in the category of population increase and this rate for metropolitan areas is up to 80%.

Table 2 Categories of Population Change (%) for Regional SLAs

Categories of change %	No. of SLAs within each Category	% of SLAs within each Category	Population (000's) within each category	
			2001	2006
Decline more than 5	111	16	289.9	262.0
Decline 0 to 5	153	22	1015.3	995.9
Increase 0 to 5	178	26	1627.2	1667.2
Increase 5-10	118	17	1431.1	1530.3
Increase 10-15	50	8	504.8	568.2
Increase more than 15	79	11	779.9	968.3
Total	**689**	**100**	**5648.2**	**5991.9**

There is a gap in the number of regional SLAs (111) experiencing a sharp decline of more than 5% in population compared to the number of metropolitan SLAs (34) that experience the same decline rate. Sharp decline only includes 5% of metropolitan SLAs whereas this encompasses up to 16% for regional SLAs. In this sense number of regional SLAs experiencing a sharp decline in population is at least 11% more than number of metropolitan SLAs that experience the same decline rate.

Table 3 Categories of Population Change (%) for Metropolitan SLAs

Categories of change %	No. of SLAs within each Category	% of SLAs within each Category	Population (000's) within each category	
			2001	2006
Decline more than 5	34	5	96.1	89.5
Decline 0 to 5	102	15	2190.9	2153.0
Increase 0 to 5	211	32	6100.1	6240.2
Increase 5-10	131	20	2606.2	2785.1
Increase 10-15	77	12	1140.0	1282.8
Increase more than 15	104	16	1633.4	2032.9
Total	**659**	**100**	**13766.7**	**14583.6**

This scenario reverses when population increase is considered. Again there is a big difference in the number of regional SLAs (79) experiencing a sharp increase of more than 15% in population compared to the number of metropolitan SLAs (104) that experience the same increase level. Number of regional SLAs experiencing a sharp increase in population is at least 5% less than the number of metropolitan SLAs that experience the same increase rate. Even in a fairly smooth decline rate (0-5%) some 22% of regional SLAs experience this decline level, whereas only 15% of metropolitan SLAs experience the same decline level.

Similarly when a small increase (0-5%) is considered, 26% of regional SLAs experience this level of increase in population compared to 32% of metropolitan SLAs which experience the same level of increase. Comparing the total regional population figures for 2001 and 2006 in Table 2 indicates an increase in population for those areas. This supports the findings of Beer and Clower (2009, p. 378) which suggest that although some parts of rural Australia is experiencing population losses, especially in the north-eastern and south-eastern parts of the country, "overall, the number of regional cities in Australia has grown, partly as a consequence of national population and economic growth".

CLUSTERING

The ABS identifies 18 industry types, 8 occupational categories, 6 classes of employment status, 12 levels of individual weekly income, 21 age groups, and 7 education levels (see Table1). Industry of employment includes number of people employed within each industry. The study utilised all 18 industry types. Occupation type includes number of people employed within each occupation. The study utilised all 8 occupational categories. Individual weekly income includes number of people with a particular income level as well as people with negative and nil income. The 12 individual weekly income levels have been merged into five categories to include nil income; negative income; $1-$999; $1000-$1999; and $2000 and more. Employment status includes number of employed and unemployed people as well as people not in the labour force. The 6 employment status classes have been merged into three new ones of employed; unemployed; and not in the labour force classes. Age group includes number of people within a particular age group. Age groups have been merged to create three new categories of 25-39 years old; 40-64 years old; and 65 and more. Education level includes number of people with different education degrees ranging from certificate level to Postgraduate degree level. Postgraduate degree level was considered as a category which includes people with a higher level of tertiary education and all the other education levels

were merged to create another category. As a result the seven education levels have been merged to create two new categories of high tertiary and postgraduate, and low tertiary and postgraduate.

Industry of employment, occupation type, and income were calculated as a percentage of employed people within each category and employment status, age group, and education level were calculated as a percentage of population for each SLA in 2006. Depending on the number of categories for each variable, cluster analysis generated different number of clusters ranging from two clusters to seven clusters (Tables 4 and 5).

Table 4 Variables and the Emerged Clusters (Regional)

Variables	Number of clusters	Clusters
Industry of employment	7	IndusC1, IndusC2, IndusC3, IndusC4, IndusC5, IndusC6, IndusC7
Occupation type	7	OccupC1, OccupC2, OccupC3, OccupC4, OccupC5, OccupC6, OccupC7
Employment status	3	EmployC1, EmployC2, EmployC3
Individual weekly income	7	IncomeC1, IncomeC2, IncomeC3, IncomeC4, IncomeC5, IncomeC6, IncomeC7
Education level	2	EduC1, EduC2
Age group	2	AgeC1, AgeC2

Note: ‘C’ stands for ‘Cluster’.

Table 5 Variables and the Emerged Clusters (Metropolitan)

Variables	Number of clusters	Clusters
Industry of employment	7	IndusC1, IndusC2, IndusC3, IndusC4, IndusC5, IndusC6, IndusC7
Occupation type	7	OccupC1, OccupC2, OccupC3, OccupC4, OccupC5, OccupC6, OccupC7
Employment status	2	EmployC1, EmployC2
Individual weekly income	5	IncomeC1, IncomeC2, IncomeC3, IncomeC4, IncomeC5
Education level	2	EduC1, EduC2
Age group	2	AgeC1, AgeC2

Note: ‘C’ stands for ‘Cluster’.

Clusters for each variable, categories, and the highest mean scores are presented in Tables 6 and 7.

CLUSTER ANALYSIS RESULTS

Cluster analysis revealed clusters and categories associated with each cluster (see Tables 6 and 7). For the purposes of the analysis only clusters of categories with the highest mean scores are reported. As a result not all the clusters relating to a particular variable will appear in the table. For example, "Employment" cluster 2 (EmployC2) is not reported in Table 6 as three categories of "Employed", "Unemployed", and "Not in labour" appear only in clusters 1 and 3 (EmployC1 and EmployC3). Additionally the highest mean score for both "Unemployed" and "Not in labour" appears in cluster 3 (EmployC3) and for this reason cluster 3 (EmployC3) has been reported twice in Table 6. Some categories relating to a particular variable could appear in more than one cluster. For example "Managers" in "Occupation" appear in both clusters C3 and C6 (OccupC3 and OccupC6). Additionally when a category does not have the highest mean score in any of the clusters, it is not reported (e.g. Wholesale for Occupation).

In the first part of Table 6, clusters based on the industry are presented. Each "Industry" cluster includes a combination of different industry categories with different mean scores. For example, cluster 1 (IndusC1) includes all eighteen industry types. However industry with the highest mean score is selected (Retail Trade). As shown in the table six of eighteen industries indicating the highest mean score appear in one of the existing clusters.

Regional

As it is shown the proportion of employed people in the Public Administration and Safety industry (IndusC2) is higher than all the other industry types with the mean score of 53.20. Agriculture, Forestry and Fishing appears with the second highest mean score within two clusters (IndusC6, IndusC7). Five of eight occupation categories appear with the highest mean scores within which Managers (OccupC3, OccupC6) have the highest mean score. For employment the Employed category (EmployC1) happens to have the highest mean score of 47.11.

The highest mean score (56.56) in cluster 7 (IncomeC7) indicates that the proportion of employed people in income category of "$1-$999" is higher than all the other income categories. Cluster C6 (IncomeC6) appears to include the highest mean score (18.48) for both "$1000-$1999" and "$2000 and more" categories. The High Tertiary and Postgraduate education (EduC2) has the highest mean score (29.72). This indicates that within this cluster the proportion of people with a higher Tertiary and Postgraduate education is higher than those who do not have this level of education. For age, all three categories appear in one of the clusters indicating the highest mean score for that particular age group. The highest mean score (34.25) for the 40-64 years old age group indicates that the proportion of people within this age group are higher than all the other age groups.

Metropolitan

Table 7 presents clusters and the associated categories for metropolitan areas. As shown in the table, six of eighteen industries appear in one of the generated clusters with a highest mean score. Similar to regional areas the proportion of employed people in Public Administration and Safety industry (IndusC6) with mean score of 33.37 is higher than all the other industry types. Four of eight occupation categories appear with the highest mean scores within which Professionals (OccupC3, OccupC4, OccupC6) have the highest mean score (36.88). For employment, similar to regional areas the Employed category (EmployC2) has the highest mean score of 50.36.

Table 6 Variables and Categories, Clusters and Mean Values for Each Cluster (Regional)

Variable	Categories (Name)	Highest Mean% Cluster/Variable
Industry of employment		
IndusC1	Retail Trade	12.20
IndusC2	Public Administration and Safety	53.20
IndusC3	Accommodation and Food Services	23.75
IndusC4	Professional, Scientific and Technical Services	13.12
IndusC5	Mining	30.98
IndusC6	Agriculture, Forestry and Fishing	23.01
IndusC7	Agriculture, Forestry and Fishing	46.41
Occupation type		
OccupC1	Professionals	28.75
OccupC2	Technicians and Trades Workers	16.75
OccupC3	Managers	24.20
OccupC4	Labourers	37.98
OccupC5	Labourers	37.17
OccupC6	Managers	41.13
OccupC7	Machinery Operators And Drivers	18.57
Employment status		
EmployC1	Employed	47.11
EmployC3	Unemployed	2.79
EmployC3	Not in labour	29.32
Individual weekly income		
IncomeC2	Nil income	6.39
IncomeC5	Negative income	1.91
IncomeC6	$1000- $1999	18.48
IncomeC6	$2000 and more	8.83
IncomeC7	$1- $ 999	56.56
Education level		
EduC2	High Tertiary and Postgraduate	29.72
Age group		
AgeC1	40-64 years old	34.25
AgeC1	65 and more	14.47
AgeC2	25-39 years old	22.29

Table 7 Variables and Categories, Clusters and Mean Values for Each Cluster (Metropolitan)

Variable	Categories (Name)	Highest Mean% Cluster/Variable
Industry of employment		
IndusC1	Health Care and Social Assistance	13.17
IndusC2	Retail Trade	11.27
IndusC3	Manufacturing	15.40
IndusC4	Retail Trade	12.29
IndusC5	Professional, Scientific and Technical Services	12.90
IndusC6	Public Administration and Safety	33.37
IndusC7	Agriculture, Forestry and Fishing	20.12
Occupation type		
OccupC1	Managers	23.95
OccupC2	Labourers	17.99
OccupC3	Professionals	36.88
OccupC4	Professionals	26.74
OccupC5	Technicians and Trades Workers	16.68
OccupC6	Professionals	19.83
OccupC7	Technicians and Trades Workers	18.39
Employment status		
EmployC1	Unemployed	3.36
EmployC1	Not in labour	27.88
EmployC2	Employed	50.36
Individual weekly income		
IncomeC1	$1000- $1999	23.55
IncomeC3	Nil income	5.83
IncomeC3	$2000 and more	11.32
IncomeC5	Negative income	0.34
IncomeC5	$1- $ 999	54.95
Education level		
EduC2	High Tertiary and Postgraduate	40.44
Age group		
AgeC1	40-64 years old	31.95
AgeC1	65 and more	15.89
AgeC2	25-39 years old	22.25

All five income levels appear in one of the listed clusters. The highest mean score (54.95) indicates that similar to regional areas the proportion of employed people included within the "$1-$999" income level (IncomeC5) is higher than all the other income levels. The High Tertiary and Postgraduate (EduC2) in education has the highest mean score (40.44). Similar to regional areas this indicates that within this cluster the proportion of people having a higher Tertiary and Postgraduate education is greater than those who do not have that level of education. For age, all three age groups appear within one of the clusters. The 40-64 years old age group (AgeC1) has the highest mean score (31.95).

MULTIPLE REGRESSION

In the second stage of analysis this study attempts to utilise the generated clusters. Therefore clusters with the highest mean scores are selected and used as the basis for regression analysis. These clusters are used as nominal-level dummy variables to examine which clusters determine population growth and decline.

Initial regression analysis was conducted by including industry of employment, occupation type, employment status, individual weekly income, age group and the education level in a model. This analysis revealed that neither occupation type nor employment status had a statistically significant impact on population change. The regression models for regional and metropolitan areas are as follows:

Regional regression model: includes dummy variables associated with industry of employment, individual weekly income, education level, and the age group.

$$\text{Population change} = a + b_1\text{IndusC1} + b_2\text{IndusC2} + b_3\text{IndusC3} + b_4\text{IndusC4} + b_5\text{IndusC5} + b_6\text{IndusC7} + b_7\text{IncomeC1} + b_8\text{IncomeC2} + b_9\text{IncomeC3} + b_{10}\text{IncomeC4} + b_{11}\text{IncomeC6} + b_{12}\text{IncomeC7} + b_{13}\text{EduC2} + b_{14}\text{AgeC2}$$

Metropolitan regression model: includes dummy variables associated with industry of employment, and the age group.

$$\text{Population change} = a + b_1\text{IndusC1} + b_2\text{IndusC2} + b_3\text{IndusC3} + b_4\text{IndusC4} + b_5\text{IndusC5} + b_6\text{IndusC7} + b_7\text{AgeC2}$$

The standard ordinary least-square (OLS) regression method was used for this analysis.

Since the population change data was not normally distributed, it was therefore transformed using a log (10) of the percentage change between 2001 and 2006 population data. After transformation some cases appeared to have negative values, and therefore a constant was added and applied across whole cases of the population change variable to maintain positive scaling. Results for multiple regression analysis are reflected in Tables 8 and 9.

Multiple Regression Analysis Results

For this study regression analysis yielded a low R^2 (Particularly for metropolitan analysis with R^2 of 0.073). The low R^2 reflects the nature of the analysis in which there are a lot of variables that could explain population growth. This study did not intend to provide a comprehensive account for "what" influences population growth, but instead to find some key variables that "significantly" account for population growth and could help to explain it.

When incorporating dummy variables into regression model, only *n*-1 dummy variables are entered to represent the required information (where *n* signifies the number of clusters for

each variable category). As shown in Tables 8 and 9, within each variable (industry, income, education, age) one cluster constitutes the base cluster and all the other clusters are compared against that cluster. As a result the base clusters (IndusC6; IncomeC5; EduC1; AgeC1) do not appear in Table 8 and (IndusC6; AgeC1) are not reported in Table 9.

Table 8 Model Regression Results (Regional)

Independent Variables	Categories (Name)	Coefficient	SE coefficient	Standar-dised coefficient	T-Stat.	P-value
Intercept		0.660	0.009		72.161	0.001
Industry of employment						
IndusC1	Retail Trade	**0.026**	0.006	0.178	4.372	0.001
IndusC2	Public Administration and...	-0.014	0.012	-0.054	-1.154	0.249
IndusC3	Accom. and Food Services	**0.052**	0.019	0.090	2.781	0.006
IndusC4	Professional, Scientific and..	**0.049**	0.015	0.125	3.176	0.002
IndusC5	Mining	**-0.100**	0.014	-0.296	-7.358	0.001
IndusC7	Agriculture, Forestry and...	**-0.034**	0.008	-0.181	-4.332	0.001
Individual income level						
IncomeC1	$1- $ 999	0.007	0.010	0.045	0.720	0.472
IncomeC2	Nil income	0.006	0.015	0.017	0.378	0.706
IncomeC3	$1- $ 999	**0.026**	0.014	0.094	1.909	0.057
IncomeC4	$1- $ 999	0.021	0.014	0.059	1.468	0.142
IncomeC6	$1000- $ 1999 $2000 and more	**0.136**	0.019	0.323	7.227	0.001
IncomeC7	$1- $ 999	-0.002	0.009	-0.014	-0.210	0.834
Education level						
EduC2	High Tertiary and Postgrad.	**0.014**	0.006	0.097	2.429	0.015
Age group						
AgeC2	25-39 years old	**0.022**	0.007	0.140	3.040	0.002

Notes: R^2 = 0.353; adjusted R^2 = 0.340; SEE = 0.056.
Coefficients in bold: Significant at the 95% level.

Regional

Agriculture, Forestry and Fishing (IndusC6) constitutes the base cluster, all the other industry clusters are compared against this cluster. Another Agriculture, Forestry and Fishing cluster (IndusC7) shows a negative coefficient of -0.034 and a negative t-value of -4.33. There is a negative correlation between Agriculture, Forestry and Fishing with both the 25-39 years old age group (r= -0.03, p<0.352) and the High Tertiary and Postgraduate education cluster (r=-0.05, p<0.174), however, neither are statistically significant. This indicates that on the one hand the industry is not labour intensive and on the other hand highly educated people are absorbed in other different sectors. Agriculture, Forestry and Fishing is commodity export industry and have a negative impact on population growth. Industrial restructuring and the need for improvement in efficiency was identified by Regional Women's Advisory Council (2001).

Table 9 Model Regression Results (Metropolitan)

Independent Variables	Categories (Name)	Coefficient	SE coefficient	Standar-dised coefficient	T-Stat.	P-value
Intercept		2.236	0.061		36.579	0.001
Industry of employment						
IndusC1	Health Care and Social Assistance	**0.304**	0.076	0.200	3.997	0.001
IndusC2	Retail Trade	**0.334**	0.109	0.130	3.050	0.002
IndusC3	Manufacturing	**0.222**	0.069	0.175	3.234	0.001
IndusC4	Retail Trade	**0.383**	0.069	0.301	5.533	0.001
IndusC5	Professional, Scientific and Technical Services	**0.296**	0.088	0.156	3.352	0.001
IndusC7	Agriculture, Forestry and Fishing	**0.224**	0.130	0.072	1.720	0.086
Age group						
AgeC2	25-39 years old	**0.202**	0.043	0.182	4.699	0.001

Notes: $R^2 = 0.073$; adjusted $R^2 = 0.052$; SEE = 0.53.
Coefficients in bold: Significant at the 95% level.

Similarly the Mining industry (IndusC5) has a negative impact on population growth with a negative coefficient of -0.100 and a t-value of -7.36. The analysis also suggests that the correlation between Mining and the 25-39 years old age group is positive but the correlation is small ($r = 0.28$, $p < 0.001$). Similarly the correlation between the Mining and High Tertiary and Postgraduate ($r = 0.01$, $p < 0.669$) is positive but not statistically significant. Positive correlation also exists between Mining and the $2000 and more income level ($r = 0.57$, $p < 0.001$). This indicates that on the one hand the industry is relatively labour intensive however it does not attract numerous highly educated people. On the other hand the income level attracts people to the industry.

Beer and Clower (2009) emphasise the role of industry and suggest that if a region or city specialises in industries with limited prospects they may stagnate, whilst areas that link their economy to a growing industry will benefit into the future. Beer *et al*. (2003) suggest that the mix within industries is important as well. This was identified by O'Connor *et al*. (2001) which suggest that attraction of New South Wales and Victoria to businesses could be seen as a result of concentration of particular types of industries in those areas. On the other hand similar to Agriculture, Forestry and Fishing the Mining industry is commodity export industry and has a negative impact on population growth. Clusters with concentration in mining experienced population loss despite the success in the mining exports as identified by Beer and Clower (2009).

Considering the coefficient values for all industry clusters, Accommodation and Food Services (IndusC3) has the highest positive coefficient of 0.052 and a t-value of 2.78. There is a positive correlation between Accommodation and Food Services with the 25-39 years old age group ($r = 0.15$, $p < 0.001$) and the High Tertiary and Postgraduate education cluster ($r = 0.39$, $p < 0.001$). This indicates that Accommodation and Food Services industry is labour intensive and highly educated people are absorbed in this sectors. There is a positive correlation between Accommodation and Food Services with the $1000-$1999 income level ($r = 0.18$, $p < 0.001$) as well.

The second highest positive coefficient belongs to Professional, Scientific and Technical Services (IndusC4). The coefficient for this cluster is 0.049 with a t-value of 3.17. The findings indicate a positive correlation between Professional, Scientific and Technical Services with the 25-39 years old age group ($r = 0.28$, $p < 0.001$) and with the High Tertiary and Postgraduate education cluster ($r = 0.71$, $p < 0.001$). This indicates that similar to Accommodation and Food Services, Professional, Scientific and Technical Services is labour intensive and highly educated people are absorbed in this sector. Professional, Scientific and Technical Services also shows a positive correlation ($r = 0.44$, $p < 0.001$) with the $2000 and more income level.

The Retail Trade (IndusC1) follows the previous two industries. Although this cluster does not have as large a positive coefficient (0.026) as the other two clusters (IndusC3, IndusC4), the t-value of 4.37 does indicate the relative importance of this cluster. Retail Trade also shows a positive correlation with the High Tertiary and Postgraduate ($r = 0.46$, $p < 0.001$) however, it correlates with the 40-64 years old ($r= 0.23$, $p<0.001$) and the 65 and more age groups ($r = 0.49$, $p < 0.001$). Similarly there is a positive correlation between Retail Trade and the $1000-$1999 income level ($r = 0.12$, $p < 0.001$).

Negative income (IncomeC5) constitutes the base cluster, all the other income clusters are compared against this cluster. Examining parameter estimates indicates that Negative income in fact has a negative coefficient of -0.040. The highest coefficient (0.136) belongs to "$1000-1999$ and $2000 and more" income level (IncomeC6) which encompasses both the income levels with t-value of 7.22. Association of $1000-$1999 income level with Accommodation and Food Services and the Retail Trade is considerable. Similarly association of $2000 and more income level with the Professional, Scientific and Technical Services and the Mining industries is considerable. Analysis of individual weekly income reveals that negative income (IncomeC5) is directly associated with population decline. On the other hand the $1000 and over individual weekly income level has a positive impact on population change.

Low Tertiary and Postgraduate (EduC1) constitutes the base cluster, other education cluster (EduC2) is compared against this cluster. Considering the coefficient values for both clusters, High Tertiary and Postgraduate (EduC2) has a positive coefficient of 0.014 and t-value of 2.42. The High Tertiary and Postgraduate also shows a strong correlation ($r = 0.63$, $p < 0.001$) with both the $1000-$1999 as well as the $2000 and more income levels ($r = 0.47$, $p < 0.001$). The High Tertiary and Postgraduate has the lowest correlation with the $1-$999 income level ($r = 0.30$, $p < 0.001$), but the correlation is still significant. This shows that a higher level of education positively contributes to higher population growth. In contrast, a lower level of education does not have as much impact on population growth.

Regional areas with the capacity to offer some services such as education have population growth potential as identified by Beer (1999) and this is clearly supported by the findings of this current study. Attracting skilled population to regional Australia is a very challenging task and every regional area needs to be considered separately based on their different needs and resources.

The "40-64 years old and 65 and more" age groups cluster (AgeC1), is considered as the base cluster, other age cluster (AgeC2) is compared against this cluster. Analysis indicates that 25-39 years old (AgeC2) has a positive coefficient of 0.022 and t-value of 3.04. Not surprisingly 25-39 years old age group has a positive correlation ($r = 0.20$, $p < 0.001$) with the High Tertiary and Postgraduate. Analysis of age groups also revealed that age groups of 40-64 and 65 and more do not have as much impact on population growth. These patterns of ageing are crucial but little studied primarily.

Metropolitan

As shown in Table 9, within each variable category (industry of employment, individual weekly income, education level, age group) one cluster constitutes the base cluster and all the other clusters are compared against that cluster. As a result the base clusters (IndusC6; AgeC1) do not appear in the Table.

For metropolitan areas the factors having positive impact are very different to the regional areas. As results indicate unlike regional areas, for metropolitan areas income and education did not appear to have any impact. Similarly industries with the highest positive coefficient values are different to the industries with the highest positive coefficient values for regional areas.

Public Administration and Safety (IndusC6) constitutes the base cluster, all the other clusters are compared against this cluster. Considering coefficient values for all industry clusters, Retail Trade (IndusC4) has the highest positive coefficient of 0.383 and t-value of 5.53. The second highest positive coefficient (0.334) belongs to the Retail Trade (IndusC2) also. Findings also shows that the Retail Trade has a positive correlation with the 65 and more age groups ($r = 0.08$, $p < 0.001$) also the correlation is small. Retail Trade also shows a negative correlation with the $1000-$1999 income level ($r = -0.14$, $p < 0.001$) and the $2000 and more income level ($r = -0.30$, $p < 0.001$). This could be due to the fact that most of people employed in Retail Trade industry belong to the lower category of the income level ($1-$999). This industry also shows a negative correlation with the High Tertiary and Postgraduate ($r = -0.07$, $p < 0.001$) although the correlation is small. This indicated that highly educated people are absorbed in other industries rather than the Retail Trade.

Health Care and Social Assistance (IndusC1) has the second highest coefficient value of 0.304 and t-value of 3.99. This industry shows a positive correlation with the 65 and more age group ($r = 0.13$, $p < 0.001$). Health Care and Social Assistance also shows a positive correlation with the $2000 and more income level ($r = 0.10$, $p < 0.001$)

Professional, Scientific and Technical Services industry (IndusC5) follows the previous two industries. Although this cluster does not have as large a positive coefficient (0.296) as the previous three clusters (IndusC4, IndusC2, IndusC1), the t-value of 3.35 does indicate the relative importance of this cluster. Analysis shows that Professional, Scientific and Technical Services industry has a negative correlation ($r = -0.10$, $p < 0.001$) with the Negative income level, and the $1-$999 income level ($r = -0.11$, $p < 0.001$), however this industry shows a positive correlation with the $1000-$1999 income level ($r = 0.17$, $p < 0.001$) and a very strong correlation with the $2000 and more income level ($r = 0.70$, $p < 0.001$). Professional, Scientific and Technical Services industry also shows a positive correlation with the High Tertiary and Postgraduate ($r = 0.15$, $p < 0.001$). These findings obviously indicate that within Professional, Scientific and Technical Services industry income level attracts the highly educated people.

Agriculture, Forestry and Fishing (IndusC7) has the second lowest coefficient of 0.224, and t-value of 1.72. Analysis shows that Agriculture, Forestry and Fishing industry has a positive correlation with the Negative income level ($r = 0.11$, $p < 0.001$), however it shows a negative correlation ($r = -0.13$, $p < 0.001$) with the $2000 and more income level. this is an indication of the decrease in income level within Agriculture, Forestry and Fishing industry. Agriculture, Forestry and Fishing industry is a commodity export industry and have a negative impact of population growth.

Manufacturing (IndusC3) has the lowest coefficient value of 0.222 and the t-value of 3.23. Analysis shows that Manufacturing has a positive correlation with the Negative income level

($r = 0.10$, $p < 0.001$) and the \$1-\$999 income level ($r = 0.10$, $p < 0.001$). However this industry shows a negative correlation with the \$1000-\$1999 income level ($r = -0.15$, $p < 0.001$) and an average negative correlation with the \$2000 and more income level ($r = -0.40$, $p < 0.001$). Manufacturing also shows a negative correlation with the High Tertiary and Postgraduate ($r = -0.10$, $p < 0.001$). Similar to the Agriculture, Forestry and Fishing industry, Manufacturing indicated a decrease in income. It also indicates that highly educated people are less absorbed in this industry.

The "40-64 years old and 65 and more" age groups cluster (AgeC1), is considered as the base cluster, other age cluster (AgeC2) is compared against this cluster. Analysis indicates that 25-39 years old (AgeC2) has a positive coefficient of 0.202 and t-value of 4.69. Analysis shows that the 25-39 years old age group has a very strong positive correlation with the \$1-\$999 income level ($r = 0.97$, $p < 0.001$) and the \$1000-\$1999 income level ($r = 0.94$, $p < 0.001$). Correlation between the 25-39 years old age group and the \$2000 and more income level decrease ($r = 0.44$, $p < 0.001$) but still considerable.

The 25-39 years old age group also shows a very strong positive correlation with the High Tertiary and Postgraduate ($r = 0.96$, $p < 0.001$). Analysis of age groups also revealed that age groups of 40-64 and 65 and more do not have as much impact on population growth. These patterns of ageing are crucial but little studied primarily.

POPULATION CHANGE INSIDE THE CLUSTERS

The previous section presented the results of the regression analysis and identified clusters with the significant coefficient values. This section attempts to represent the population change direction within those clusters and to find out whether the magnitude and the direction of population change within a cluster relates to its coefficient value. Tables 10 and 11 represent clusters and the percentage of members (SLAs) of each cluster which are facing positive or negative population change. They also present the net percentage of change within each cluster.

Regional

Within Accommodation and Food Services cluster (IndusC3) 71% of the SLAs are facing population increase as opposed to 29% of the SLAs which are losing population. For Professional, Scientific and Technical Services cluster (IndusC4) this rate is a 90% increase and 10% loss and for Retail Trade (IndusC1) it is 72% increase and 29% loss. In Mining (IndusC5) 53% of SLAs are losing population and 47% are gaining population. This cluster indicates a negative coefficient value in Table 8. For Agriculture, Forestry and Fishing cluster (IndusC7) which indicates a negative coefficient value in Table 8 up to 62% of SLAs are facing population loss and only 38% are gaining population.

Within the "\$1000- \$1999 and \$2000 and more" income levels cluster (IncomeC6) 97% of the SLAs are gaining population and only 3% are losing population. For the \$1- \$999 income level cluster (IncomeC3) the rate is 73% gain and 27% lose. It is clear that clusters with a higher positive coefficient value have a higher population gain rate.

Within the High Tertiary and postgraduate cluster (EduC2) 85% of SLAs are gaining population and 15% are losing population. Finally for 25-39 years old age group cluster (AgeC2) there is a 65% population gain and 35% population lose. Age categories in regional Australia appear to be skewed compared to the urban capital centres.

Table 10 Percentage of SLAs within Each Cluster with Negative or Positive Population Change (Regional)

Clusters	Categories (Name)	% of members (SLAs) inside each cluster facing negative or positive population growth		Net % of change inside each cluster
		Positive	Negative	
Industry				
IndusC1	Retail Trade	29	72	6
IndusC2	Public Administration and Safety	48	52	-1
IndusC3	Accommodation and Food Services	29	71	5
IndusC4	Professional, Scientific and Technical Services	10	90	19
IndusC5	Mining	53	47	-2
IndusC7	Agriculture, Forestry and Fishing	62	38	-1
Income				
IncomeC1	$1- $ 999	28	72	7
IncomeC2	Nil income	43	57	3
IncomeC3	$1- $ 999	27	73	11
IncomeC4	$1- $ 999	19	81	6
IncomeC6	$1000- $ 1999 $2000 and more	3	97	36
IncomeC7	$1- $ 999	40	60	3
Education				
EduC2	High Tertiary and Postgraduate	15	85	24
Age				
AgeC2	25-39 years old	35	65	12

Metropolitan

Within the Retail Trade cluster (IndusC4) 86% of the SLAs are facing population increase as opposed to only 14% of the SLAs which are losing their population. For the Health Care and Social Assistance cluster (IndusC1) this rate is a 91% increase and 9% loss. Within Professional, Scientific and Technical Services cluster (IndusC5) 89% of SLAs are gaining population and only 11% are losing population. Within the Agriculture, Forestry and Fishing cluster (IndusC7) up to 100% of SLAs are gaining population. For Manufacturing cluster (IndusC3) this rate is up to 80% increase as opposed to 20% decrease in population. For 25-39 years old age group cluster (AgeC2) there is a 63% population gain and 37% population lose.

As is evident, for both regional and metropolitan areas, clusters with a positive coefficient value in regression analysis show a positive population gain and clusters with a negative coefficient value show a population loss. Overall clusters with a positive coefficient value in Tables 8 and 9 show a higher rate of population gain in Tables 10 and 11 and clusters with a negative coefficient value are clusters that show a higher rate of population loss.

Table 11 Percentage of SLAs within Each Cluster with Negative or Positive Population Change (Metropolitan)

Clusters	Categories (Name)	% of members (SLAs) inside each cluster facing negative or positive population growth		Net % of change inside each cluster
		Positive	Negative	
Industry				
IndusC1	Health Care and Social Assistance	9	91	7
IndusC2	Retail Trade	14	86	9
IndusC3	Manufacturing	20	80	7
IndusC4	Retail Trade	14	86	9
IndusC5	Professional, Scientific and Technical Services	11	89	8
IndusC7	Agriculture, Forestry and Fishing	0	100	6
Age				
AgeC2	25-39 years old	37	63	5

DISCUSSION

This paper builds upon the works of researchers Smith (1965), Beer (1999), Beer and Maude (1995), Beer and Clower (2009), Freestone (2003), but takes a different approach to investigate the impact of socio-economic factors on population change in regional and metropolitan Australia. This study uses a different clustering algorithm (*k*-means) to cluster SLAs in regional and metropolitan Australia to investigate the impact of emerging clusters on population growth and decline. The study further examines each cluster separately to investigate whether the role of emerging clusters on population growth and decline are linked to the population change trend inside each cluster.

As a result of reaction to the changing structure of industry, regional and metropolitan Australia experience either a positive or a negative change in population. Results show that regional economy reacts positively to Accommodation and Food Services; Professional, Scientific and Technical Services industries as well as the Retail Trade industry. Analysis from this research suggests that within Accommodation and Food Services; Professional, Scientific and Technical Services; and Retail Trade clusters some SLAs are losing and some are gaining population however, the balance of change for these industries is positive. This current analysis suggests that some regional SLAs in Mining cluster are losing population and some are gaining population but the balance of change is negative. This indicates that clusters with concentration in mining might experience population loss (Beer and Clower, 2009).

SLAs in Agriculture, Forestry and Fishing experience the same situation i.e. the balance of change is negative.

Metropolitan economy on the other hand reacts positively and strongly to industries such as Retail Trade, Health Care and Social Assistance, Professional, Scientific and Technical Services, and Manufacturing. Although results show that within the Retail Trade, Health Care and Social Assistance, Professional, Scientific and Technical Services and Manufacturing clusters some SLAs are losing and some are gaining population however, the balance of change for these industries is positive.

While for regional areas Retail Trade has the third highest impact on population change, it takes the first place for metropolitan areas. Health Care and Social Assistance industry has the second place. Professional, Scientific and Technical Services industry that has the second place for regional areas takes the third place for metropolitan areas. The role of Manufacturing industry for metropolitan areas is considerable as well while this is absent for regional areas.

This analysis also shows that a higher level of education positively contributes to higher population growth in regional areas. In contrast a lower level of education does not have a big impact on positive population growth. Beer (1999) suggests that regional cities with the capacity to offer some services such as education might have growth potentials. Every regional area needs to be considered separately based on their different needs and resources. Investing in people and harnessing innovation through tertiary education could assist as identified by Smith *et al*. (2011). Unlike for regional areas, income and education did not appear to have any impact in metropolitan areas. The analysis shows that the 25-39 years old age group has a positive impact on population and the 40-64 and 65 and more age groups do not have a big impact on population growth.

Comparison of regression analysis results with population change direction inside each cluster shows a close association. For the regional areas Accommodation and Food Services (IndusC3); Professional, Scientific and Technical Services (IndusC4); and the Retail Trade (IndusC1) each with a high positive regression coefficient (Table 8) show a positive net population growth (Table 10). Mining (IndusC5), and Agriculture, Forestry and Fishing (IndusC7) show high negative coefficients and they have a negative net population growth. The "$1000-1999$ and $2000 and more" income levels (IncomeC6); and the $1-$999 income level (Income C1, C3, C4, C7) all show a positive net population growth in Table 10. Also both the High Tertiary and postgraduate (EduC2) and the 25-39 years old age group (AgeC2) show a positive net population growth. Regional Development Australia (2010) discusses a report by OECD and suggests that policy initiatives such as investing in people and higher education in regional areas are most likely to help with the development of those areas.

For metropolitan areas Retail Trade (IndusC2); Health Care and Social Assistance (IndusC1) and Professional, Scientific and Technical Services (IndusC5) each with a high positive regression coefficient (Table 9) show a positive net population growth (Table 11). Also the 25-39 years old age group (AgeC2) show a positive net population growth.

CONCLUSION

This paper builds upon previous works, but takes a comparative approach to address population change issue in regional and metropolitan Australia. This study clusters SLAs in regional and metropolitan Australia and investigates the impact of emerging clusters on population growth and decline.

Findings of this paper have some implications on both regional and metropolitan economic policy making. This highlights the need for reviewing investment policies in regional and metropolitan areas in terms of investing in particular industry types. It is believed that in order to generate a balance in population change between regional and metropolitan areas or reverse the current trend as explained earlier in this paper, the factors influencing population change should be considered separately for regional and metropolitan Australia. Overall this research identifies a number of key factors such as industry of employment, age group, individual weekly income, and education level that contribute to the population growth and decline in regional and metropolitan Australia.

These key factors for regional areas are Accommodation and Food Services; Professional, Scientific and Technical Services; and Retail Trade industries. For metropolitan areas Retail Trade is the most important industry followed by Health Care and Social Assistance, Professional, Scientific and Technical Services and Manufacturing industries. Income and education did not appear to have impact in metropolitan areas.

This research would benefit from further comparative analysis of the clustering algorithms. Since different clustering methods are applicable for different problems, the aim for further research is to consider a comparative study of the clustering methods using two different algorithms: *k*-means and modified global *k*-means (MGKM) algorithms (Bagirov and Mardaneh, 2006). This could help in identifying the algorithm that performs better for the purpose of SLAs clustering.

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Transaction Sector, Markets and Regional Income Disparities

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ABSTRACT

The New Institutional Economics argues that markets must be made, usually by identifiable people such as the producers of new products or services (Furubotn and Richter, 2010). This paper argues that the transaction sector (Wallis and North, 1986) provides the services necessary to make and extend markets. Following Adam Smith, an extension of the market enables a more efficient division of labour, thus growing productivity and incomes. Markets are organised in a wide variety of ways, and are formed and embedded in pre-existing social structures (Granovetter, 1992, 2005). The paper reviews literature on the relationship between regional transaction sectors, regional incomes, and social structure. Regional disparities of income may not be simply a function of resource endowment; they may arise from pre-existing local and inter-regional social structures which affect market development. The paper outlines a program of future research which may provide a practical diagnostic for regional economic development policy.

INTRODUCTION

This paper is part of a larger project to estimate the size and structure of the transaction sector (Wallis and North, 1986) in regional and national economies, to estimate the relationship between the transactions sector, income and productivity, and to identify the social and structural factors which may affect this relationship and so cause national and regional income disparities.

The exchange transaction is the fundamental element of economic life and productivity growth. Scarcity, insatiable demand facing limited supply, defines economic action (Granovetter, 1992, p. 32) and motivates the exchange transaction. In an exchange transaction two parties voluntarily exchange one scarce good for another scarce good and each party judges the result as improving their welfare.

Schumpeter points out that since before Adam Smith's (1776) *An Inquiry into the Nature and Causes of the Wealth of Nations*, economists have argued that improvement in productivity and incomes depends on the division of labour which in turn relies on the extent of exchange transactions and the markets in which they occur. In Adam Smith:

> Division of labor itself is attributed to an inborn propensity to truck and its development to the gradual expansion of markets – the extent of the market at any point of time determining how far it can go. (Schumpeter, 1954, p. 187)

The exchange transaction is not a free lunch; it requires resources for search, inspection, bargaining, agreement, control and enforcement (Coase, 1937). These resources are provided in markets and are measured as the transaction sector by Wallis and North (1986).

Furubotn and Richter (2010) in *The New Institutional Economics of Markets* describe the need to make markets and the diverse institutions and networks which may be engaged in the making and extending of markets. Markets provide governance and services for exchange transactions, including search, inspection, negotiation, agreement, control and enforcement. Markets have to be made and come in many forms such as internet platforms (Baron, 2002), networks, physical meeting spaces, or corporations. Indeed, markets are privately produced public goods. (Furubotn and Richter, 2010, pp. ix-xi)

Markets are not simply economic constructs: they are formed and embedded in social structures (Granovetter, 1992, 2005).

The formation of markets creates winners and losers (Furubotn and Richter, 2010), and positive transaction costs and faulty time perspectives, among other factors, mean that it is seldom possible for winners to compensate, or even identify, the losers (Coase, 1960). The choice of market structure is an arbitrary compromise between social and economic interest, reflecting history and social structure.

Regional income disparities can arise from differences between regions in the capacity to make markets for the goods and services of the region, thus limiting the capacity of the region to conduct the exchange transactions necessary for the division of labour, productivity growth and income growth. These differences are not necessarily a function of resource endowment, they can also arise from social structure and from a failure to develop or invest in market development.

The paper begins an investigation of the relationship between regional transaction sectors, regional specialisation and regional incomes, and how this relationship may be affected by pre-existing social structures. It lays a foundation for a future program of empirical work on the relationship between the transaction sector and regional incomes, and on the effects of other factors, such as social structure, particularly the structure and narrative history of social networks. The paper builds on previously published work on a regional measure of the transactions sector (O'Malley, 2010). Further research may provide a practical diagnostic measure targeting regional economic development policy.

THE NEW INSTITUTIONAL ECONOMICS AND MARKETS

The New Institutional Economics provides an operational definition of markets as loci for exchange, as institutions which must be created in order to manage exchange transactions by dealing with problems of positive transaction costs, imperfect foresight, and bounded rationality of traders (who may act guilefully) (Furubotn and Richter, 2010, pp. ix-x). Specific markets are established by entrepreneurs, intermediaries, producers, governments and others; markets seldom evolve spontaneously as for instance in so-called 'black' markets.

Markets are institutions which coordinate the many individual plans of suppliers and demanders, and enable the formation of contracts for trade in goods and services. The individual trader must "…choose (or establish) a specific market organization within which to undertake the trade in the commodity; and …select, within that market organization, a specific contract (a contractual governance structure) to utilize in conducting exchange with a trading partner" (Furubotn and Richter, 2010, p. x and note 6).

The design of markets is complex. Furubotn and Richter (2010: xi) define the tasks of market organisations to include establishing:

- "…the common usage of money, common accounting of time, common units of measurement," which are usually functions of central government;

- "common locations of trade (as local markets, an internet platform), the organization of the pricing mechanism (as auctioning, rigid prices cum advertising, wage bargaining between unions and employers)", which may be functions of local traders or of local or central government, and
- a "…specific …market design …to find ways of dealing with certain activities of trade such as: search, inspection, bargaining, contract execution, control, and enforcement".

The transaction sector performs the tasks of making market; Wallis and North (1986) identify these tasks as the tasks of the transaction sector, performed by, among others, wholesale and retail traders, bankers and financiers, insurers, real estate and other sales agents, managers, inspectors, clerks, the legal system, police and security workers, and local or national government.

The formation of specific markets by the transaction sector is relevant to policy making because "…specific markets can be conceived as privately formed and operated public goods that are based on sets of particular formal or informal rules (in addition to the elementary constitutional rules …)" of "…private property, contractual obligations and obligations from tortuous acts" (Furubotn and Richter, 2010, pp. ix-x).

The public good of markets arises from specific rules which create a balance between transaction costs, self-seeking behaviours, uncertainty and risk. In this imperfect but more realistic economic world, specific markets matter to individuals and to society but cannot exist without rules or institutions to sustain them. Specific markets have to be formed, some spontaneously but mostly by individuals, who may be intermediaries or producers of new products. The formation, governance and operation of markets matters to society, requires governance and institutions, and is therefore clearly relevant to and affected by public policy.

Market institutions provide coordination and governance for exchange transactions. The next section describes the role of the transactions sector.

THE TRANSACTION SECTOR AND MARKET TASKS

Wallis and North (1986) introduce the idea of the transaction sector and measure it as the value of the total resources committed to performing exchange transactions expressed as a share of total economic output (GDP). Estimates of the transaction sector provide a measure of the commercial (i.e. paid) capacity to find or to design and form markets.

The transaction sector consists of the banking, finance, insurance, real estate, and wholesale and retail trade industries, public administration and defence, together with transaction service occupations located in other industries. Transaction service occupations include managers, legal service workers, accounting workers, sales and procurement workers, inspectors, clerical and protective service workers and police. These are the intermediaries and occupations which organize the location, the pricing mechanism, search, inspection, bargaining, contract execution, control and enforcement required for markets (Wallis and North, 1986).

Their measure relies on input-output tables, earnings data and Census of Population data, and is not feasible for regions where detailed input-output tables are not available.

However, Australian Census of Population data do allow an estimation of the share of the total labour force employed in the industries and occupations of transaction sector as a share of total employment, providing an alternative and feasible measure for use in regions. (O'Malley, 2010) This estimation uses readily accessible regional data from the Australian population census to estimate the size of regional transactions sectors and enables the study of the relationship of the transaction sector with regional competitiveness and productivity. A

robust relationship would provide policy makers and planners with a diagnostic tool for assessing the capacity of regional transactions sectors and policies to strengthen the foundations for regional productivity and competitiveness.

The paper argues that this alternative methodology for estimating the resources used in the transaction sector, as estimated by Wallis and North (1986), is a workable estimate of the resources used in the making and extending of markets in which exchange can occur. There are several possible objections to this view.

First, the labour force estimate, like the Wallis and North (1986) estimate, excludes those market making services which are not traded, but are provided without economic reward. The counter-argument can be that since the provision of market transaction services requires some skills, at least some of the non-market transaction services may be provided by people who are employed in the transactions service labour force.

Second, the workforce engaged in sustaining regional markets may not be resident in the regions. Possible reasons for this include agglomeration effects and scale economies in the conduct of transactions attract transaction workers to cities. Government agencies, higher education, health services and cultural institutions tend to concentrate in capital cities; the resulting forces of agglomeration may reduce transaction costs in cities and thus attract the transaction sector workers in banking and trading activities, as well as the managers of major corporations.

There will be inter-regional linkages which may allow the transaction sector of a region, particularly a capital city, to have an effect on market formation in other regions.

Building on Coase (1937), Wallis and North (1986) measure transaction services within firms, institutions and markets, and they assert that the growth of transaction services has extended markets and provided for an increase in the division of labour, thus providing an explanation of long term productivity growth and economic development.

> Economics and theories of economic growth revolve around the gains from trade arising from specialization and division of labor. But such gains are only realized through exchange …. Until economic organizations developed to lower the costs of exchange we could not reap the advantage of ever greater specialization. …The development of specialized banking, finance, trade, and other transaction functions are the necessary requirements for enhancing productivity, and so is the role of government in specifying and enforcing a system of property rights. (Wallis and North, 1986, pp. 120-121)

Markets are the economic organizations which support exchange; markets take many forms, including hierarchies and hybrid contracts, and the transaction sector measures the resources they use.

The New Institutional Economics provides a powerful explanation for the existence of the transaction sector as the means by which markets are created, sustained and extended, and Wallis and North (1986) provide an empirical measure of the traded services devoted to creating, sustaining and extending markets.

The next section outlines literature on the diversity of markets, and the subsequent sections outline the literature on effects of social structure and history on market structure and performance.

THE DIVERSITY WITHIN THE MARKET 'BLACK BOX'

> Coase's [(1937)] key insight was that firms and markets were alternative means for organizing similar kinds of transactions. (Powell, 1990, p. 296, in Furubotn and Richter, 2010, p. 154)

Coase (1937) demonstrated that positive transaction costs cause firms to be formed in order to avoid the higher cost of managing exchange transactions by using the price mechanism in a formal market. "The main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism." (1937, p. 390) He proceeds to note costs of 'discovering' prices, 'costs of negotiating and concluding a separate contract for each exchange transaction', the 'difficulty forecasting' and specifying in advance what the counterparty in a long term contract will be required to do, and the different tax treatment of transactions within or outside firms (idem, pp. 390-392).

If markets are institutions for the management of exchange transactions, then Coase (1937) shows that positive transaction costs require some exchange transactions to take place inside firms where prices may be set in many ways.

Between firms, or hierarchies, and markets, Williamson (1991) interposes hybrids as relational contracting structures in which 'credible commitments' between the parties provide for the governance of continuing transactions.

Coase (1937) and Williamson (1991) established hierarchies and hybrid contracts as alternative means of organising continuing exchange transactions. Where hierarchies use administrative fiat to restore order when an unanticipated change has made continuation of a transaction disadvantageous to one of the parties, hybrid contracts create, in advance, credible commitments between the parties to adjust their terms and behaviours under the contract to restore mutual advantage.

Markets can take various institutional forms: in the classical form price is established by auction, by advertisement or by haggling, and the quality of the exchange is governed by law; in the network form trading is regularly repeated and the exchange is governed by reputation and trade organisations; and in the vertically integrated form trade is governed by the employment contract and administrative decision (see Powell, 1990, p. 300, Table 1).

The contracts on offer tend to align with the institution: spot contracts in classically defined markets and advertised outlets; hybrid contracts providing for long-term cooperative adaptations between the parties in network market organisations such as clusters, alliances or cooperatives, or finally vertically integrated hierarchies to manage exchange transactions within hierarchical organisations and companies (Williamson, 1996, p. 330; Coase, 1937; Powell, 1990, p. 300, reprinted in Furubotn and Richter, 2010, p. 158).

The New Institutional Economics describes a myriad of ways in which exchange transactions are organized in firms, networks, clusters and other social institutions as well as in the organized places of exchange more commonly recognised as markets.

Acheson (1985) describes the networks and long-term relationships in the Maine lobster market. The search and inspection problem, finding prices and discerning the quality of goods available, is addressed by (Nelson, 1970, 1974). Nelson notes that the quality of 'search' goods can be discerned by inspection but inspection involves transport costs; however the quality of 'experience' goods cannot be discerned without trying the goods by tasting, test driving, or making an initial purchase. Powell (1990) describes the diversity of trading arrangements including markets, networks and hierarchies, all of which solve the problems of exchange transactions and so create opportunities to trade. (Furubotn and Richter, 2010)

Powell (1990, p. 297) suggests several forms of transaction management including the governance of the employment relationship, the multi-divisional firm, relational contracting, collaboration, out-sourcing, repeated trading, quasi-firms, subcontracting, franchising, joint ventures, decentralised profit centres and matrix management.

Because these are all forms of market (exchange organisation) within which exchange transactions are conducted, they all fit the Smithian analysis that an extension of markets and exchange transactions extends the division of labour and specialisation thus improving productivity and incomes.

Rather than a continuum, Powell prefers the view that there are "…many forms of collaboration that are viable means of exchange." (1990, p. 298) and he points to the role of reciprocity and collaboration as alternative governance mechanisms. Powell (1990, p. 298, note 4) agrees that credible commitments provide "…a marvellous array of mechanisms for creating mutually reliant and self-enforcing agreements [which] …are quite useful in assessing what kinds of network agreements are likely to prove durable."

Powell's concerns about the market, hybrid, hierarchy continuum are that "It is historically inaccurate, overly static, and it detracts from our ability to explain many forms of collaboration that are viable means of exchange" (Powell, 1990, p. 298).

Powell (1990) seems to have the organisation of the firm or the social network as his sociological focus. For the sociologist or the organisational theorist, who must dissect the agents involved and identify their linkages and influences, the continuum is indeed not helpful. It is no more helpful for the economist concerned with the exchange transaction; each form of market organisation introduces variability in the resources required to complete it, and will create specification errors in comparing aggregate measures of the resource costs of markets over time or between regions.

Further, each form of market is a cultural and social construction which sustains and extends exchange transactions. Different market forms may have different resource costs and different effects on productivity, introducing variability into the relationship between the resources used to organise exchange transactions and productivity.

The next section reviews some contributions from economic sociology on how social structure and history affect market structures.

EFFECTS OF SOCIAL STRUCTURE AND HISTORY ON MARKET STRUCTURE AND PERFORMANCE.

Powell (1990) notes Finley (1973) that "…markets [did not] spring full blown with the Industrial Revolution. Economic units emerged from the dense webs of political, religious and social affiliations that had enveloped economic activity for centuries" (Powell, 1990, p. 298). In a similar vein, Powell notes Larson (1998) and Lorenzoni and Ornati (1988) that

> …high tech start-ups in the United States and craft-based firms in Northern Italy …do not follow the standard model of small firms developing internally through an incremental and linear process. Instead, they suggest an entirely different model of externally-driven growth in which pre-existing networks of relationships enable small firms to gain an established foothold almost overnight. These [pre-existing] networks serve as conduits to provide small firms with the capacity to meet resource and functional needs. (Powell, 1990: 298-299)

Granovetter (1992, p. 26) quotes from Emile Durkheim in *Division of Labor in Society*:

> [E]ven where society rests wholly upon the division of labor, it does not resolve itself into a myriad of atoms juxtaposed together, between which only external and transitory contact can be established. The members are linked by ties that extend well beyond the very brief moment when the act of exchange is being accomplished ([1893] 1984:173).

Market structures emerge from and are embedded in pre-existing social structures.

Economic sociology can improve explanations of economic action because:

> (1) The pursuit of economic goals is typically accompanied by that of such noneconomic ones as sociability, approval, status, and power. … (2) Economic action (like all action) is socially situated and cannot be explained by reference to individual motives alone. It is embedded in ongoing networks of personal relationships rather than carried out by atomized actors. (3) Economic institutions (like all institutions) do not arise automatically in some form made inevitable by external circumstances; rather they are "socially constructed" (Berger and Luckmann 1966). An understanding of this process requires both theory and empirical research to pay attention to dynamics [rather than comparative statics]. (Granovetter, 1992, p. 25)
>
> 'Embeddedness' refers to the fact that economic action and outcomes, like all social action and outcomes, are affected by actors' dyadic (pairwise) relations and by the structure of the overall network of relations. (Granovetter, 1992, p. 33)

Granovetter (1992) argues that the relational and structural aspects of social embeddedness affect economic behaviour and create problems of explanation for economic models. For instance, the absence of social contact in the economic model of competitive markets, where suppliers lack pricing power, limits the power of the model to explain pricing. "Structures of relations … result from processes over time and can rarely be understood except as accretions of these processes" (Granovetter, 1992, p. 34).

> Relational embeddedness typically has quite direct effects on individual economic action. …our behaviour toward others depends on a structure of mutual expectations that has become a constitutive part of the relationship.
>
> Not only particular relations may affect your behaviour, but also the aggregated impact of all such interactions. The mere fact of attachment to others may modify economic action.
>
> … Structural embeddedness typically has more subtle and less direct effects on economic action. A worker can more easily maintain a good relationship with a supervisor who has good relations with most other workers as well. If the supervisor is at odds with the others, and …in a "…situation of …'high network density', a worker may have absorbed from the group a set of behavioral principles …that would make a close relationship with the supervisor literally unthinkable. (Granovetter, 1992, pp. 34-35)

Dense networks reinforce ideas about proper behaviour, make deviation easier to detect, and administer punishment. There are limits on the number of social ties an individual can sustain, and larger networks are therefore likely to be less dense (Granovetter, 2005, p. 34)

> Structural embeddedness also affects the behavior of individuals by its impact on what information is available when decisions are made. (Granovetter, 1992, p. 36)

An account of the historical dynamics of events and circumstances which resulted in the observed structures of relations would require substantial narrative research.

Granovetter (1992, 2005) argues that the social construction of markets means that the selection of market form may not be determined by efficiency in generating productivity but by pre-existing social ties and obligations. He gives three main reasons: "…social networks affect the flow and quality of information", generate incentives in the form of "…reward and punishment" and create the conditions for trust or malfeasance (Granovetter, 2005, p. 33).

The choice of market organisation in a context of positive transaction costs, bounded rationality, imperfect foresight and uncertainty will create winners and losers within the pre-existing group of traders and the social networks in which they are involved. Because a market is embedded in a pre-existing social structure, the market design must achieve a balance between winners and losers in the social structure and the particular circumstances and preferences of the traders using the market. Since compensation of losers by the winners is normally not a practical possibility, then any choice will be arbitrary, that is based on social

norms, value-judgments about people, and political power (Furubotn and Richter, 2010, p. xi; Coase, 1960).

REGIONAL AND INTER-REGIONAL EFFECTS OF SOCIAL STRUCTURE

Local market institutions provide solutions to the problems of designing and conducting the search, inspection, bargaining, contract execution, control and enforcement processes required for trade. A feature of the New Institutional Economics literature is the local nature of many of the markets studied (Furubotn and Richter, 2010).

The design of the specific market institutions serving a region provides rules and codes adapted to the characteristics of regional traders (buyers and sellers), the goods and services they trade, and the transaction costs, self-seeking behaviours, uncertainties and risks they face. Enterprises and entrepreneurs located in regions will choose or create and sustain markets best adapted to their particular location and preferences.

Every region has its distinctive endowment of physical, social and cultural features and its accumulated wealth, physical capital, formal and tacit knowledge and technologies. Every novel product or service, every construction or demolition, every change in crop or operations, every economic opportunity requires trade and requires the selection, design or formation of a market in which to conduct trade. These distinctive features create opportunities to create different forms of market and to trade with other regions, and also make it likely that each region will choose to create some of its own distinctive market institutions.

The design of an organisation to manage the search, inspection, bargaining, contract execution, control and enforcement processes required for trade in a regional market will be resolved differently in different social structures and situations. These differences will introduce interregional variation in the resources required to sustain markets and in the effectiveness of those markets in creating division of labour and productivity growth. Regions endowed with different economic and social structures, and different historical narratives will have different inter-regional networks, will use different transaction sector to create different markets, and will achieve different economic results.

The arbitrary choice of market institutions in regions has particular implications for regions in Australia where certain national market institutions may create winners or losers in local communities. Local political institutions may have insufficient resources to create alternative markets (Brown, 2005). On the other hand, local choices can restrict the markets available to the region, and therefore regional incomes, as for example in local policies which may foster local shopping, exclude major supermarket chains from existing shopping precincts and restrict competitor access to suitable sites.

A trader obtains performance relevant information from all the social networks that cut across their life, and this information affects economic performance. In regions, local and inter-regional social networks, and the normative rules and relevant information they provide, can have a determining influence on whether a market is created, on the form the market takes, on the local transaction sector, on which counterparties are accepted, and on the terms of business. Burt (1992) describes how structural holes in networks create the social structure of competition and how the process can be studied empirically.

The density of local networks within smaller or isolated regions is likely to be higher than in larger or metropolitan regions (Granovetter, 2005); these regions will be better able to apply local norms to control market making or market extending behaviour such as the entry of new competitors or practices. A potential side effect of this may be a restriction on the capacity of

transactions sectors from other regions to create markets in smaller or isolated regions without the collaboration of local partners.

The formation of a market for any particular good or service produced in a region will be affected by the pre-existing social and economic structures of the region and beyond. If a market is formed, the form of that market will be the result of a negotiated contest between various social networks within the region and beyond.

Bell, Tracey and Heide (2009) analyse the dynamics of clusters, which are another form of market. They show that "…the organization of an individual transaction may be facilitated and constrained by the nature of the cluster macroculture", that "…transaction-related path dependencies affect a cluster's development trajectory", and that "[t]he implication of our theorizing is that it is easier to move from a relational to a hierarchical system of governance than from a hierarchical to a relational one (Bell, Tracey and Heide, 2009, p. 635).

The resources used to organise exchange transactions will be affected by the pre-existing social structure (macroculture) of the region, and the relative strengths of the network structures within the region. Chobanov and Egbert (2007, p. 695) ascribe a rapid increase in the size of the transaction sector in Bulgaria to increasing inefficiencies arising from a lack of trust in Post-communist societies.

The relationship between regional income and the resources used to organise exchange transactions will be shifted by the pre-existing social and economic structures in regions. An analysis of the variance in this relationship will reveal the effects of pre-existing social and economic structures on the scope and efficiency of market formation. This analysis can provide a basis for future social studies in regions to understand the narrative histories, and the properties of the pre-existing social and economic structures which have relevance to the cost of establishing exchange in regions, and therefore to regional income disparities. This inevitably raises the effects of regional network social capital, weak ties and the incomes accruing to people and regions which fill structural holes (Burt, 1992, 2004).

Some writers have pointed to the potential effect of uneven spatial distribution of people with advanced business services skills on the geography of innovation (Spiller, 2008, pp. 70-80). This paper argues that the uneven distribution of the transactions sector has similar effects on regional income. The factors affecting the uneven distribution of people, and of the transaction sector, may drive inter-regional disparities in income and productivity. The location of people with specific skills, including transaction workers, may be a result of the structure of pre-existing inter-regional and local social networks. In other words, people are embedded in social networks which affect how they behave and where they locate.

The transaction sector exists to solve the problems of market formation. Distinct regions require the transaction sector to solve at least some of the market formation problems differently in local situations. Much, but not all, of the transaction sector can be located in central, urban places where high volumes of transactions take place; regional transaction sectors may use inter-regional networks to create and support local markets.

CONCLUSION AND FUTURE RESEARCH

Schumpeter (1954) points out that since before Adam Smith's (1776) *An Inquiry into the Nature and Causes of the Wealth of Nations*, economists have argued that improvement in productivity and incomes depends on the division of labour which in turn relies on the extent of exchange transactions and the markets in which they occur.

Wallis and North (1986) link making exchanges with productivity and division of labour and provide a workable procedure to estimate of the resources used in the making and extending of markets in which exchange can occur.

> … our basic approach is to segregate economic activities and actors into those that are primarily associated with making exchanges, and those that are not. The sum of the resources used by those associated with transacting make up our estimate of the transactions sector. (Wallis and North, 1986, p. 97)
>
> Economics and theories of economic growth revolve around the gains from trade arising from specialization and division of labor. But such gains are only realized through exchange. …The development of specialized banking, finance, trade, and other transaction functions are the necessary requirements for enhancing productivity, and so is the role of government in specifying and enforcing a system of property rights. (Idem, pp. 120-121)

Following Adam Smith, the extent of the specific markets serving a region determines the extent of specialisation and division of labour. If regions extend the scope of the markets for the specific and differentiated local produce in which they trade, then they gain an increase in productivity and living standards through an expanded regional division of labour. If regions choose a design which limits the market in order to reduce competition for local traders then there is no gain in productivity or living standards. Productivity thus depends upon the extent and design of markets.

Each region invests resources in a transaction sector which takes account of the unique social structures, risk preferences, product characteristics and networks of the region. The size and quality of the regional transaction sector affects the capacity to extend the markets available to the region and this is critical to regional division of labour, productivity and income.

Wallis and North (1986) provide a testable hypothesis: a positive relationship between the economic resources devoted to the making, sustaining and extending of markets and, via the division of labour, productivity and income.

In testing this hypothesis in regions it will be important to recognise that markets are not simply economic constructs: they are formed by and embedded in social structures (Granovetter, 1992, 2005). The choice of market structure in a region is an arbitrary compromise between social structures and economic interests in the region and in other regions. Furthermore, the formation of markets creates winners and losers in every region (Furubotn and Richter, 2010). Positive transaction costs, faulty time perspectives, bounded rationality with guile, among other factors, mean that it is seldom possible for the winners to compensate, or even to identify, the losers (Coase, 1960).

The pre-existing social and network structures, which link people in a region with others inside and outside the region, influence the selection of regional market structures, affecting both the efficiency and effectiveness of the selected exchange transaction mechanism, and the extent of specialisation and division of labour which results in the region. This introduces other variables, such as the social structure and the form of market, to the relationship between the resources devoted to making and sustaining markets and the resulting changes in productivity and income. While incomes should continue to be positively related to the transaction sector resources devoted to the construction of markets, differences in social structure will affect the costs of establishing exchange and the extent of specialisation and division of labour which follows.

The hypothesis of this paper is that the regional transaction sector contributes to regional productivity and income, and that pre-existing social structures influence which market structures are produced, the quality of market design and the resources devoted to producing

them. The exogenous factors affecting investment in a transaction sector and market formation, and the ways in which they operate, are not fully defined: pre-existing social structures have an effect and future research will be required to learn how they operate, and which other factors are exogenous to market formation. Burt (1992) provides some insights on how this may be studied.

The first (pilot) stage of the empirical work for this paper constructed estimates of the transaction sector using Census of Population and Housing Australia data on Industry of Employment by Occupation, based on place of usual residence and compared these with data on average taxable income for Australia, the States and Territories, the Statistical Divisions of South Australia and Victoria, and the Statistical Sub-Divisions of South Australia. The results for the cross section of Statistical Divisions generated high and positive correlation coefficients between the lower estimates of the transaction sector and average taxable income, but very much lower correlation coefficients for Statistical Sub-Divisions (O'Malley, 2010).

In the next stage of the study, these estimates will be constructed for the Functional Economic Regions (FER's) of Australia. These use "…census data on the commute of workers from their place of living to their place of work …to form functional regions within which that commuting is self-contained to a very high degree and cross-regional commuting is minimised" (Mitchell and Stimson, 2010, pp. 178-179). They provide some confidence that the estimated population of transaction workers actually works in the region specified.

The second stage will seek to explain the residual variability in the relationship between regional incomes and the regional labour force engaged in the regional transactions sectors (the market making resources available in the region) by examining for a selection of regions, regional narrative histories, regional markets and their forms, regional and inter-regional social networks and their densities, and regional industrial structure.

By pursuing these questions it should be possible to deliver to regional economic development practitioners a framework which allows them to address some of the local causes of income disparities.

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Factor Structure to Make Central Areas Vibrant with People – Based on Field Surveys of Kyoto, Seoul, and Florence

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ABSTRACT

There has been a trend to restrain the entry of automobiles and to improve facilities for pedestrians in several cities around the world. The goal is to fill the central areas alive with people. However, it is not clear which factors affect city vibrancy and how they are related in the city center. Actual pedestrians as well as a variety of potentially relevant factors were surveyed on each street in the central areas of Kyoto, Seoul, and Florence to elucidate relationship between vibrancy and street environment. Structural equation modelling was performed with the field survey data in central areas of each city to determine the factor structure between vibrancy and street environment. As a result, it is clear that pedestrian facility directly and indirectly has a positive effect on vibrancy, and besides parking condition has a negative effect on vibrancy.

1. BACKGROUND AND PURPOSE

Growth of motorization has led to a decline of the previously important urban centers. Cities and streets have been transformed to accommodate automobiles. There are still high numbers of automobiles in city centers, causing traffic jams and pollution. Suburbanization further contributes to this problem. For example, large-scale stores in the suburbs lead to larger stores in urban centers. As a result, the variety and number of traditional stores has declined.

The progress of automobile-centered urbanization has resulted in less vibrancy in the urban cores of many cities. This trend is most severe in historic cities because their old narrow streets are not appropriate for automobile traffic. The governments of several countries have recently adopted policies to limit urban sprawl and to revive downtown shopping centers, with recognition of the need for revitalization in urban centers.

Vibrancy is the most important factor indicating the current status of an area. Vibrancy is the origin of every activity, including shopping. A commercial area with high vibrancy can be identified based on certain factors. Thus, it is essential to understand these factors in order to revitalize urban shopping areas and to create vibrant and sustainable urban centers. Our research focuses on environmental factors responsible for high vibrancy as the first step to regenerating urban commerce.

We select Kyoto and Seoul as cities to consider in Asia, due to their long history as population and commercial centers. We choose Florence for comparison as a historical city in Europe with similar characteristics. In all three cities, several streets in commercial areas have been designated pedestrian zones, and additional facilities for pedestrian convenience such as

trams have been created or planned. We analyze the relationship between vibrancy and several street-level factors, such as pedestrian zones, community stores, parking conditions, road shapes, and connections.

2. PREVIOUS RESEARCH AND THE CHARACTER OF THIS STUDY

Vibrancy is one of the most important factors in regional development. Hamana *et al*. (2009) suggests that the relation between pedestrians and the allocation of public transportation needs to be surveyed. Eighty-six shopping malls in Kyoto were researched to analyze the effect of the allocation of road space for pedestrians. However, the unit of research is not each street and the parking situation is not considered. Kitamura *et al*. (2005) have shown that vibrancy can be created in an existing urban area by introducing a transit mall. The liveliness of an area could be increased by pedestrian-oriented development, better accessibility, and traffic control, as shown in the survey by Taniguchi and Fujii. (2006). Following common sense, shop owners view negatively restricting cars to benefit pedestrians. However, as a result of the restriction, their attitude changed after they learned that over ninety percent of pedestrians prefer a car-free shopping environment.

Illegal parking destroys the convenience of a pedestrian street environment and affects the vitality of the area. There has been research on the influence of vehicle use on pedestrians. For example, to demonstrate the negative psychological influence of cars on pedestrians, Taniguchi *et al*. (2009) have conducted a survey in shopping centers. They found that the presence of cars and bicycles had a negative impact on walking, both directly and indirectly.

There has also been research suggesting that pedestrian movement is related to street topography. Hiller and Iida (2005) researched correlation between the street network and movement pattern and found that individual road choice is connected to not only travel time but also individual preference to route. Bogers and Timmermans (1986) revealed that the pedestrian route choice and destination choice behavior took the impact from the location patterns of retail facilities. Street patterns influence the choice of transportation: walking, bicycle, public transportation or private vehicle. Cervero and Radisch (1996) introduced the effect of the new urbanism; return movement to compact neighborhoods with grid-like street patterns. When the neo-traditional neighborhood and conventional suburban communities are compared, the former was proved to reduce the proportion of private vehicle use. Pedestrian-oriented development can indeed increase the proportion of walking and bicycle-riding.

3. RESEARCH AREA AND METHODOLOGY

The survey of central areas in Kyoto, Seoul, and Florence were conducted in November 2009, November 2008, and July 2010, respectively. The survey areas were Shijo and Gion in Kyoto, Myongdong and Insadong in Seoul, and Centro and Santacroce in Florence. In Kyoto, Shijo and Gion are located between Kyoto station and Kyoto palace. They are located on the left and right in Figure 1. Shijo is surrounded by Sanjo-dori, Karasuma-dori, Kawaramachi-dori, and Shijo-dori. Gion is surrounded by Sanjo-dori, Kawabata-dori, Higashi-oji, and Matsubara-dori. In Seoul, Myongdong and Insadong are located between Seoul station and Gyeongbok palace, which are shown on top and bottom in Figure 2. Myongdong is surrounded by Eulji-ro, Namdaemun-ro, Samil-ro, and Toegye-ro. Insadong is surrounded by Yulgok-ro, Ujongkuk-ro, Samil-ro, and Jong-ro. In Florence, Centro and Santacroce are located Southeast of the Santa Maria Novella station, along the river Arno. They are shown on the left and right in Figure3. Centro is surrounded by Via de Cerretani, Via de Tornabuoni, Via de Giraldi, and Lungarno degli Acciaiuoli. Santacroce is surrounded by Via G.B. Niccolini, Via de Giraldi, Viale della Giovine Italia, and Lungarno della Zecca vecchia.

Figure 1 Shijo and Gion, Survey Areas in Kyoto and a Local Photo

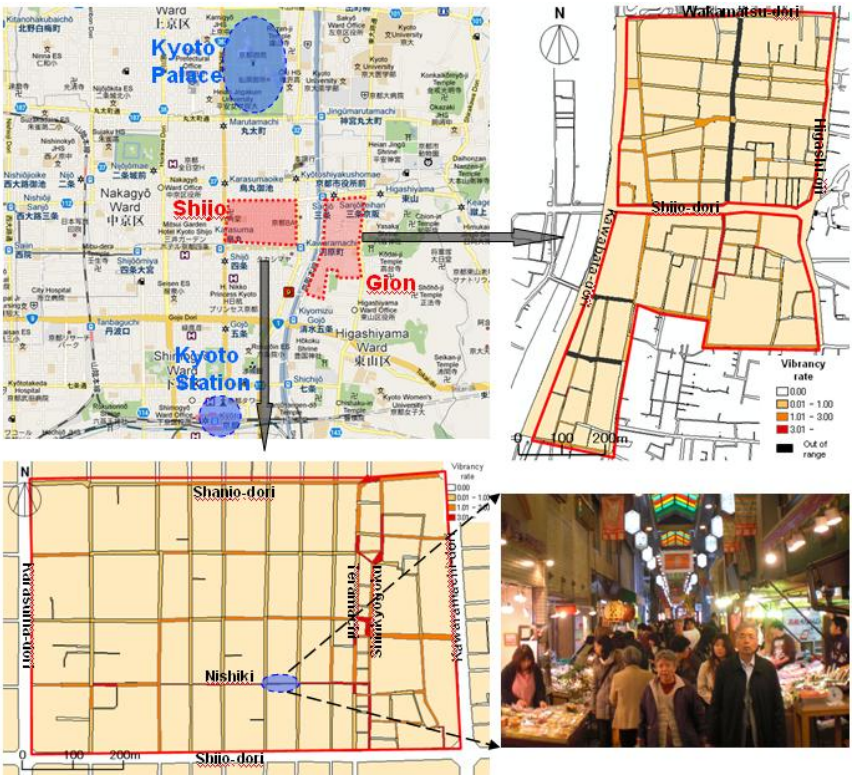


Figure 2 Myongdong and Insadong, Survey Areas in Seoul and a Local Photo

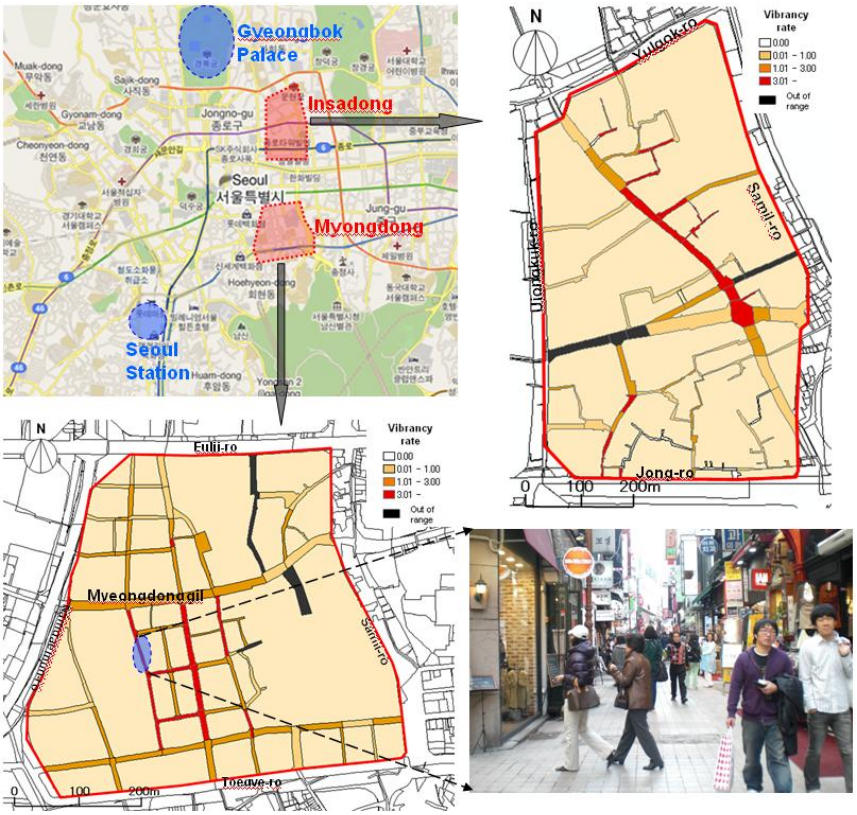


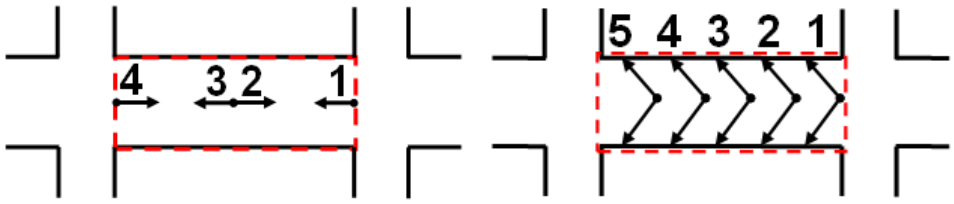
Figure 3 Centro and Santacroce, Survey Areas in Florence and a Local Photo

It is important for all factors to be measured in the unit of a street block. It is to seek environmental factors making street vibrant with people. The street as an institution is an important entity. Beyond its architectural identity, every street traditionally has an economic function and social significance. The street has roles such as enabling traffic flow, as well as the exchange of goods, and social exchanges, which are inseparably related to the physical form of the street.

We have taken four pictures on each street, from 11 a.m. to 12 p.m. and from 1 p.m. to 4 p.m. on weekdays. We excluded roads on the outskirts and blocked streets such as cul-de-sacs, to avoid the effect of commuting. In addition, we excluded streets with multiple car lanes, streets that went through buildings, those without buildings on their sides, large or small squares, and riverside streets. All of these cases were excluded because the aim of the study was dealing with the street as a public space. A vibrancy rate was calculated by finding the number of pedestrians per area of each street (see Figure 4).

Vibrancy rate (persons/m^2 * 100) = Number of pedestrian / Area of one street unit * 100

Figure 4 Methodology to Survey Vibrancy and Factors Affecting Vibrancy



The justification of one street unit in each area is as follows. Factors affecting vibrancy surveyed in three areas are the following: pedestrian zone, commodity store, arcade, street vendor, piazza, parking lot, street car parking, street motorcycle parking, bicycle parking, road shape, and road connection.

4. BASIC ANALYSIS

Total length and street area, as well as the number of pedestrians are shown in Table 1. Each of the three cities established a pedestrian zone to revitalize its old urban center. In this paragraph, the differences between the streets that were included or excluded from the pedestrian zone are manifold.

Table 1 Details of Pedestrian Zone on Survey Areas of Each City

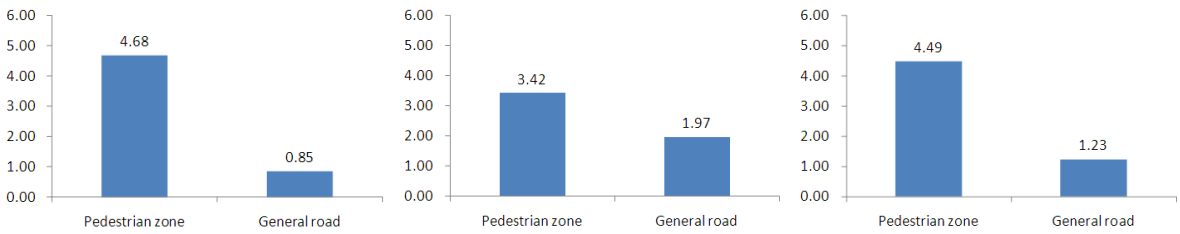
City-region	Total street length (m)	Total street area (m2)	Number of pedestrians (persons)	Fraction of pedestrian zone (persons/m^2 * 100)
Kyoto	18,492	96,776	1,179	37 / 279
Seoul	8,615	60,047	1,079	38 / 151
Florence	19,175	110,488	2,114	196 / 388

In Table 1, the fraction of street blocks in the pedestrian zone in central areas of Kyoto and Seoul is below thirty percent. In contrast, the fraction of pedestrian streets in the center of Florence is over fifty percent. It means that the pedestrian-friendly policy is pursued more actively in Florence.

As seen in Figure 5, the difference in vibrancy rate between pedestrian zone and general road is common to the three cities. Specifically, the difference between them is on the order of five, two, and four for Kyoto, Seoul, and Florence, respectively. Vibrancy rates for streets with or without commodity stores are also different. They are almost three times greater, as shown in Figure 6. We see that there are obviously differences in vibrancy depending on the presence or absence of pedestrian zones and commodity stores.

Figure 5 Vibrancy Rate of Pedestrian Zones

Vertical axes: vibrancy rate (persons/m^2 * 100)

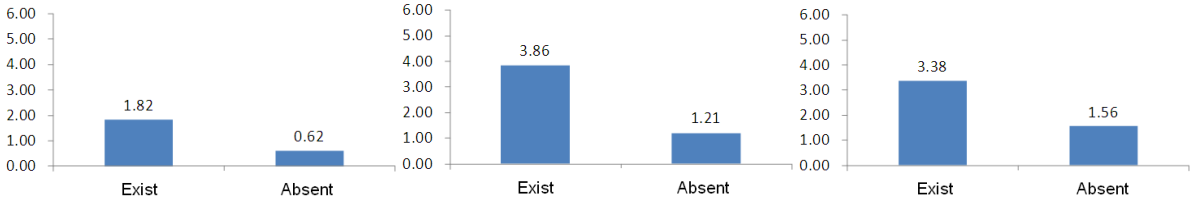


Kyoto Seoul Florence

The difference in vibrancy rates on streets with or without parking lots is clear for all areas in Kyoto and Seoul. This difference is approximately double. In Florence there were no parking lots, although there was street parking for residents. We also find clear differences in vibrancy rates depending on the kind of parking – car, motorbike, or bicycle. Figure 8 below shows that the vibrancy rate on a street with illegal parking is generally lower than on a street without illegal parking, irrespective of the type of parking.

Figure 6 Vibrancy Rate According to Commodity Store

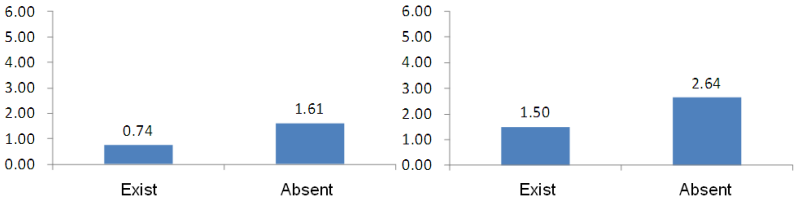
Vertical axes: vibrancy rate (persons/m^2 * 100)



Kyoto Seoul Florence

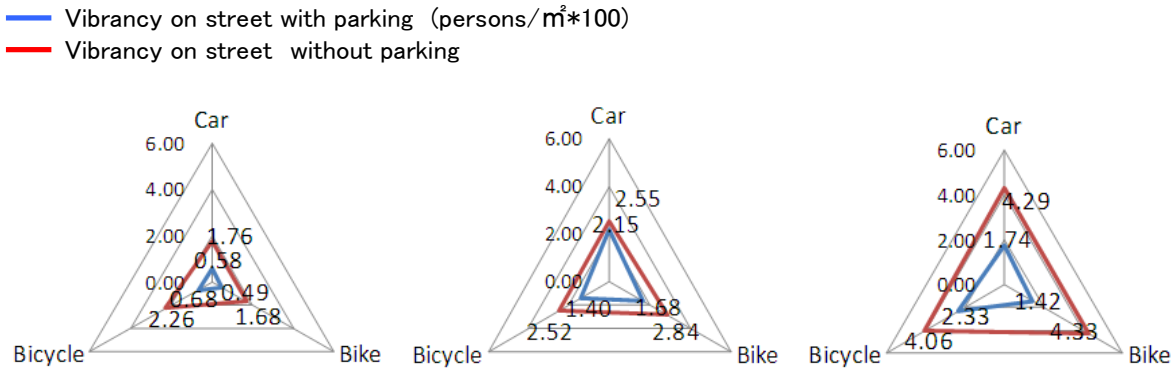
Figure 7 Vibrancy Rate as a Function of Parking Lot

Vertical axes: vibrancy rate (persons/m^2 * 100)



Kyoto Seoul

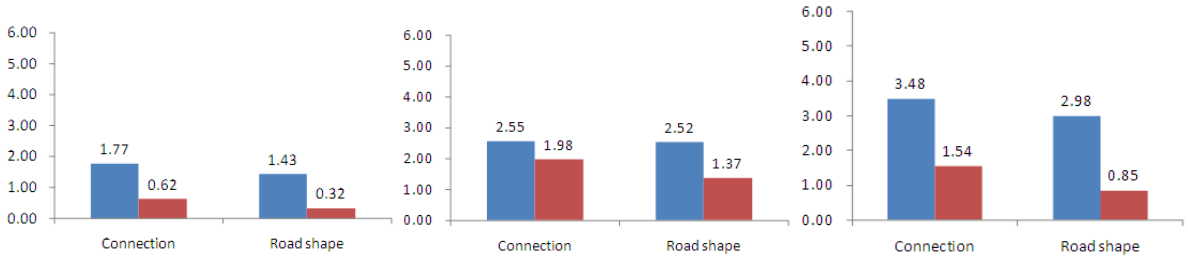
Figure 8 Vibrancy Rate as a Function of the Kind of Parking



Kyoto Seoul Florence

Figure 9 Vibrancy Rate as a Function of Road Connection and Road Shape

Vertical axes: vibrancy rate (persons/m^2 * 100)



Kyoto Seoul Florence

As shown in Figure 9, there is a two-fold vibrancy difference between straight and not-straight streets in Kyoto and Florence. And there is a three-fold difference over between right and curved streets. In Seoul, these differences are relatively small.

5. FACTOR STRUCTURE

Various street-level factors have similar characteristics with regard to their influence on vibrancy, as has been shown above. Therefore, various measured variables can be grouped into a few latent variables. Moreover, the results in the previous sections come from the presence or absence of such latent variables. We review each street factor to analyze its influence on vibrancy, grouping related factors into a single latent variable, as shown in Table 2. This allows the relationship between vibrancy and the latent variables to emerge by using structural equation modelling.

Table 2 Latent Variables and Measured Variables in the Model

Latent variables	Measured variables
Pedestrian facility	Pedestrian zone, Commodity store, Arcade or Piazza
Parking condition	Parking lot, Parking of car, Parking of motorbike, Parking of bicycle
Absence of latent variable	Road shape, Road connection, Street vendor

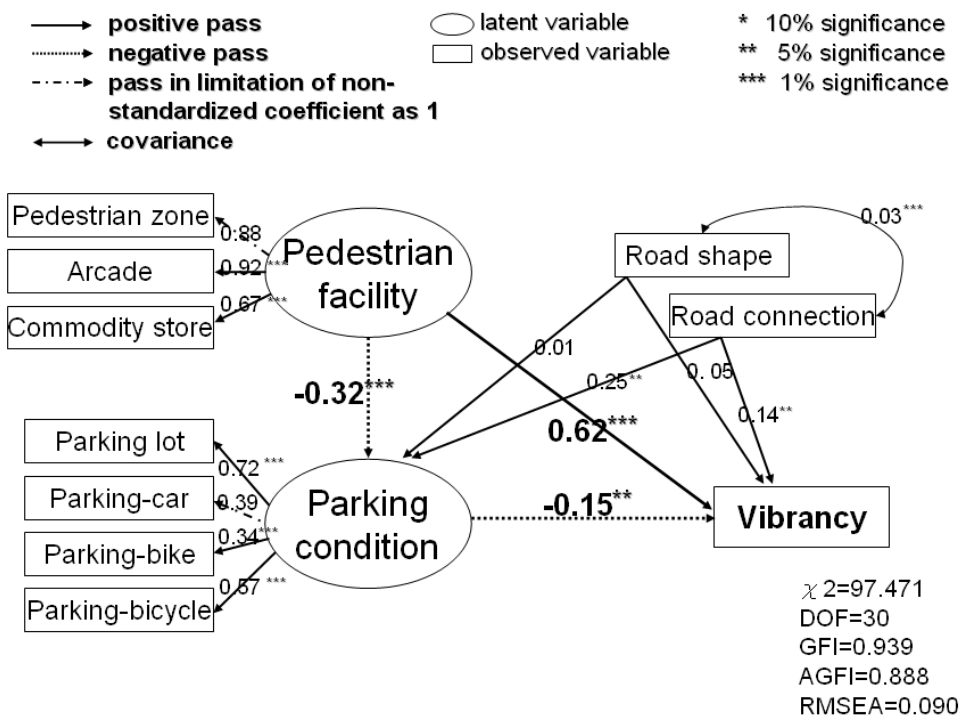
In the structural models of the three cities, there are common results. The fit index and the significance of the model are good. Moreover, the change in vibrancy due to pedestrian facility is positive. In addition, either having parking or changing from pedestrian facility to parking affects vibrancy negatively. Therefore, both direct and indirect effects of pedestrian facility on vibrancy are positive.

In the case of Kyoto, the impact due to pedestrian facility and its observed variables is highly significant. Arcade and pedestrian zone have more loading for pedestrian facility. Parking also has a high impact on vibrancy. In addition, road connections have a positive influence both on parking and vibrancy. The standardized total effect of vibrancy due to pedestrian facility is 0.66. The direct effect of pedestrian facility is very high (0.62), while the indirect effect is low (0.05).

In the case of Seoul, the pedestrian zone also has more loading for pedestrian facility. Here, too, parking has a large impact on vibrancy. Unlike in Kyoto, bicycle parking has low impact and significance. Street vendors have a positive impact on parking condition. Road shapes and connections, however, are not found to be significant. The standardized total effect of vibrancy due to pedestrian facility is 0.25. The direct effect of pedestrian facility is relatively high (0.18), while the indirect effect is lower (0.07).

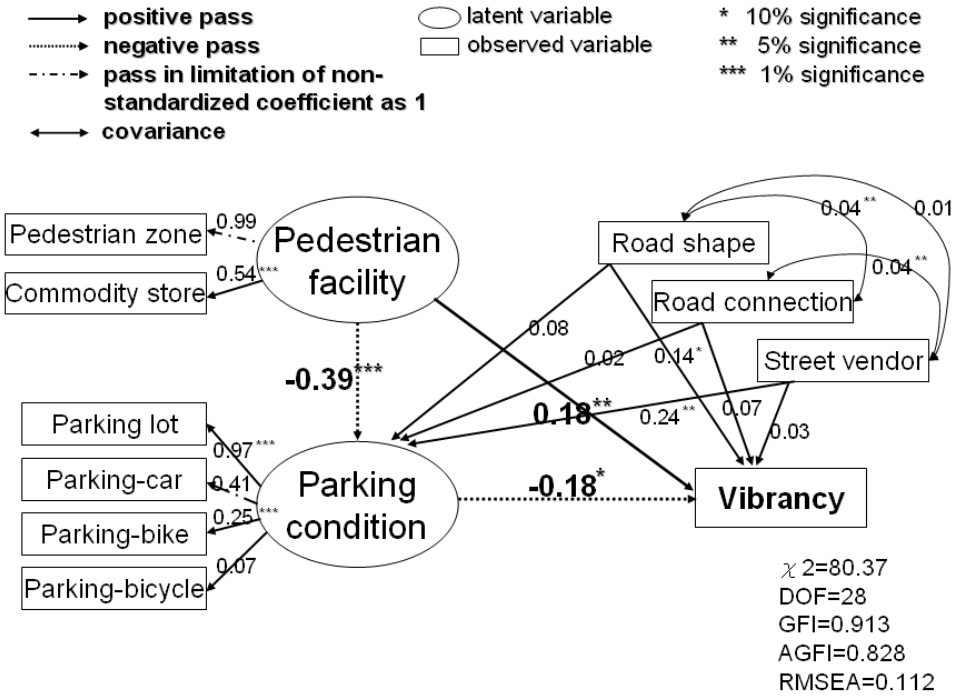
In Florence, pedestrian facility has a positive impact on vibrancy, and in addition a negative impact on parking. However, the influence of the pedestrian facility or the observed variables is not found to be significant. Pedestrian zone have more loading for pedestrian facility than other factors. Concerning parking condition, parking motorbike has more loading. In addition, road connection has a positive influence on vibrancy. The standardized total effect of vibrancy received from the pedestrian facility is 0.39. The direct effect of pedestrian facility is high at 0.20, while the indirect effect is nearly the same – 0.19.

Figure 10 Structural Equation Model in Kyoto



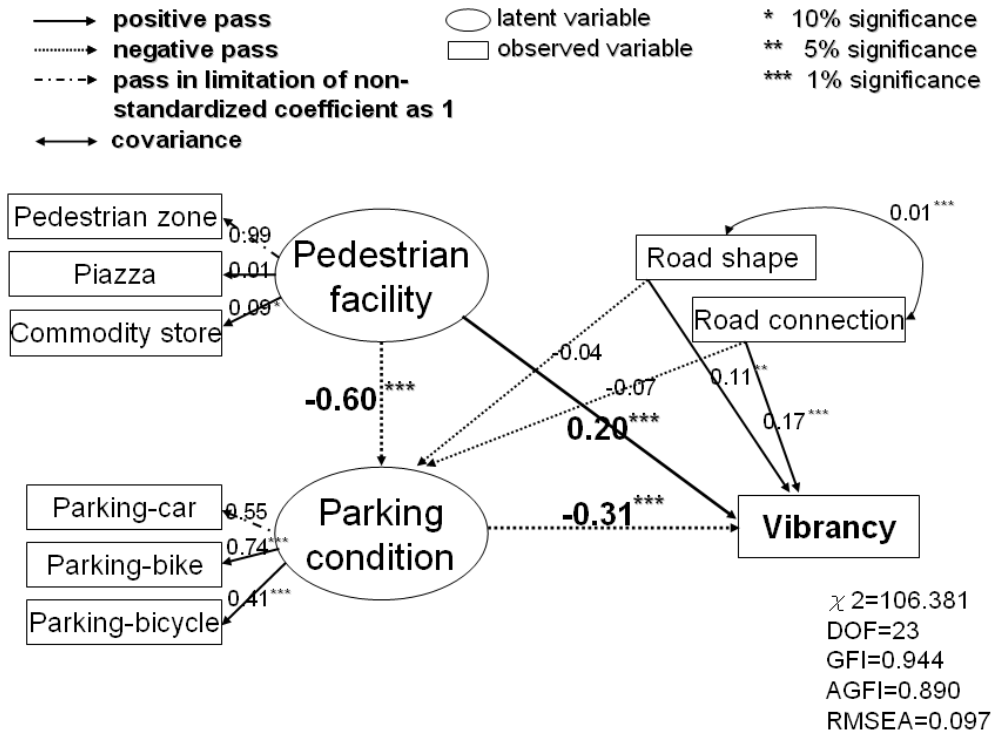
* Vibrancy: Std TE(0.66) = Std DE(0.62) + Std IE(0.05)

Figure 11 Structural Equation Model in Seoul



* Vibrancy: Std TE(0.25) = Std DE(0.18) + Std IE(0.07)

Figure 11 Structural Equation Model in Florence



* Vibrancy: Std TE(0.39) = Std DE(0.20) + Std IE(0.19)

A pedestrian zone has more loading for pedestrian facility more than a commodity store. A parking lot has loading for a parking condition more than others. In Seoul and Florence, bicycle is less related to the parking condition. However, road shape and road connection are relatively weakly connected to latent variables, with low significance.

6. CONCLUSION

The issue of sustainability of cities is one of the pressing issues of our modern world. Recently, there have been number of policies promoting sustainability. Walking in itself is regarded as one of the best solutions. Although it is a simple action, it does not happen spontaneously. Creating an environment is important to encourage more walking. We have identified the factors at street level that promote walking.

In this study, we have created structural equation models of three cities. We found that pedestrian facilities give not only direct but also indirect effects on vibrancy through a negative effect on parking. We find this is true for all three cities. In addition, parked vehicles influence the number of pedestrian negatively. Therefore, we conclude that both pedestrian facilities and the location of parking facilities are important in revitalizing urban centers.

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Regional Adaptation in a Global Market – The Case of Water Infrastructure

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ABSTRACT

Many regions in Australia and the United States experience limitations that are due to natural aridity. Many have adopted similar strategies to encourage settlement in those regions, and have experienced similar environmental and social problems as a result of implementation of those strategies. This article compares the development of irrigation infrastructure in the United States and Australia, using two small communities as case studies to highlight the temporal parallels up to the point at which Australian agricultural policy changed in the late 1960s and early 1970s. It considers the recent shifts in the Australian water agenda which have resulted in the adoption of a broadly market solution to water resource management issues, and speculates on the degree to which the United States will follow a similar route. It also tracks an evolving dissimilarity in farm policies during the same period, by which Australian farmers are subjected to market mechanisms in their domestic and export markets, whilst United States' farmers continue to be shielded from some of these pressures. The history of the development of irrigation in both countries indicates that there is a contiguity of issues and approaches; this article argues that a comparison of these histories provides a valuable assessment of the effectiveness of varying approaches.

> Every mistake is in a sense a product of all that has gone before it, from which it derives a sort of cosmic forgiveness, and at the same time every mistake is in a sense the determinant of all the mistakes of the future from which it derives a sort of cosmic unforgiveableness.[1]

I INTRODUCTION

Australia and the United States share a set of complex water management problems requiring resolution of competing interests, and a Federal system in which both State and Federal governments have interests in water. Like some regions of the United States, much of Australia has also been in a period of water scarcity which has continued for more than a decade.[2] Whilst this event is not unprecedented, population expansion, naturally variable

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1 George F Kennan, *American Diplomacy*, 1900-1950 Chicago: Chicago University Press 1951, pp. 50, 78.

2 The Murray-Darling Basin has experienced an extended period – approximately 10 years – of below average inflows: Murray-Darling Basin Authority, *River Murray System: Drought Update* Issue 21, November 2009, available online at www.mdba.gov.au. Declining rainfall and increasing warming trends have been identified since the middle of the 20th century: Neville Nicholls, 'The changing nature of Australian droughts' (2004) 63 *Climatic Change* 323. However, all-Australian annual rainfall has shown a positive trend over the the full period, mainly due to increases in some parts of the system over the latter part of the period 1952-2002: Ian Smith, 'An assessment of recent trends in Australian rainfall' (2004) 53 *Australian Meteorological Magazine* 163. Changes in rainfall patterns have also been observed over a long period; for instance, more rainfall in Summer and long term decreases in Winter rains. Generally, trends show a long term slight upward trend.

climates[3] and an aging water infrastructure have concentrated attention on competing water uses, and governments have employed various mechanisms to avert the potential for cities, in particular, to run out of water. Both Australia and the United States have been compelled to redress consequences of historical water allocations on the environment, in the context of rising consumptive demand. Both Australia and the United States have faced issues of competing consumptive uses for water, and both have addressed problems of water transfer, typically to urban communities, both within and between catchments.

In this article a comparison will be made of two irrigation regions, one in Central Victoria, Australia, and one in Central Oregon, United States of America. Both are semi-arid inland regions,[4] with a relatively small population base and at some distance from large urban centres. In the case of both areas, settlement, and later, irrigation, occurred as a result of aggressive government and private measures designed to settle inland regions. However, both share modern agricultural problems – a globalised sector, falling agricultural returns, rising inputs, including difficulties employing agricultural workers, increasing environmental regulation and compliance costs, and increasing urbanisation of their respective societies.

Table 1 Characteristics of the Two Study Areas, Rochester and Tumalo

Location	Latitude / Longitude	Classification	Mean Annual Precipitation (mm)	Mean Maximum Annual Temperature (°C)
Rochester, Victoria, Australia	36.36° S 144.71° E	BWk[5]	441.7	21.3
Tumalo, Oregon, USA	44.03° N 121.18° W	Dsb[6]	304-381	15

In this paper, the immediate policy environment affecting water distribution and consumption in Australia and the United States is examined. This entails a brief comparison of the concept of 'ownership' of water in States of Australia and a selection of States in the United States, then a consideration of an increasingly 'marketised' environment for water, pursuant to which

Interdecadal variability and variability between regions makes it difficult to define trends, and measurements typically are limited to the period commencing 1901 with information in some regions sparse, and information from some measurement stations compromised because of alterations in environment (eg, encroaching urbanisation increasing the shelter of the measuring device), movement of measuring devices or the unreliability of observational patterns: Neville Nicholls, Beth Lavery, 'Australian rainfall trends during the twentieth century' (2006) 12 *International Journal of Climatology* 153.

3 Of Australia, Walker notes that '*average* flows perhaps are more apparent than real': K F Walker, 'A review of the ecological effects of river regulation in Australia', (1985) 125 *Hydrobiologia* 111.

4 Rochester is part of a arid climate zone based on M C Peel, B L Finlayson and T A McMahon, 'Updated world map of the Köppen-Geiger climate classification', (2007) 11 *Hydrology and Earth System Sciences* 1633-44, which assesses the climate as Bsk (cold arid steppe), abutting a temperate zone to the east of Rochester. The map is available online at http://koeppen-geiger.vu-wein.ac.au/. The set of locations defined as having a B (arid) climate classification is identified by a combination of mean annual precipitation and mean annual temperature. Tumalo and Bend are classified as Dsb – Cold, with a dry, warm summer, but Deschutes is classified as Bsk (cold arid steppe) based on the same classification. Other classification systems use slightly different terminology. The updated Köppen-Geiger climate map is available as a GoogleEarth layer (*.kml): see http://people.eng.unimelb.edu.au/mpeel/koppen.html.

5 According to Peel *et al*, above n 4.

6 According to Peel *et al*, above n 4.

water is 'leaving' rural environments for utilisation in urban communities, creating issues of 'stranded assets', and increasing infrastructure cost burdens on irrigators.

Pressures to change the historical position have arisen through political, social and environmental factors, and this paper will consider these, and the mechanisms by which change is being mediated. It will become apparent that small irrigation districts are constrained by social, political and economic factors that render the user-pays model unlikely to succeed *for them*. In an economy in which commodity prices are not keeping pace with inputs, and imports are artificially suppressed by various mechanisms for subsidisation, small communities like Rochester and Tumalo are likely to continue their decline. Conversely, the trend of current Australian policies to adopt a market framework may also derive a sort of 'cosmic unforgiveableness', in that the problems arising from overallocation are not being mitigated to deliver environmental benefits; instead 'savings' are being applied to urban domestic usages.

II A TALE OF TWO TOWNS

The precepts upon which Australia was settled drew upon American influences, and were affected by the participation of Americans.[7]

> Nowhere is this to be seen more than in northern Victoria, the cradle of large irrigation schemes in the continent, which has led other regions with important irrigated elements of the nation's dried fruits, canning fruits, dairying and fat lamb industries. Progress in water resources law, and its implementation for enabling works and land settlement schemes throughout northern Victoria, owe much to American ideas; these in turn have greatly affected water development in other states.[8]

The history of rural settlement in both Australia and the United States illustrates more than a coincidence of ideas. It illustrates the tension between opening up the interior to settlement and the tendency of the bulk of the population to settle along the coast and in the cities.[9] There were varying motivations for closer settlement: social justice for selectors or returned soldiers, incentives for army recruitment, increased revenue as a result of closer settlement,[10] (or homesteading in the United States), or xenophobia.[11] The general expectation, however, appeared to be that once these settlers were on the land, they would become self-sufficient 'yeoman' farmers and not require government subsidisation or continuing commitment to infrastructure funding.[12] The declining agricultural population in these regions demonstrates that this approach was, perhaps, too optimistic.

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7 John Rutherford, 'Interplay of American and Australian ideas for development of water projects in northern Victoria' (1964) 54 (1) *Annals of the Association of American Geographers* 88 – 106, 88.

8 Ibid, 88.

9 M. Keneley, 'A dying town syndrome: a survey of urban development in the Western District of Victoria 1890 – 1930' *Working Paper No 2105* Deakin University Faculty of Business and Law May 2001; D. Ingle Smith, *Water in Australia* Melbourne: Oxford University Press 1998, 143.

10 'Closer' settlement in Australia, promoting denser settlement, was first considered necessary by Governor Macquarie (1809 – 1821) based primarily on the view that large landholding discouraged genuine settlement: Tom Connors, 'Closer settlement schemes' (1970) 42 *The Australian Quarterly* 72. In Victoria early schemes involving dryland were administered by the Closer Settlement Board, later the Closer Settlement Commission. The State Rivers and Water Supply Commission administered irrigable lands: Closer settlement schemes followed each of the world wars as Soldier Settlement Schemes.

11 Keneley, above n 9, N F Barr *Salinity Control, Water Reform and Structural Adjustment: the Tragowal Plains Irrigation District* 1999 (unpublished PhD thesis, the University of Melbourne), 45.

12 Again, this concept was probably borrowed, through Elwood Mead, from Thomas Jefferson's idea of the yeoman bringing about American democracy through agrarian labour: James W Hewitt, 'Review of "Turning

A. Tumalo, Oregon

Tumalo (previously Laidlaw) in central Oregon is located in the north central portion of Deschutes County, near Bend at latitude 44.03 N longitude 121.18 °W, elevation 1103m, has a mean annual rainfall of 304 - 381 mm (12 – 15 in) and a mean maximum annual temperature of 15° C. The summers are generally quite warm, although the elevation moderates temperatures.[13]

The landscape is arid and irrigation is required for large scale agriculture. The Federal *Homestead Act* 1862 first encouraged settlement by dry farmers around the 1880s. Currently the Tumalo Irrigation District serves around 155 square kilometres (60 square miles) with over 3,275 irrigated hectares (8,093 acres), serving 635 land owners.[14] The population in July 2007 was 6996. Its near neighbour, Bend, Oregon, has recently been described as 'poverty with a view'.[15] Located in Oregon's scenic high desert, its economy is not exclusively tied to farming; rather, logging and tourism, and until recently construction, were strong industries, supporting a city of around 82,000 people which was reported in 2009 to be still growing at a rate of 1.2%, possibly on the basis that it is 'better to be unemployed in Bend than in other places'.[16]

The early experience in the United States displays similar themes to those experienced in Australia, including State-sponsored settlement, attempts to leverage private funding of infrastructure and recognition of the economic and environmental costs of irrigation. The Commission on Geosciences, Environment and Resources (CGER) noted that

> Through a series of Executive Orders and Acts of Congress, legislation was enacted that provided for the division of land, the establishment of reservations and the settlement and sale of 'excess public land'. Not by coincidence, one of the major federal water resource development agencies, the US Bureau of Reclamation, was formed during this time, and it provided significant engineering and financial capital to develop irrigation on newly acquired lands in the West.[17]

The series of Acts providing Government subsidisation of the settlement of the western States included the *Desert Land Act* in 1877 and the *Carey Act* in 1894, amid increasing agitation for 'reclamation' of arid lands through irrigation projects. The elevation of President Theodore Roosevelt in 1901 gave further impetus to the development of the Jeffersonian ideal, and the *Reclamation Act* was passed in 1902. The Reclamation Service was established in that year. It became the Bureau of Reclamation in 1923.[18]

Oregon became a State on February 14, 1859. Measurement of water being appropriated did not occur for more than 45 years after that date,[19] but of course appropriations did occur – for

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on Water with a Shovel: The Career of Elwood Mead" by James R Kluger' (1995) 5 *Great Plains Research* 181, 181.

13 George Taylor, 'Climate of Deschutes County' [online] http://ocs.oregonstate.edu/county/Deschutes_files/Deschutes.html, accessed August 3, 2010.

14 Tumalo Irrigation District (nd), http://www.tumalo.org/about.htm accessed March 29, 2010.

15 Noelle Crombie, 'Oregon's recession is 'poverty with a view'' *The Oregonian* 20th July, 2009, accessed online at http://www.oregonlive.com/news/index.ssf/2009/07/oregons_recession_is_poverty_html on 29th January 2010.

16 Ibid, quoting Michael Hollern, chairman of Brooks Resources Corp.

17 Commission on Geosciences, Environment and Resources, *A New Era for Irrigation* 1996 p. 9.

18 US Department of the Interior, *Reclamation: Managing Water in the West* [online] http://www.usbr.gov/history/

19 Louis S Bonney, 'Oregon's coordinated integrated water resources policy' (1964-65) 3 *Willamette Law Journal* 295.

irrigation, logging, mining, mills, factories and municipal water supplies.[20] In 1891 use of water in the State for irrigation, livestock and domestic consumption was a declared public use:

> The use of the waters of the lakes and running streams of the State of Oregon for general rental, sale or distribution for purposes of irrigation and supplying water for household and domestic consumption and watering livestock upon dry lands of the State, is a public use, and the right to collect rates or compensation for such use of said water is a franchise.[21]

This made the use of water in a running stream a revocable, limited privilege to use public property dedicated to public use.

The first irrigation district was established in 1895. The Tumalo irrigation project had originally been managed by the Three Sisters Irrigation Company and its successors. Operating in the context of the *Carey Act* (1894),[22] pursuant to which settlers could acquire 64.75 hectares (160 acres) of arid land if they irrigated 8.1 hectares (20 acres), the Company would finance water projects to serve parcels of land made available to farmers who settled and improved a portion of the State's Federal land grant. The State sought to administer the provisions of the *Carey Act* with no injection of public funds, so a self-sufficient project was attractive. The Three Sisters Irrigation Company claimed to have the capacity to deliver Tumalo Creek water to 4,047 hectares (10,000 acres).[23] In 1902 the Columbia Southern Irrigation Company acquired the rights to Tumalo Creek's flow. In 1905 the State, using the figures provided by the company, certified that 4719 hectares (11,660 acres) had been provided with sufficient water to raise crops, and Tumalo lands became the first of the *Carey Acts* patented to Oregon. However, the settlers found that the first 405 hectares (1000 acres) to be settled had taken all of the available water. They formed the West Side Users Association to pressure the State Government to intercede.[24]

Oregon's *Appropriation Act* of 1909 finally declared that all waters belonged to the public, regardless of their source. It provided that 'all waters within the State may be appropriated for beneficial use … and not otherwise.'[25] The same Act set up the administrative superstructure for the regulation and control of the use of water – the Board of Control, later to become the State Water Board.[26] Under the prior appropriation doctrine, rights to water 'attached and became vested in the order of time in which the water was applied to a beneficial use.'[27] Tarlock reports that semi-arid States adopted the common law of riparian rights but 'switched to prior appropriation or dual appropriation-riparian systems in the late 19th century to promote irrigation.'[28] Under the principle of prior appropriation, allocation of water rights occurs on the basis that the first person to put a specific quantity of water to beneficial use is allocated the right. 'The user obtains a temporal priority, and in times of scarcity, the right to withdraw or pump water is curtailed in reverse order of the manifestation of an intent to appropriate.'[29] As Tarlock notes,

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[20] Ibid.
[21] General Laws of Oregon 1891 §1, p13.
[22] Adopted by Oregon in 1901. Also known as the Desert Land Act. It was named for Senator Joseph Maull Carey.
[23] Tumalo Irrigation District Website, http://www.tumalo.org/history.htm, accessed February 2, 2010.
[24] Ibid.
[25] General Laws of Oregon 1909 ch 221.
[26] Bonney, above n 19, 296.
[27] Bonney, above n 19, 297, citing *Hough v Porter*, Ore. 318, 417, 95 Pac.732, 98 Pac. 1083 (1909).
[28] A Dan Tarlock, 'Prior appropriation: rule, principle or rhetoric?' (2000) 76 *North Dakota Law Review* 881, 881 note 2; Joseph W Dellapenna, 'Riparian rights in the west' (1990) 43 *Oklahoma Law Review* 51, 51-55.
[29] Tarlock above n 28, 882.

> [p]rospective enforcement of priorities dominates the legal and political discourse…Water users rely on the possible enforcement of priorities in calculating the security of their entitlements, and all drought and long-term shortage projections are predicated on a worst case enforcement scenario. However, the enforcement of priorities assumes that adequate use and streamflow information exists and that there is a speedy curtailment process.[30]

At the time of Tumalo's settlement there were no limits or directions as to appropriations on a particular stream.[31]

The original privately funded irrigation company in Tumalo failed because the irrigation infrastructure was insufficient for irrigation requirements, and as a consequence irrigators could not sustain their mortgages and water fees. Around 1912 the State took control of the Tumalo project. Oregon's *Columbia Southern Act* appropriated public funds to build a reservoir at Wimer Flat.[32] Around 1912, the railroad that had been expected to reach the town and revive its prospects bypassed it and was situated at Bend instead.[33] The projected population increase, which would have contributed to - and perhaps sustained - infrastructure costs, did not occur.

In 1913 a survey of the water resources of the State was commissioned; amongst those areas surveyed were the Deschutes River and Central Oregon in 1914. Waters of the Deschutes River were withdrawn for Bend township, and in 1929 Tumalo Creek was withdrawn from further diversion in acknowledgement of the recreational rights of the public.[34] In Tumalo irrigators agitated for more water and a water right. Between 1916 and 1925 they issued irrigation bonds and purchased a storage right on the Deschutes River at Crescent Lake, and built a diversion dam on the Deschutes at Bend. They sought further colonization to help pay for infrastructure. However, the campaigns failed in the context of extremely low flows in the Deschutes and Tumalo Creeks. The first adjudication of the Deschutes recognised 2739 hectares (6,768 acres) of Tumalo lands as beneficially irrigated. However, the bond interest and operation and maintenance assessments remained unpaid. The Bureau of Reclamation recommended that government funds should not be expended on Tumalo lands.[35] Between 1935 and 1953 infrastructure continued to deteriorate, and the bondholders and the State were not repaid. In 1954 the Bureau of Reclamation agreed to rebuild the dam at Crescent Lake, with each irrigated acre obliged to repay the cost within forty years.

In 1953 the Oregon Legislative Assembly created the Legislative Interim Committee on State Water Resources, which was required to consider the various laws and authorities with responsibility over aspects of water resource management to make recommendations to address the uncoordinated laws. The increasing demand for water was noted as part of the Committee's findings, but it considered that Oregon had sufficient water resources for its future needs if water was appropriately administered. The State Water Resources Board was created in 1955 to meet the Committee's recommendation that a single agency administer a statutory State water authority.[36] The Board was to formulate the State water resources policy taking into account the policies that

1. Existing rights and priorities were to be protected subject to the principle that all waters of the State belong to the public.

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30 Tarlock above n 28.
31 Bonney, above n 19, 296.
32 Tumalo Irrigation District Website, http://www.tumalo.org/history.htm, accessed February 2, 2010.
33 Tumalo Irrigation District Website, http://www.tumalo.org/history.htm, accessed February 2, 2010.
34 Bonney, above n 19, 298.
35 Tumalo Irrigation District Website, http://www.tumalo.org/history.htm, accessed February 2, 2010.
36 Bonney, above n 19, 303.

2. Water for human consumption should be protected.
3. Multiple use is to be preferred over single purpose uses.
4. Drainage projects should protect domestic supplies and wildlife.
5. Maintenance of minimum flows to support aquatic life and minimize pollution.
6. When proposed uses conflict preference shall be given to human consumption and then to livestock.[37]

The State Water Resources Board was assigned the function of conducting an inventory of the waters of Oregon and projected demand until 2070, and the growing demand for water interstate has been recognised. By comparison, in Tumalo irrigated farms are increasingly maintained by off-farm income. The district has continued to struggle with the cost of maintenance and improvement of infrastructure, although the Bureau of Reclamation agreed to a proposal that repayments be made on the basis of a per-user fee, rather than on the basis of acreage and the productivity of the land.[38]

The declining incomes of farmers in Tumalo are broadly consistent with international trends. However, unlike the trend in Australia, market reform to achieve competition outcomes has not been a priority. The Federal *Agricultural Adjustment Act* of 1933, introduced in the context of drought and the Great Depression, reduced commodity supplies and raised prices paid to farmers by paying farmers to decrease the acreage planted in major commodities.[39] Commodity loans were introduced, which enabled farmers to forfeit crops to the government, without repayment of the loan, if the floor price for the crop was not achieved on the market. These policies continued until the 1960s, and during the post World-War II period food aid exports also contributed to market protection. When global markets revived, protection continued in the form of two tier pricing systems that allowed farmers to export at world market prices, but subsidised domestic sales through direct 'deficiency payments'.[40] During the 1980s, the high American dollar, declining demand and increasing competition from the protected European farmers encouraged the adoption of export subsidies for American farm produce. The 1985 Federal *Farm Bill* used paid acreage set-asides to improve prices paid to farmers. The Export Enhancement Program was introduced in response to European subsidies. Non-recourse loans were replaced by marketing loans, under which 'farmers could export stored commodities even when world prices were below the loan rate and the government would make up the difference.'[41] The 8th round of multilateral trade negotiations conducted within the General Agreement on Tariffs and Trade (GATT) (the Uruguay Round) prompted the 1996 US Federal *Farm Bill*, which trended towards competition, but the decline in commodity prices prompted further protection and elements of the Bill were reversed within two years.[42] The trend against protection in both the Europe and the United States is partially linked to the high costs of maintaining the current system of protection, rather than the distorting effects of protection on world trade. Australia, with its much smaller economy, is not capable of providing similar levels of protection. The 2002 US Federal *Farm Bill*, whilst retaining some anti-protectionist elements, institutionalised other anti-competitive aspects. In addition, Congress reintroduced counter-cyclical payments in instances when commodity prices dropped below target levels.[43]

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37 General Laws of Oregon 1955 ch.707 §10(3), summarised by Bonney, above n 19, 306.
38 Tumalo Irrigation District Website, http://www.tumalo.org/history.htm, accessed February 2, 2010
39 Kimberly Ann Elliott, 'Agricultural protection in rich countries: how did we get here?' Center for Global Development Working Paper Number 47, September 2004, 10.
40 Ibid 11.
41 Ibid 15.
42 Ibid 12, 15.
43 Ibid, 17.

Despite some protection of the agricultural sector, holders of agricultural water rights are experiencing significant pressure from a range of alternative uses. In addition to pressure from environmental use, American Indian Tribal uses, and hydropower, 'rapid urban growth is forcing cities and developers to take a more aggressive role in water supply planning and acquisition as legislatures and courts impose new risk analysis mandates on them.'[44] Unlike the Australian experience, however, the role of the Federal Government in the United States has diminished. As the Federal Government was the principle driver of reclamation era projects that encouraged development, the reversal of the supply augmentation trend also signals a shrinking Federal role.[45] Conversely, however, urban development is continuing in areas with naturally variable and unreliable water supplies, particularly in the western States. Reallocation of water from irrigation to urban uses

> increases the demand for water transfers, especially from existing to new uses …[and] many of these transfers will be extremely controversial because they threaten to disrupt established economic and cultural patterns, stress ecosystems, and raise long-standing fears about the monopolization of water.[46]

Despite significant transfers to date, however, the United States has not implemented marketisation of water on the scale or with the political will experienced in the eastern States of Australia.

B. Rochester, Victoria

Rochester, at latitude 36.36 S longitude 144.71 °E, elevation 114m has a mean annual rainfall of 441.7 mm (17 inches) and a mean maximum annual temperature of 21.3°C.[47] Australian Bureau of Statistics figures in 2001 had its population at 2600, but it had a population of only 1849 in 2006.[48] The Rochester statistical subdivision had a growth rate of 1.1 from 1996 – 2001.[49] It is reliant on dairying to support the economy. The Rochester irrigation district supplies 1,733 irrigators with a volumetric entitlement of 170,601 ML. The Campaspe Irrigation District supplies 162 irrigators with a volumetric entitlement of 18,112 ML.[50] Echuca, to the north of Rochester, has a population of around 12,000, developed as a river port city, and is situated close to the junction of the Goulburn, Campaspe and Murray Rivers. Bendigo, to the southwest, is a former goldrush town with a population reaching 88,000 and extremely precarious water resources.The Rochester district is part of the vast system of the Murray Darling Basin occupying one seventh of Australia's land mass. The Murray River Mouth is the only outlet for surface and underground water for this area. Both the Murray and the Darling Rivers, prior to European settlement, would flow strongly after seasonal rain but dry to a series of pools in times of severe or prolonged drought – 'natural flows in the system are low and variable …Although rainfall is no less reliable than in other regions of similar

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[44] David A Getches and A Dan Tarlock, 'Water Law and Management' in Lawrence J MacDonnell, Sarah F Bates (eds) *The Evolution of Natural Resources Law and Policy* American Bar Association/Natural Resources Law Center, University of Colorado School of Law 2010, 316.

[45] Ibid, 318.

[46] Ibid, 321.

[47] Australian Bureau of Meteorology, 'Climate statistics for Australian locations' http://www.bom.gov.au/climate/averages/tables/cw_080049_All.shtml accessed 30th July 2010.

[48] Australian Bureau of Statistics, 25th October 2006, 2006 Census QuickStats: Rochester (State Suburb) http://www.censusdata.abs.gov.au accessed January 29, 2010.

[49] R W Edwards, 'Census of population and housing: population growth and distribution, Australia 2001' Commonwealth of Australia 2003, available online www.environment.gov.au accessed August 3, 2010.

[50] As at 30 June 2009: State of Victoria, *Goulburn-Murray Water 2008/09 Annual Report* 2009 available online at http://www.g-mwater.com.au/about/reports-and-publications/annualreports. A map of the Rochester and Campaspe Irrigation districts, as well as the other irrigation districts operated by Goulburn-Murray Water, is available at http://www.g-mwater.com.au/about/regionalmap.

annual precipitation, the effects of even minor variations on flows are magnified by the small size of the Murray's contributing sector.'[51] The quality of river water in its natural condition is not always good, as it is affected by salt leached from relictual marine deposits.[52] Charles Sturt, in early exploration of the Darling River, noted 'I found and left the Darling in a complete state of exhaustion. As a river it had ceased to flow; the only supply it received was from brine springs, which, without imparting a current, rendered its waters saline and useless'.[53] Australian rivers are sometimes asserted to 'flow upside down'.[54] These combined limitations have reduced the amenability of the land to settlement:

> Australia has no great mountain ranges to carry snow to water her vast flat surface. Her rivers, for the most part, flow upside down, if indeed water runs at all. She carries a population of plants, animals and human beings and their societies, yet she remains the emptiest inhabitable place on earth. Seventy-five per cent of the continent has a human population of less than one person per 10 square kilometres.[55]

The major rivers were first regulated to meet the demands for river transport, then to provide water supplies in urban and rural areas. The rivers no longer run as low as they did in drought, nor do they flood as often.[56] As a consequence, native species reliant on flooding or drought events have been compromised. Regulation of rivers in the Murray-Darling basin has had a range of effects, including the disruption of flows and sedimentation downstream due to construction of dams, long term siltation and consequent aggradation upstream of dams, bank erosion in the first few years after regulation, and some indefinite sedimentary redistribution, salinity, reversal of peak flows (naturally peak flows are in winter; when regulated peak flows occur in summer), and the potential for temperature fluctuations and the transfer of biota due to inter-divisional transfers.[57]

The Rochester Irrigation Area is serviced by Goulburn-Murray Rural Water Corporation, (trading as Goulburn-Murray Water), which is empowered to provide, manage and operate an irrigation district,[58] a water district,[59] and a waterway management district.[60] It operates water-related services across 68,000 square kilometres of Victoria, involving 70% of

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51 Walker, above n 3, 117.

52 Walker, above n 3, 120. Salinity in the Murray River increases as it flows towards South Australia because of evaporation and inflows of generally naturally saline groundwater. Explorer Charles Sturt reported that the water of the Darling River in the dry season of 1829 was too salty to drink. Clark reports that the salt flow from the Murray to South Australia in a normal year is around 1,100,000 tonnes, 'comprising tributary inflows of 600,000 tonnes, drainage inflows of 250,000 tonnes. A further contribution of 500,000 tonnes is added within SA, mainly from groundwater inflows.' Sandford D Clark, 'The River Murray Waters Agreement: Peace in our time?' (1983-85) 9 *Adelaide Law Review* 108, note 62, 124

53 Captain Charles Sturt, *Two Expeditions into the Interior of Southern Australia During the Years 1828, 1829, 1830, 1831 with Observations on the Soil, Climate and General Resources of the Colony of New South Wales.* Available from Project Gutenberg Australia http://freeread.com.au/ebooks/e00059.html accessed 29th March 2010.

54 Walker notes that '[t]he middle and lower reaches of the Murray carry a heavy washload, and there is widespread erosion associated with agriculture', and that the Darling, like the Murray, is 'predominantly a washload stream': Walker, above n 3, 119.

55 Professor Eric Willmot (1987) cited in John Fien, David Yenchen, Sharon Connell and Helen Sykes (eds) 'Australia', in *Education in the Asia-Pacific Region: Issues, Concerns and Prospects* 2002 Kluwer Academic Publishers 103. The reference to rivers flowing upside down is frequently used in a jocular fashion to mean that the mud is on the top, particularly in the case of the Yarra River in Melbourne. However, it also refers to the fact that most rivers inland run below the surface.

56 Barr above n 11, 51.

57 Walker, above n 3, 112.

58 *Water Act* 1989 (Vic) s.221.

59 *Water Act* 1989 (Vic) s.163.

60 *Water Act* 1989 (Vic) s.189.

Victoria's stored water.[61] Rochester is largely surrounded by irrigated farmland serviced by the Waranga Western Channel, sourced from the Waranga Dam, coming from Eildon Dam, all of which are part of the Goulburn System and administered by Goulburn Murray Water. The Rochester and the Campaspe Irrigation Districts serve the irrigation properties around Rochester. However, Campaspe Irrigation District farmers divert from the Campaspe River, which is supplemented by irrigation transfer from Lake Eppalock to Campaspe Weir.[62] Lake Eppalock is also a supplementary water supply for the City of Bendigo. Goulburn Murray Water is entitled to 82% of the capacity of Lake Eppalock, and has primary management control of the dam, whereas Coliban Water (which manages the Bendigo water supply) is entitled to 18%.

In Victoria, the political imperative to open the land to settlement was mediated by a series of Acts through the nineteenth and twentieth centuries. The characteristic of alienation of Crown lands from the earliest days of the Colony was the strong emphasis on settlement. After the Separation of the Colony of Victoria from New South Wales on 1 July 1851, the New South Wales laws applying to the sale and occupation of Crown lands continued in force in the State of Victoria until they were altered by the new Victorian legislature. That didn't occur until the *Sale of Crown Lands Act* 1860 (Vic) (the *Nicholson Act*).[63] This Act enabled selection of allotments of between 32.4 and 259 hectares (80 and 640 acres) at one pound per 0.4 hectares (one acre). However, this system of selection became less palatable as miners left the diminishing returns of the gold fields and turned to agriculture. The Act was amended by the *Sale and Occupation of Crown Lands Act* 1862 (Vic) (the *Duffy Act*) which sought to address this perceived weakness and make property available to 'tenant farmers, farm labourers' and others.[64] The Act introduced a ballot system but sought to release land 'as much as possible in defined and extensive districts and not in isolated or scattered portions'. The land was to be in allotments which could not be less than 16.2 hectares (40 acres) or more than 259 hectares (640 acres). Conditions of the leasehold moieties were the requirement of cultivation of one-tenth of the area, erecting a habitable dwelling or enclosing the area with a substantial fence. These could be avoided, however, by immediate payment of purchase money, thus obtaining freehold. The *Amending Land Act* 1865 (Vic) (the *Grant Act*) sought to address the perception that the system thereby gave preference to affluent selectors. This required that land had to be held under a leasehold, which could not be made freehold until after three years, and improvements amounting to the value of one pound per acre had to be effected.[65]

The *Land Amendment Act* 1869 (Vic) brought in new and more relaxed requirements. It established a system of licensing for three years for allotments of, or less than, 129.5 hectares (320 acres). During the licence period, conditions requiring fencing, cultivation and residence were required, and on satisfactory compliance the freehold could be claimed by purchase at one pound per 0.4 hectares (one acre) or a lease taken for seven years, over which period the purchase price could be paid. The ballot system was abolished in favour of a system of public hearings at which evidence was submitted by applicants, and a recommendation made by a Local Land Board. The Act placed restrictions on further acquisition by those who had already obtained land, and placed a limit on disposal of further lands. Under the more liberal rules of the 1869 Act the Rochester district experienced population growth. However, the

61 http://www.g-mwater.com.au/ accessed February 1, 2010.
62 The detail of these structures can be seen at http://www.nvirp.com.au/the_project/the_backbone.aspx.
63 Survey Practice Handbook – Victoria, Section 3, A C Brown, 'Land settlement and the role of the surveyor' Part 31989, 1994, 68.
64 Ibid, 69.
65 Ibid, 70.

absence of reliable water beyond the rivers made farming tenuous. The failure of water at various times was a further driver for the development of reliable water supplies.

The *Land Act* 1884 (Vic) provided for the division of remaining unalienated land into eight classes: pastoral lands, agricultural and grazing lands, auriferous lands, lands which could be sold by auction, swamp lands, State forest reserves, timber reserves and water reserves. The acreage of, and conditions attaching to, licences depended on their classification. Alienation of State forest, timber reserves and water reserves was prohibited. Agricultural and grazing land, however, could be licensed in areas of, or not exceeding, 129.5 hectares (320 acres). Conditions included residence and improvements. The term was six years, after which a lease could be obtained and the purchase amounts payable over fourteen years. This further liberalised the conditions for acquisition of agricultural lands. There were other region specific measures: the *Mallee Pastoral Leases Act* 1883 (Vic) and the *Mallee Lands Act* 1886 (Vic) made specific provision for the selection of the marginal Mallee lands. The *Settlement of Lands Act* 1893 (Vic) provided for the allocation of Crown lands for communities.

Water policy experienced parallel development, but Victorian water policy diverged from United States policy in significant ways. Alfred Deakin, later a delegate to the Constitutional Conventions, had travelled extensively in the United States and the recommendations of the Royal Commission on Water Supply which he chaired formed the basis of water administration in Victoria. The Commission developed several innovations as a result of what were perceived to be weaknesses in the systems of the western United States.[66]

In 1898 the government of the day sought to remedy the 'past recklessness, profligacy and extravagance [of land legislation which had] resulted in the creation of large estates'.[67] They sought to 'encourage closer settlement in a vast land … with the interventionist proposition of the 'home maintenance area'.[68] This was based on the proposition that a family required a certain amount of land to support themselves – depending on the nature of the land and the availability of water. The policies in general sought to establish the idea of a self-sufficient set of 'yeoman farmers'. The *Land Act* 1898 (Vic) subdivided the previously created classification of agricultural land into 'good agricultural or grazing land', 'agricultural and grazing land', 'grazing land' and 'pastoral land' (large areas). The size of agricultural blocks and the price reflected the variable land quality.

At the inception of the irrigation schemes in Victoria, the private model was adopted for the development of infrastructure. The *Water and Conservation District Act* 1880 (Vic), which was part of the platform of the re-elected O'Loughlen government, was a reaction to the state-wide droughts of 1877-81, and a recognition that the provision of secure water involved major infrastructure works. The Act provided that local councils could work together to plan water infrastructure, and if the schemes were approved by the State government they would be eligible for government loans. The United Echuca and Waranga Waterworks Trust was established under the provisions of the Act in 1882. The Trust sought the creation of a channel along the lines of an abortive 1871 proposal for a North-Western Canal. The works of the trust included the Goulburn Weir at Nagambie, started in 1887, the Waranga Reservoir, surveyed before 1890 but not commenced until the impact of a drought in 1902 prompted funding, and the construction of the Sugarloaf (Eildon) Weir just below the junction of the Goulburn and Delatite Rivers.

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66 See below at III.

67 Second Reading Speech on a Bill to amend the *Land Act*

68 Lin Crase, Phil Pagan and Brian Dollery, 'Water markets as a vehicle for reforming water resource allocation in the Murray-Darling Basin of Australia' (2004) *Water Resources Research* 40, 41.

In 1882 an amendment to the *Water and Conservation District Act* 1880 (Vic) was designed to apply the same principles to the development of infrastructure for irrigation. It enabled the formation of irrigation trusts, avowedly with the intention

> [to have regard to] the conservation and distribution of water not only as a means of preserving life, both animal and human, but also as a means of increasing the yield of the soil, giving some security to agriculturalists in districts where the rainfall is precarious.[69]

By 1900 nearly ninety irrigation trusts had been formed in the Rochester district, including the Campaspe Irrigation Trust, which was responsible for the construction of the Campaspe Weir, the Torrumbarry North Trust, formed in 1889 to pump water from the Murray to irrigate contiguous lands, and the Millewa Irrigation Trust, formed in 1890 to irrigate Ballendella, Bamawm and Millewa.[70] However, the terms upon which the irrigation trusts were to operate differed from the waterworks trusts in that the financing of the trusts were to be a local responsibility, with the purported effect of encouraging self-reliance, self-support and independence, and to discourage reliance on Government.

The irrigation trusts very quickly suffered financial difficulties. Most found the collection of sufficient revenue to meet interest and maintenance costs impossible, and the infrastructure fell into a state of disrepair. Barr notes that the trusts were quite successful in obtaining bank loans, and most trusts borrowed heavily, and when the banks crashed in 1893 'they faced insolvency and a legacy of debt'.[71] Legislation in 1885 empowered the government to make loans available to them on the same terms as were originally allowed to the waterworks trusts. In 1899 the Turner government passed the *Water Supply Advance Relief Act* 1899 (Vic), in recognition that the trusts would not become solvent.[72]

The Water Supply Department (later the State Rivers and Water Supply Commission) was formed in 1886. A report to the Government of the day recommended that the supply of water to the area along the lines proposed by the United Echuca and Waranga Waterworks Trust be regarded as a National Work. However, the Government had learnt from the experience of the trusts: to ensure the return on their investments, farmers would not have the choice to take the water or leave it. Water rights were fixed and were attached to the land, and a water right had to be paid for, whether the water was used or not. These principles have applied to the provision of irrigation water up until the *Water Act* 1989 (Vic) and beyond, largely constraining the creation of a market for water until recent reforms.

In the 1890s, water failed altogether, and the Australian constitutional conventions took place in the context of the 'federation' drought, which lasted for at least a decade.[73] Water was a significant issue, and the American experience was drawn upon in several respects – largely negative. In his analysis of the drafting history of s.100, Chief Justice French, cites Inglis

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69 Ingle-Smith, above n 9, 151.

70 Rochester Centenary Celebrations Committee *Live and Prosper 1854-1954* Rochester: Rochester Centenary Celebrations Committee, (1954).

71 Barr, above n 11, 8.

72 Ibid.

73 The 'Federation Drought continued from around 1895 to 1903 and has been commonly attributed to an extremely severe El Nino/Southern Oscillation event: Michael Coughlan, David Jones, Neil Plummer, Andrew Watkins, Blair Trewin and Shoni Dawkins, 'Impacts on 2002-03 El Nino on Australian climate', *DroughtCom Workshop* http://134.178.63.140/climate/droughtcom/abstracts/coughlan.pdf. Recent research indicates, however, that it was driven by the Indian Ocean Dipole, exacerbated by higher temperatures: Caroline C Ummenhofer, Matthew H England, Peter C McIntosh, Gary A Meyers, Michael J Pook, James S Risbey, Alexander Sen Gupta and Andrea S Taschetto, 'What causes southeast Australia's worst droughts?' 36 (2009) *Geophysical Research Letters* L04706. The weather patterns were not localised; many other countries experienced drought.

Clark's critique of the 1897 draft Constitution, which 'referred to decisions of the courts of the United States establishing that Congress had power to legislate, under the commerce power in the United States Constitution, with respect to the use of all the navigable rivers as highways for commerce between those States or with foreign countries.'[74]

The experience of the federation drought was the genesis of agitation for infrastructure to preserve water in periods of flood to deliver water beyond the immediate environs of the river in times of drought. Agitation as early as 1856 for the development of a storage at Gunn's Swamp (Waranga Lagoon) failed because of insufficient land settlement in the area[75]. However, by 1910 the Victorian Government was actively pursuing an immigration policy, attracting settlers from England and America by issuing booklets advocating settlement in the Rochester and Cohuna Districts. The experience in the western States in America provided a model for closer settlement policy, and a number of expatriates helped form significant parts of the Australian system. The Chaffey Brothers, although Canadian, had been instrumental in the Santa Ana River Irrigation Settlement in California, and tried to import this to the Mallee scrub around Mildura and Renmark, seeking Crown grants of land to replicate their success.[76] During this period, Elwood Mead, from Patriot, Indiana, became the first chair of the Victorian State Rivers and Water Supply Commission in 1907. He had been a State engineer in Colorado and Wyoming, then worked for the Department of Agriculture in California. Lake Mead, formed by the Hoover Dam, is named for Elwood Mead.

However, even in the context of State advocacy for large infrastructure schemes, the need for closer settlement to fund infrastructure development was still experienced by smaller communities. The loss in 1913 to Bendigo of a direct rail link to Melbourne was seen as an attempt to make Rochester 'subservient' to Bendigo.[77] The dominance of urban interests in the development of infrastructure was reportedly a feature of development:

> The fact is, Ministers and their supporters have lent a too willing ear to the persistent clamour and threats of centralized metropolitan interests and their press organ, which insisted that the railways and marketing and other requirements of the farmers and producers should be subordinated to the demand for electrification of suburban railways.[78]

The formation of the Rochester District Irrigators' League was primarily motivated by the failure of water in 1914. This occurred when, against the advice of the then Chairman of the Water Commission, the channel from the Waranga Basin in the Goulburn system was extended to supplement supply to Loddon irrigators. This placed greater demands on Goulburn storages. The League sought the creation of further storages and the reposing of responsibility for water rights in the Commission. In these efforts the League was successful; the construction of Eildon was brought forward, and the Commission came to talk of water rights as its responsibility.

Agricultural policy in the period after the Second World War was largely directed towards expanding production, with the objective of improving Australia's balance of payments in the

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[74] *Arnold v Minister Administering the Water Management Act* 2000 [2010] HCA 3 [10] (French CJ), citing Williams, *The Australian Constitution: A Documentary History*, 2005, 706.

[75] S Thomas *Covered with dust and troubled with mud* Echuca: Riverine Herald Pty Ltd (1979), 30

[76] The agreement between Alfred Deakin (on behalf of the government of the Colony of Victoria) and George and William Chaffey is available in the Digital Collection of the National Library of Australia MS 1540 *Papers of Alfred Deakin*, 1804-1973 (bulk 1880-1919) [manuscript]. Series 10: Irrigation, c.1884-1949 (bulk 1885-1917) Subseries 10.3: Agreement between the Chaffey brothers and the Victorian Government, 1886-1888 Item 10/112 available at http://www.nla.gov.au/apps/cdview?pi=nla.ms-ms1540-10-112, accessed 11th February, 2010.

[77] Thomas, above n 75, 44.

[78] Ibid, 45, citing a 1914 source.

context of fixed exchange rates, which continued until the early 1970s, despite the demise of fixed exchange rates.[79] Measures adopted during that time, aside from water and land resource development schemes, included 'a mixture of direct incentives to farmers (tax concessions, input subsidies and investment allowances), … and price support and stabilisation measures.'[80] During this period the American influence continued. David Lilienthal, the Chair of the Tennessee Valley Authority was influential in the post-war development of rural policies, particularly those of decentralisation, regionalism[81] and programs to enhance 'grass roots' development.[82]

Only a decade after the last soldier settlement schemes,[83] and around the same time as the Rochester scheme, the process of mediated depopulation ('rural adjustment') began. This was part of a shift in policy direction in recognition that previous schemes which had been intended to provide income stabilisation were ineffective in achieving the policy goals to which they were primarily directed: although they may have stabilised commodity prices, they could not control the cost of input commodities and production variability. The Rural Adjustment Scheme was first formed in the 1960s, and sectoral approaches to rural depopulation and farm mergers to ameliorate rural poverty occurred: for instance, the *Marginal Dairy Farms Reconstruction Act* 1970 (Cth); *State Grants (Rural Reconstruction) Act* 1971 (Cth) and the *Rural Reconstruction Act* 1972 (Cth). Income Stabilisation Deposits were introduced with the objective of allowing farmers to stabilise their own incomes, and price policy shifted to 'the more limited objective of reducing some of the uncertainty farmers face because of the prospect of substantial price declines.'[84] Rural Adjustment Schemes were intended to 'assist farmers to adjust to changing economic conditions rather than attempt to fight against them.'[85] Attempts to integrate farm and regional policy were abandoned and regional policy was developed as an area separate from farm policy. The difficulties faced by farmers in relation to other, subsidised areas of the economy were addressed by the Director of the Bureau of Agricultural Economics thus:

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79 Geoff Miller, 'Future agricultural policy in Australia', paper presented at *Future Marketing Policies for the 1980's,* AGRO-79, Perth, March 1979, 3.

80 Ibid.

81 Michael C Steiner, 'Regionalism in the Great Depression' (1983) 73 *Geographical Review* 430 – 446.

82 David Ekbladh, '"Mr TVA": Grass-roots development, David Lilienthal, and the rise and fall of the Tennessee Valley Authority as a symbol for U.S. overseas development, 1933 – 1973' (2002) 26 *Diplomatic History* 335 – 374; Donald E Voth, 'A brief history and assessment of federal rural development programs and policies', (1994-5) 25 *University of Memphis Law Review* 1266. The influence of Lilienthal and the Tennessee Valley Authority was extraordinary:

> The word "Tennessee" is well known all the way from the Mediterranean to the Pacific…They know about Tennessee because they have heard of the Tennessee Valley Authority. It is the Tennessee Valley Authority that fits their needs and will solve many of their basic problems. The TVA can also be utilized as one of the major influences to turn back the tide of communism what today threatens to engulf Asia. Address of Justice William O Douglas before the General Assembly of the State of Tennessee, 22 February 1951, *Appendix to the Congressional Record*, 82nd Congress, 1 Sess, 1 May 1951.

83 Soldier Settlement Schemes after World War 1 are largely considered to have been a tragic failure; a Royal Commission concluded that returned soldiers were stymied by a range of factors, including the inadequate size of the blocks provided and their own lack of capital and lack of experience: Report, *Royal Commission on Soldier Settlement* Victorian Parliamentary Papers, vol 2 1925. Nevertheless, the scheme was revived after World War 2, under the *War Service Land Settlement Agreement Act* 1945 (Vic). Dryland farms were allocated around Rochester, and new irrigated blocks were allocated in the Goulburn-Murray irrigation region.

84 Ibid, 4.

85 Ibid, 12.

> Efficient, justifiable farm policies are probably the most effective weapon for ensuring that the farmers' case against assistance being given to other sectors at its expense, is heard. In the end, having the strength to cope with the forces of economic change is far more important to an industry's long run prosperity than the static benefits and costs of government subsidies and tariffs.[86]

During the 1980s and 1990s there was a collapse in commodity prices at an international level[87] and low farm incomes overseas were recognised as a policy problem in Australia. However, the prevailing agenda in Australian policy continued to be premised on microeconomic reform intended to enhance free competition. This was institutionalised by the national *Competition Policy Reform Act* 1995 (Cth), based on intergovernmental agreements on Competition Principles, a Conduct Code and an Agreement to implement reforms. In 1997 the Rural Adjustment Scheme was radically overhauled, and a policy advocating reliance on market mechanisms was introduced, overtly raising 'the relative importance of efficiency over equity'[88] and reflecting a long term political ideology within government and the public service.[89] This was despite the 1995 ratification of the WTO Agreement on Agriculture which 'established a system of managed international trade for agriculture rendering irrelevant Australia's domestic policy direction based on a free trade agenda.'[90] In the water sector, this political ideology has been reflected in the corporatisation of water supply authorities and a pressure on supply authorities to obtain full cost recovery and to generate a return on capital.[91]

III THE LEGAL FRAMEWORK FOR WATER ADMINISTRATION IN AUSTRALIA AND THE UNITED STATES

Each of the States in the United States has the authority to determine how water will be allocated and administered.[92] Amos notes that '[s]tate control over waters originated under the equal footing doctrine which provides that the federal government held in trust for the States beds of navigable waters.[93] Upon entering the Union, title for the beds of navigable waters passed to the individual States for the benefit and trust of the people of the State.'[94] Western States' allocations occurred according to the doctrine of prior appropriation.[95] 'This doctrine allows the first user, established by priority dates, to retain a right to water if it is used for a specific "beneficial use." These beneficial uses are determined and defined by State law,'[96] however, they would generally be agricultural, household or industrial use. Environmental uses were not initially regarded as beneficial use, although in some cases they have been

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86 Ibid, 15.

87 Ben Rees and Mark McGovern, 'Regions between theory and reality: Agricultural policy and its impacts in Australia', Paper presented to the 28th Annual Conference of the Regional Science Association International, Australia and New Zealand Section Woolongong, 29th September to 1st October 2004.

88 Barr, above n 11.

89 Michael Pusey, *Economic Rationalism in Canberra* (Cambridge: Cambridge University Press, 1992).

90 Rees and McGovern, above n 87, 2.

91 A Reynolds, and P von Nessen, 'The Government Owned Corporations and State Owned Corporations Statutes' in Collier, B and Pitkin, S (Ed) *Corporatisation and Privatisation in Australia. A collection of papers examining legal, economic and policy issues*. CCH Australia, 1999. 117.

92 Adell Amos, 'The use of state instream flow laws for Federal lands: respecting State control while meeting Federal purposes' (2006) 36 *Environmental Law* 1247, 1241-42; Alexander Wood, 'Watering down Federal court jurisdiction: what role do Federal courts play in deciding water rights?' (2008) 23 *Journal of Environmental Law and Litigation* 241, 247.

93 *Shively v Bowlby*, 152 U.S. 1, 49–50 (1894) cited in Amos, supra n 92, 1241, note 13.

94 *Ill. Cent. R.R. Co. v. Illinois*, 146 U.S. 387, 452 (1892), aff'd, 154 U.S. 225 (1894), cited in Amos, supra n 92, 1241, note 13.

95 *Wyoming v Colorado*, Amos, supra n 92, 1242.

96 Wood, supra n 92, 247.

developed in case law or legislation. Other States had little water law aside from the riparian doctrine arising in common law, however modern patterns of settlement have contributed to water scarcity and disputes with neighbouring States over water resources.[97] Federal rights to water in the United States can arise when the federal government 'reserves or acquires land for some particular purpose, [and] a certain amount of unappropriated water necessary to achieve the purposes of the federal land designation is implicitly reserved.'[98] Federal reserved rights generally 'trump' State prior appropriation rights.[99]

In Australia, the legislative power over water and the environment lies primarily with the states.[100] Having the advantage of the experience of the United States' approach to water administration, delegates to the Australian Constitutional Conventions considered reposing legislative authority for water in the Federal Government. It was argued that water should be conceded to the common use of the nation, rather than to the exclusive use of a State. During the 1898 debate Gordon argued:

> Is it not extraordinary that nations which are hereditary enemies – nations whose soil has too often been wetted with each other's blood – should concede this principle, and that it should be denied amongst us who … owe allegiance to one Crown, are one in race and nationality, are brothers dwelling in amity in a land which is ours from sea to sea?[101]

Despite this plea, the Australian Constitution emphatically reposed power over water in the States, and by s 100 minimised Federal intervention.[102]

Victorian water law was developed following a Royal Commission on Water Supply chaired by Alfred Deakin. His extensive enquiries into different models of water management, particularly in the United States of America, prompted the Royal Commission to make the recommendation that '[i]t is essential that the State should exercise supreme control of ownership over all rivers, lakes, streams, and sources of water supply, except springs rising upon private lands'.[103] The Royal Commission also recommended that the State should dispose of water to those desiring to irrigate, to encourage the greatest possible utilisation of the water on the largest possible area, but that there should be unity of title to water and land.[104] The *Irrigation Act* 1886 (Vic) was based on these premises and the premise that the rights of individuals and the State should be properly defined so that costly litigation would be avoided.[105] Thus, the original legislation and subsequent Acts vested water in the Crown in

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97 Joseph W Dellapenna, 'Special challenges to water markets in riparian states' (2004) 21 *Georgia State University Law Review* 305, 305.

98 Wood, supra n 92, 248.

99 Ibid. This is generally the case because the priority date for a Federal reserved right is the date the Federal reservation was established. It is possible that the state prior appropriation right may be senior to the Federal reserved right.

100 Each jurisdiction in the catchment has a general piece of legislation which, broadly speaking, establishes a system for the planning, allocation and use of water. These are the Water Act 1989 (Vic), the Water Management Act 2000 (NSW), the Water Act 2000 (Qld), the Water Resources Act 1997 (SA).

101 The Hon J H Gordon, *Official Report of the National Australasian Convention Debates (Third Session)*: Melbourne 1898, 33.

102 Section 100 states that '[t]he Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a State or of the residents therein to the reasonable use of the waters of rivers for conservation or irrigation.'

103 *Royal Commission on Water Supply 1885 - First Progress Report* Victoria, Parliamentary Papers (1885) vol 2.

104 For an extensive analysis of the history of water legislation in Victoria, see S Clark and I Renard, *The Law of Allocation of Water for Private Use* 1972 Vol 1 and S D Clark and I A Renard, 'The Riparian Doctrine and Australian Legislation' (1970) 7 *Melbourne University Law Review* 475.

105 Ibid 487.

right of the State.[106] However, in irrigation districts the State allocated water rights to land according to formulae which altered depending on the settlement priorities at the time[107] and the capacity to trade in water existed only insofar as the land was traded. The statutory rights of a Victorian irrigator, therefore, had features common to other those in other States: a conditional right to access water, rather than an ownership right, grants for certain users for designated use, defined either by the amount of land to be irrigated or by a volumetric entitlement, generally tied to the land, capable of suspension during periods of water shortage, and generally not tradeable. The duration of the licenses varied both within and between States.[108]

The Victorian administrative arrangements for water could not, however, survive the federalisation of water resources developing alongside an increasingly homogenous water policy. The dominant tendency of water management over the past few decades has been the continuation of the national competition policy reform to introduce market mechanisms to the administration of water resource management.

> Management of rural water has been driven by reforms mandated by the Council of Australian Government (CoAG) endorsement of the Productivity Commission Reforms and the National Water Initiative,[109] all of which have market principles as their underlying premise. The National Water Initiative contained a package of reforms, including changes to water prices, allocations, environmental and water quality, and trading.[110]

Homogeneity of water administration was the inevitable consequence of State and Federal government endorsement of Productivity Commission Reforms. In addition, Commonwealth/State agreements and State/State agreements are also a characteristic of the policy and legislative structure, in recognition of the catchment-wide issues arising in water management and in recognition of shared river resources. The Commonwealth, States and territories have entered into several key pieces of water related agreements.[111] Inter-jurisdictional agreements are given effect by State legislation.[112] In addition, States have committed to the Murray Darling Basin Commission Cap on Diversions from the Murray-Darling Basin. The Federal government also can – and does – exert significant influence

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[106] See Francine Rochford, 'Private rights to water in Victoria: Farm Dams and the MDBC Cap', (2004) 9 *The Australasian Journal of Natural Resources Law and Policy*, 229.

[107] Francine Rochford, 'Dissonance and Distrust: Recurring Issues in Regional Settlement and Water Resources Development' *The Australian Sociological Association Conference* 2004 December 8-11, 2004 Beechworth Katy Richmond (ed). http://www.tasa.org.au/conferencepapers04/docs/RURAL/ROCHFORD.pdf.

[108] Thomas Garry, 'Water markets and water rights in the United States: Lessons from Australia' (2007) 4 *MqJICEL* 23

[109] Intergovernmental Agreement on a National Water Initiative between the Commonwealth of Australia and the Governments of New South Wales, Victoria, Queensland, South Australia, the Australian Capital Territory and the Northern Territory, available at http://www.coag.gov.au/meetings/250604/index.htm#water_initiative.

[110] Francine Rochford, 'Sustainable rural water delivery: balancing resource and social sustainability' (2008) 12 *Australasian Journal of Natural Resources Law and Policy* 59 [some footnotes excluded].

[111] Including the National Water Initiative, the Council of Australian Governments Water Reform Framework 1994, the National Action Plan for Salinity and Water Quality 2000, and the Murray-Darling Basin Agreement 1992. The Murray-Darling Basin Agreement 1992 includes provisions for managing the Murray Darling Basin, and provides for a cap on diversions from the rivers in the Murray-Darling Basin: Murray–Darling Basin Agreement 1992: Murray–Darling Basin Act 1992 (NSW) sch 1.

[112] Such as the New South Wales-Queensland Border Rivers Act 1947 (NSW), New South Wales-Queensland Border Rivers Act 1946 (Qld); the Murray-Darling Basin Act *1992* (NSW), the Murray-Darling Basin Act 1993 (Vic), Murray-Darling Basin Act 1996 (Qld), Murray-Darling Basin Act 1993 (SA), the Victoria South Australia Border Groundwaters Agreement 1985 (Vic), the Groundwater (Border Agreement) Act 1985 (SA), the Lake Eyre Basin Agreement Act 2001 (Qld),the Lake Eyre Basin (Intergovernmental Agreement) Act 2001 (SA).

through steering mechanisms such as funding arrangements. The payment or non-payment of tranche payments as part of Council of Australian Governments (CoAG) agreements and the availability of Federal funding for major infrastructure works are typical negotiating tools.

Despite its limited Constitutional authority, the Federal government can exert legislative power over water through more circuitous means and has done so with the *Water Act* 2007 (Cth). Section 11 has the effect that if any provision of the Act which would contravene the restrictions in ss 99[113] and 100 of the Constitution it is to be interpreted so that it does not do so. In addition, States have referred their powers to the Commonwealth pursuant to paragraph 51(xxxvii) of the Constitution, and the *Water Amendment Act* 2008, detailing amendments pursuant to that referral, deals with, inter alia, the requirement for a Basin Plan to deal with critical human needs, state water sharing arrangements, water market rules and water charges, including charges for infrastructure.

IV THE MARKET PARADIGM

The market paradigm remains dominant in rural water provision in Victoria, as in the rest of Australia. The ubiquity of market mechanisms in Australian natural resource management is a result of the dominance of 'co-operative federalism', with a recent segue into 'financial federalism.' According to this approach, Federal and State governments commit to a program of reform which will deliver unanimity in selected policy fields, mediated by payments by the Commonwealth government to compliant States. The overall tenor of reform as it relates to irrigators has been the introduction of market mechanisms by which, theoretically, water will move to the most efficient use,[114] although the effectiveness of market mechanisms to deliver these goals is the subject of debate.[115]

In recent years the State has been attempting to reduce irrigation infrastructure through a variety of mechanisms. There are several reasons for reduction of services. The most potent justification is the over-allocation of water from rivers and the resulting environmental damage. However, the environmental problems have been overshadowed by increasing urban consumptive water use and a long period of reduced inflows in catchments servicing both irrigation and non-irrigation areas. There are a number of other reasons for reduction of the extent of irrigation infrastructure: it is expensive to maintain, and on a user pays basis, on various costing models, water delivery to irrigators cannot compete on a market basis with water delivery to urban areas.

The introduction of a market for water has developed to a reasonably advanced state in Victoria, although the market for water generally could still be said to be immature.[116] The

[113] The Commonwealth shall not, by any law or regulation of trade, commerce, or revenue, give preference to one State or any part thereof over another State or any part thereof.

[114] Environment and Natural Resources Committee (ENRC), *Inquiry into the Allocation of Water Resources*. – Report, Parliament of Victoria (2001), 221.

[115] M E Warner and J Gerbasi, Privatization, Public Goods, and the Ironic Challenge of Free Trade Agreements' (2007) 39 *Administration & Society* 127; P Trawick, 'Against the privatization of water: An indigenous model for improving existing laws and successfully governing the commons' (2003) 31 *World Development* 977 – 996.

[116] P Hughes and W Gebbies, *Getting More From Less, a Review of Progress on Energy Efficiency and Renewable Energy Initiatives in New Zealand*, Office of the Parliamentary Commissioner for the Environment, Wellington, NZ, 2000, February, 47; H Bjornlund, and J McKay, Australian Water Market Policies: Current Issues and Future Directions, (2001) *Water*, March 74-78; R G Dumsday, & I M Fraser, *Estimating the Environmental Benefits of Lake Wartook Reservoir, the Grampians National Park, Victoria,* consultant's report, November, Wimmera Mallee Water, Melbourne (1996).

market reforms, following Coase's case for voluntary market solutions for public goods,[117] are based upon a system of property rights, an open and fair bargaining framework based on complete information, and an adjudication process.

> Together these elements lower the otherwise high transaction costs of such market arrangements by eliminating uncertainty and therefore risk. Trade rules and obligations may create a more stable environment for business in protected sectors, but a less predictable environment for regulators, legislators and planners.[118]

The first of the key market-enabling shifts that has occurred over the past three decades has been the separation of water from land to enable water to be traded separately. This occurred in 1986, when limited trading of water rights between irrigation properties was enabled. More recent Victorian legislation has made alterations to the fundamental connection between water and land.[119] In relation to northern Victorian water authorities, unbundling of water products has occurred. As a result of the provisions of the *Water (Resource Management) Act* 2005 (Vic), which amended the *Water Act* 1989 (Vic), existing water rights were converted into water shares, delivery rights and water-use licences upon the declaration of an irrigation district. It is possible for the irrigator to trade the actual water share, but the infrastructure access fee would still be payable, unless the irrigator surrenders it, paying a termination (exit) fee which was originally set at a fixed multiple of the Infrastructure Access Fee. This is intended to ameliorate the burden on the remaining irrigators to sustain the infrastructure, but it constitutes a serious burden on the property and limits the capacity of the irrigator to adapt to change.

In March 2007 the largest irrigation water supplier, Goulburn-Murray Water, imposed 'basin pricing' strategies, intended to recover from customers the cost of water harvesting and storage services.[120] Separate registration of water share details was enabled on 1st July 2007.[121] Water Rights shown on registers as being associated with particular land as at that date became separately tradeable as water shares. On the same date the reforms have reposed in irrigators an altered form of water entitlement. What was previously called a 'water right' now amounts to a set of 'unbundled water shares'.[122]

Reconfiguration of irrigation infrastructure was part of the structural adjustment built into the Victorian strategy for governing water resource use. It was primarily directed towards ameliorating the cost of maintaining infrastructure, as well as addressing costs due to changing engineering standards and escalating costs of compliance with occupational health and safety requirements.[123] Infrastructure was 'rationalised' through a number of mechanisms,

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[117] R H Coase, The Problem of Social Cost (1960) 3 *Journal of Law and Economics* 1-44

[118] Warner and Gerbasi, above n 115

[119] The *Water Act* 1989 (Vic) provided for trade in entitlements, but water was still attached to land: trade in a water entitlement meant that the water entitlement was severed from one parcel of land, but had to be attached to another.

[120] Goulburn-Murray Water Annual Report 2007-08, 24; available at http://www.g-mwater.com.au/downloads/Annual_Reports/G_MW_2007_08_Annual_Report.pdf accessed February 1, 2010.

[121] The Victorian Water Register commenced operation on July 1, 2007 for irrigation districts in northern Victoria.

[122] The unbundling of water products into a water share, water use and delivery capacity share was promised by the White Paper: State of Victoria, Department of Sustainability and Environment White Paper *Our Water Our Future: Securing our water future together* 2004 and introduced by the Water (Resource Management) Act 2005 (Vic), which amends the Water Act.

[123] F Rochford, 'Getting to Yes: Clearing the Way for Agreement in Water Reform.' In P. Dalziel (Ed.) *Building Sustainable Growth in SMEs: Refereed Proceedings of the 31st Annual Conference of the Australian and*

including upgrading or piping channels, repairing leaks, improving on-farm infrastructure and replacing defective water meters. The water 'saved' through these processes can then be returned to rivers, correcting the overallocation of water in the Basin. However, during the implementation of reconfiguration strategies, pressure has arisen to demonstrate water savings through the reconfiguration process, in order to return water to rivers. Subsequently the continuing drought necessitated more aggressive political responses to the threat of water shortages, particularly in urban communities, increasing pressure to find water savings which could then be 'transferred' to urban authorities. In addition to reconfiguration, a modernisation program was implemented in some districts, replacing open channels with piped systems or lined channels, replacing Dethridge meters with Magflows or Flume Gates, and in some cases implementing total channel control. Many irrigators have not been able to access a full volumetric entitlement for many years, and are amenable to negotiated reduction or privatisation of infrastructure, or closure of infrastructure altogether. Irrigators wishing to adapt to increasing water shortages by exiting the industry are able to do this by accepting a negotiated settlement. Again, this process is partially funded by 'water savings.' Some of the modernisation proposals may have the effect of bringing all irrigation infrastructure back to the 'trunk' – in other words, maintaining and modernising main channels, and privatising the pods, or even the trunks. This will effectively circumscribe areas of irrigated agriculture to those clustered around the main channels, and will again privatise the losses and thus the risks of climate change. However, the modernisation programs have coincided with piping projects which aim to deliver water to urban centres in other catchments. The 'superpipe' which feeds water from the Goulburn system to the goldfields towns of Bendigo and Ballarat was followed by the 'Foodbowl ModernisationProgram (Northern Victorian Irrigation Renewal Program – NVIRP) which diverts water from the Goulburn Valley to Melbourne through the Sugarloaf pipeline. This politically sensitive project is intended to supplement Melbourne water supplies,[124] but is premised on 'saving' water through infrastructure investment, thus creating 'new' water. The Productivity Commission notes that:

> One of the purported benefits of water saving investment over market purchase is that it avoids reductions in rural water use by creating 'new' water. However, water 'savings' associated with indirect purchases can be illusory. That is, measures to reduce system losses actually divert water from other beneficial uses, elsewhere in the system, that rely on return flows … For example, total channel control is a water delivery technology that uses automated control gates to reduce irrigation district outfalls and improve service quality. However, district outfalls often supply downstream water users. Transferring entitlements out of the system based on illusory water savings can therefore 'double up' losses in return flows.[125]

The Victorian Auditor-General has also criticised the expedition with which aspects of the project have been carried out, finding that decisions to invest $AU2 billion in irrigation

New Zealand Regional Science Association International. Lincoln University: AERU Research Unit, 2007, ISBN 978-0-909042-87-5, 191-206.

[124] P Hunt, & D McKenzie, 'City taps in', *The Weekly Times*, June 20, 2007, 1; P Hunt, 'The pipe fight is on' *The Weekly Times* June 27 2007, 3; J Kerin, 'Bracks defiant on plan' *The Australian Financial Review*, April 20, 2007, 19; R Kleinman, 'Goulburn water pipe plan gathers steam' *The Age* May 30, 2007. Economists have not supported the construction of piping infrastructure on the basis of the NVIRP program: 'Irrigation upgrade's value defended' *Country News* March 31, 2010, http://www.countrynews.com.au/story/asp?TakeNo=201003292250136, accessed March 30, 2010: 'experts said a cheaper solution to Melbourne's water crisis would be to forget expensive irrigation upgrades and instead buy the water from willing farmers in the north and deliver it through the north-south pipeline.'

[125] Productivity Commission, *Towards Urban Water Reform: A Discussion Paper*, Productivity Commission Research Paper, Melbourne, March 2008, 78 [references omitted].

projects were poorly informed.[126] The Audit examined the planning processes for both the Foodbowl Modernisation Project and the Sugarloaf Pipeline, and found that the projects were commenced prior to the completion of a business case, that there was little management information to enable the projects to be assessed, and that processes had not been developed to determine whether the projects were meeting objectives. The Report did not assess the outcomes of the two projects, which are to be the basis of a later Audit.

There are a range of potential third-party effects of these processes such as the reduction in return flows, that will be particularly relevant in water diversion to Melbourne, out of the Murray-Darling system altogether.[127] However, the major projected outcome of these reforms will be the 'exit' of water from some irrigation districts or parts of irrigation districts. This has already been indicated by the imposition of differential rules for the 'backbone' infrastructure and non-backbone infrastructure. The 'backbone' as currently conceived is clustered around the main carriers and channels and spurs off the main carriers which have a minimum 'delivery share' attached.[128] Those channels and 'pods' which do not have the required delivery share will have to 'connect back' to the backbone on a 'connections program' the techniques and costs of which have not yet been defined.

The increasing alternative water uses, the costs of maintaining water infrastructure whilst receiving no water, the pressures of ongoing reform, and the continuing drought will have an impact on irrigation districts, some of which will consider it more rational to trade their permanent water supplies altogether. On 29th March 2010 reports indicated the demise of the Campaspe Irrigation System, which services the region south east of Rochester. This was based on a survey of farmers, 75% of whom indicated that they would 'exit irrigation, after struggling through zero per cent water allocations for four of the past five years.'[129] According to these reports, those choosing to exit would 'transfer their water shares to the Federal Government, terminate all delivery share and receive an adjustment payment.'[130]

V LESSONS FOR THE UNITED STATES

The deployment of market mechanisms to mediate natural resource management issues is well-advanced in Australian jurisdictions, and in its application to water policy it has the capacity to deliver substantial changes to the rural community over the next few years, as drought and climate change continue to have an impact on irrigated agriculture. As the pool of water is reduced, and water allocations are thus diminished, the capacity of irrigators to justify the purchase of a reduced entitlement to maintain their farming enterprise becomes increasingly limited. Efficiency offsets for those acquiring water entitlements cannot deliver the benefits of the increased costs. Thus, water will move to the more efficient user – the party or program that can build and maintain the infrastructure and sell the water at a price which will justify the purchase. Governments are relying on the invisible hand of the market to deliver efficiency gains – possibly because they will not then be the visible agents of change in rural communities.

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[126] Victorian Auditor-General's Office, *Irrigation Efficiency Programs* June 2010, available at http://www.audit.vic.gov.au/reports_publications/reports_by_year/2009-10/20100906_irrigation_efficiency.aspx

[127] Productivity Commission, above n 125..

[128] Northern Victoria Irrigation Renewal Project (NVIRP) 'Connecting to the backbone' http://www.nvirp.com.au/the_project/the_backbone.aspx.

[129] Laura Little, 'System exit to go ahead' *Riverine Herald* March 29, 2010, available on http://rivheraldechuca.net/redstory/read.asp?id=1147085, accessed March 30, 2010.

[130] Ibid.

Marketisation of water resource management is also one of the tools to be employed in the United States. CGER notes that the incentives to make environmental and technological advances in irrigation delivery had only recently begun to emerge. Overall, it recommended that artificially suppressing the price to irrigators of their water was resulting in a lag in innovation. It concluded that '[n]ew irrigation uses will be expected to meet increasingly strict standards of efficiency as a condition of use. Over time, existing uses will experience increasing pressure – in the form of prices, regulation or incentives – to increase irrigation efficiency as well.'[131]

It also noted that States would have to establish mechanisms to facilitate the voluntary transfer of water,[132] and that water now used for agriculture would have to shift to ameliorate environmental conditions.[133] Tarlock notes that competing interests must be accommodated within the water allocation regime include 'large and growing cities, traditional consumptive and non-consumptive users, Native American claims, and the restoration of degraded aquatic ecosystems and the maintenance of healthy ones.'[134] The tendency towards predominantly market-mediated transactions in water appears to be set. However, this will meet with the pressures characteristic of the Victorian experience – the problems of stranded assets, diminishing rates bases, infrastructure decline and rising maintenance costs, and the increasingly beneficial (in market terms) transfer of water to the more affluent municipalities.

Glennon notes that '[b]etween 1987 and 2005, there were 3,232 sales or leases of water rights in the twelve western states, involving a staggering 31 million acre-feet of water [25142 GL] … Plotted on a graph, the recent trajectory looks like a rocket ship taking off.'[135] He notes that although the largest number of transfers is between farmers, the largest amount of water is transferred from farmers to cities. He says

> Let's be clear about one thing: the water for new demands, whether refining ethanol or processing semiconductor chips, will mostly come from agriculture, because farmers use 70 to 80 percent of each state's water. …Another driving factor is money. …The economic value of this water for municipal and industrial uses dwarfs the value of the same water to farmers.[136]

He also notes, however, that the reason that irrigation remains unviable in the market for water is the very low cost of food comparatively. However, he asserts that a market for water will not exacerbate the problem shared by most agricultural communities, and specifically those in the United States and Australia, because farmers adjust to using less water by becoming more efficient.

However, as in Australia, irrigation infrastructure in the United States is aging and expensive. Although farming generally is subject to a higher level of subsidisation in the United States than in Australia, the ongoing decline in commodity prices and the decline in rural population are likely to continue, reducing the necessary revenue base for both private infrastructure providers and public utilities. Accordingly problems of stranded assets, declining rate bases

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131 Commission on Geosciences, Environment and Resources, *A New Era for Irrigation* 1996 p 172.
132 Ibid.
133 Ibid, 177.
134 Tarlock above n 28, 884.
135 Robert Glennon, *Unquenchable – America's Water Crisis and What to Do About It* Washington: Island Press 2009, 273. One acre-foot of water is equivalent to 1.233 megalitres, or 325,900 gallons. One thousand megalitres equals one gigalitre (GL). It is the amount of water needed to cover one acre of land one foot deep, and is the measure typically used in American agricultural water extraction and use.
136 Ibid, 273, 276.

and increasing costs are likely to be experienced with the marketisation of water resources in the United States.

VI CONCLUSION

Water policy in Australia is history in the making. It is also the product of history, and provides the lessons of history. The lessons which could be taken from the history of irrigation development in Australia and in the United States could be derived from the following commonalities:

1. Both Australia and the United States attempted private infrastructure development, without success because of the inability to sustain infrastructure revenue in periods of drought and because of the necessity for large infrastructure projects in highly variable climates;
2. Infrastructure development has enabled expansion of irrigation to marginal areas. This has been considered by some to be problematic because of the reducing contribution of agriculture to the national economy – a particularly dominant view in Australia, but also asserted in the United States – however, agricultural production from these regions was of critical importance at various times in both countries' histories, and to a degree still is;
3. Infrastructure development has other benefits, such as flood mitigation and non-consumptive use, such as tourism;
4. Marketisation of the water sector is a dominant paradigm in both Australia and the United States, although in Australia it currently has most purchase;
5. Low commodity prices and falling returns in the agricultural sector have been a theme across both systems – and across the world. To a degree falling rural incomes have been ameliorated by government assistance; however, in Australia assistance has been virtually eliminated;[137]
6. The reducing value of agriculture to the economy in both countries makes government assistance problematic, and reduced government assistance diminishes capacity to pay water costs;

[137] Federal drought assistance has been criticised as being 'wasted on inefficient farmers': Darren Gray, 'Cut drought aid to farmers, Rudd told,' *The Age* March 5, 2008. A National Review of Drought Policy included a Productivity Commission report which found that most farmers were sufficiently self-reliant effectively to manage drought (Productivity Commission, *Government Drought Support* Inquiry Report No 46, 27 February 2009, available at http://www.pc.gov.au/projects/inquiry/drought/report), a Bureau of Meteorology/CSIRO Report assessing the impact of climate change on the nature and frequency of exceptional climatic events (K Hennessy, R Fawcett, D Kirono, F Mpelasoka, D Jones, J Bathols, P Whetton, M Stafford Smith, M Howden, C Mitchell and N Plummer, *Drought: Exceptional Circumstances* July 2008, available at http://www.daff.gov.au/agriculture-food/drought/national_review_of_drought_policy/climatic_assessment/drought-impact-report) and an assessment of the social impacts of drought (Commonwealth of Australia, *It's about people: Changing perspectives on dryness* Report to the Minister for Agriculture, Fisheries and Forestry, Canberra, September 2008, available at http://www.daff.gov.au/agriculture-food/drought/national_review_of_drought_policy/social_assessment).
The Federal Government has committed to restructure drought relief to provide assistance to manage risks, in recognition of the inherent variability of the Australian climate. A pilot drought relief scheme has been instituted in Western Australia: Department of Agriculture, Fisheries and Forestry, 'Pilot of drought reform measures in Western Australia' [online] http://www.daff.gov.au/agriculture-food/drought-pilot, accessed August 3, 2010.

7. Reduced return per volume of water because of falling commodity prices makes transfer of water to other uses – particularly urban use – attractive.
8. Reduced water in an irrigation system threatens remaining users' viability because of the problems of stranded assets and increasing per-capita costs on infrastructure maintenance.

The market solution appears to be an attractive alternative because it allows water to be reallocated to other uses, some of which are critical, and many of which are currently suffering from water scarcity. However, the history of infrastructure development indicates that privately maintained infrastructure, particularly on the scale necessary in Australia, is unviable.

The historical perspective policy-makers need to maintain is the relationship between farm revenue and the market price for water. In a world environment in which food is likely to become a scarce resource, growing food in established agricultural regions, using established capital and knowledge, may well become economically viable. The increasingly clear relationship between importing agricultural commodities and their embedded carbon footprint may translate into premium prices for local food. As developing economies incorporate minimal wage, safety, biosecurity and environmental costs into their agricultural production, the costs of food imported from these regions may well increase.

The impact of retiring irrigation infrastructure in the context of these issues should caution against the adoption of purely market analyses of agricultural water use. Water trade to highest value use is an unexceptional concept. The creation of an infrastructure to enable the purchase and sale of water is one thing; the destruction of an irrigation system which cannot be feasibly replaced is another.

Sharing the Climate Adaptive Dream: The Benefits of the Charrette Approach

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ABSTRACT

Climate change adaptation is a problem that is conceived as complex, operates on longer terms and requires anticipatory planning. Current planning processes facilitate mainly more straightforward and tame problems. In this paper we argue that to include wicked problems such as climate adaptation an alternative methodology and process is more suitable. The design charrettes, as experienced in Europe and Northern Americas offer such a tailored approach. Analysis of charrette theory and practice forms the basis for the development of an adjusted original for the Victorian situation. Our findings are that bringing the problem of climate adaptation in a charrette context bridges and overcomes initial hesitation to deal with the problem, offers the creative environment to develop innovative solutions and exposes participants to the challenge of starting to dream climate adaptive dreams.

1. INTRODUCTION

The Intergovernmental Panel on Climate Change fourth assessment report (AR4) (IPCC, 2007a) concluded that even if mitigation policies reducing carbon emissions are successful, global warming will continue for several decades and adaptation to these changes is inescapable. Much research has been carried out on ways to adapt to climate change. Only few studies focus on the linkages between spatial planning and stakeholder engagement, mostly seen as separate entities of research (Fuenfgeld and McEvoy, 2011). This research has identified several problems.

The first is that spatial planning and design aims to provide solutions for relatively straightforward, 'tame' problems (Conklin, 2010), while climate adaptation is seen as a 'wicked' problem (Rittel and Webber, 1973) (VROM-raad, 2007; Commonwealth of Australia, 2007) for which no definitive solution exists because these problems are dynamic and ever changing (Roggema *et al*, forthcoming).

The second problem lies in the way stakeholders are involved in regular planning processes. In the majority of cases stakeholders are 'consulted', which means they are approached with an already well thought through and well-developed design proposal. The role left for the stakeholders is in general to accept or reject such proposals. Real influence or a contribution in the form of suggestions is often not possible, nor welcomed.

The third problem is that different stakeholders are separated in different processes. The stakeholders involved in climate adaptation (the 'environmentalists') differ from the ones involved in spatial planning (the 'designers'). Depending on the subject of the process, specific sub-groups of stakeholders show up *and* are invited. Exchange and learning rarely takes place. There is no joint 'framework of operations'.

These three types of problems inhibit adaptive capacity, defined as: The general ability of institutions, systems, and individuals to adjust to potential damage, to take advantage of opportunities, or to cope with the consequences (Millennium Ecosystem Assessment, 2005). The question we address in this paper is: How can we combine adaptation planning with conventional urban planning and design? Existing practice separates climate adaptation and urban planning, prevents stakeholders from early involvement with the potential of dividing different stakeholder groups denying the opportunity of considered and well accepted plans. Therefore, an alternative method is required, which can function as a platform for sharing the climate adaptive vision. Such a method has been found in the form of design charrettes, which we have adjusted for specific use in designing climate adapted settlements.

2. METHOD

The method we have developed for integrating adaptation and urban planning is based on the charrette methodology modified for practical use in the Victorian context. In this method the following steps are identified:

One. Review the existing literature on charrette methodology. Apart from news articles and popular publications, design charrettes are not common in the academic literature (Anderson *et al*, 2010; Sutton and Kemp, 2006).There has only been several books written on the method (Condon, 2008; Lennartz And Lutzenhiser, 2006). Information retrieved from websites is instructive, usually, linked with consultancy firms marketing their services (for example: http://www.designcharrette.com; http://www.charretteinstitute.org; http://charrettedesign.com, http://www.cits.ucsb.edu). The majority of publications, mostly in the form of reports, brochures and non-refereed articles, describe case studies.

Two. Assess the theoretical method of the charrette. We consider the books, written by Condon (2008) and Lennartz and Lutzenhiser (2006) the most useful as the theoretical basis for design charrettes.

Three. Analyse existing charrette examples. This step examined 20 charrette examples from Canada, the US, the UK, the Netherlands and China in order to learn from practical examples. The type of assignment, the length, scope into the future and public involvement were the key elements of the analysis.

Four. The fourth step of the research builds and modifies, based on theory and practical examples, a method for the specific context of climate adaptation in regional Victoria.

Five. The final stage, but not the least important, of the research consisted of the use of the developed methodology in three Victorian case studies and determined the benefits of the approach.

3. THE CHARRETTE

The charrette originates from France. At the end of the nineteenth century the Architectural Faculty of the *Ecole des Beaux-Arts* issued problems that were so difficult few students could successfully complete them in the time allowed. As the deadline approached, a pushcart (or

'charrette' in French) was pulled past students' work spaces in order to collect their final drawings for jury critiques while students frantically put finishing touches on their work. To miss the charrette meant an automatic grade of zero.

Charrettes have been used successfully in controversial and complicated design and planning problems. Examples of these, as given by the NCI (National Charrette Institute) include:

- High stakes projects involving substantial public and private investment;
- Volatile yet workable political environments – situations that are 'hot' but manageable;
- Complex design problems;
- Real projects that include imminent development. (Lennartz and Lutzenhiser, 2006)

The NCI defines the charrette as: "a collaborative design and planning workshop that occurs over four to seven consecutive days, is held on-site and includes all affected stakeholders at critical decision-making points" (Lennertz and Lutzenhiser, 2006). Building on this Condon formulates it as: "a time-limited, multiparty design event organised to generate a collaborative produced plan for a sustainable community" (Condon, 2008).

Phases of the Charette

A typical charrette is seen as part of a dynamic planning process, which starts with the preparation phase, followed by the charrette and finishes with the implementation phase. The process, as derived from both Condon (2008) and Lennartz and Lutzenhiser (2006), consists of the following phases:

The first phase we distinguish is the **preparation** phase. In this phase everything that is required to hold a successful design charrette is considered. Besides the obvious, required material, bookings of the venue, the main issues in the preparation phase are the design brief and the selection of participants. In the design brief the assignment is clearly defined. The goals and objectives, the design principles, if possible quantitative information, and the performance targets are described. The design brief is written in collaboration with several of the local stakeholders. The selection of participants is critical. People need to be interested in the charrette process. As it comes to the selection of participants, the right 'mix' of people is essential. A combination of scientists, local experts and stakeholders, decision makers and knowledge brokers, designers and technical experts, all contribute to the dynamic of the event.

The second phase when participants first come together consists of the **visioning charrette**. During this charrette the main goal is to envision the desired future. A typical visioning charrette includes the following parts: an opening event, a site tour, the design stages, during which iterative phases of conceptualisation, drawing alternatives and refinement of the vision take place (or in the words of Condon: talk-doodle-draw), the public meetings and finally the afterparty. In general, this type of charrette involves (mainly) designers for a full week. The purpose is to shift from nice sounding prospects to real solutions, which, in this phase, are represented in designs. During the charrette a common language for solutions is developed and, because no implementation questions will be raised at this stage, the risk ideas will be rejected is minimal. However, it may be expected that, in the openness of the process policy contradictions will be revealed.

The third phase is the conduct of the **implementation charrette**. This charrette typically lasts for four days and involves (mainly) design facilitators and stakeholders. Its aim is to develop a shared understanding of the desired future and what is needed to realise this future. In many governmental organisations the so-called 'window-of-no' is in operation. This prevents

change from happening and is often well established through unwritten codes and invisible agreements. The implementation charrette is a powerful tool to go past this window of no. The fast and efficient charrette process involves stakeholders in a powerful integrative way. Because the participants are connected and the solutions cannot be seen as separate, the charrette process helps to outpace approval processes, which can take years.

The final phase we distinguish is the writing of the **charrette report**. In the report the results of the charrete are integrally presented in a visual and clear way. The report functions as the 'contract' for the participants and may be used in formal decision making processes.

In conducting design charrettes Condon (2008) defines nine general rules for a good process. The four we acknowledge as the most significant are:

1. Design with everyone: Despite the fact that becoming a designer requires thorough training and very specific skills, the design process as undertaken during charrettes is integrative and contains a variety of possible solutions. This is partly an intuitive and judging activity, which makes it accessible for many individuals. In this sense, everyone is a designer;
2. Start with a blank sheet: If the group of participants are standing around the table, on which a large map of the site is laid down, the simple action to overlay this map with a blank piece of transparent paper will do. The invitation and the challenge lie before all. Everyone is invited to fill in the future and a shared vision will, in the hours to follow, fill up the formerly empty paper;
3. Provide just enough information: Too much information causes decision paralysis and too little produces bad proposals. Just enough is mainly arranged through the expertise of the participants and will be provided during the charrette in a concise and accessible manner (maps, schemes);
4. Drawing is a contract: All drawings produced during the charrette embody the consensus as experienced and achieved by the charrette team. They form a well-understood agreement, or contract, in images amongst the group. The drawings cannot be broken without consent of the group and function as such as a very strong commitment.

4. CLIMATE ADAPTATION

Climate change, and more in particular climate adaptation, defined as: "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2007b), is seen as a wicked problem (VROM-raad, 2007; Commonwealth of Australia, 2007). Wicked problems are described according the following characteristics:

1. They have no definite formulation;
2. They have no stopping rules;
3. Their solutions are not true or false, but better or worse;
4. There is no immediate and ultimate test of a solution;
5. Every solution is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly;
6. They do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan;

7. Every wicked problem is essentially unique;
8. Every wicked problem can be considered as a symptom of another {wicked} problem;
9. Their causes can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution;
10. (With wicked problems,) the planner has no right to be wrong. (Rittel and Webber, 1984)

For these types of problems an engineered solution, emphasising the one and only 'best' solution, based on a rational and well-structured analysis of the problem is not very fruitful. The wicked problem is changing its characteristic over time and once a solution is executed, new facets of the wicked problem ask for very different approaches.

Not only is climate adaptation seen as a wicked problem, as demonstrated by De Jonge, design and planning problems are also seen as wicked problems (De Jonge, 2009). The combination of both wicked problems of design and climate adaptation is one of the reasons why integration of climate adaptation in spatial designs is proven to be difficult and why an alternative approach needs to be found. The charrette approach, which does not focus on the one final solution for the problem, offers the space within which '*an interactive exploration of potential strategies aiming to facilitate a future spatial development towards a status of improved adaptation to the impacts of climate change*' can take place. In this space, one-on-one technical-rational solutions are rare and different future thinking techniques are explored. As climate change predictions come with a broad margin of certainty, so do designs. For one problem a wide range of designs are able to provide improvements.

5. EXPERIENCES

Most of the planning and design processes take place within regulated frameworks and procedures. Despite this fact, several design charrettes have been organised of which can be learned. For the purpose of this paper we've collected some of the best practices, which we briefly describe and analyse in summary in Table 1.

- The four *Drenthe Design Teams* (Van den Berg, 2010; Sikkema and Lucius, 2010; Grontmij, 2010; Polman, 2010) were asked to design a future for a specific area in the Dutch province of Drenthe. The design needed to develop design solutions focusing on the implementation of a sustainable energy supply for the next 30 years.
- In four so-called *SketchShips* (schetsschuit), which were held in Texel (Waddenvereniging, 2010), South-West Ameland (Waddenvereniging, 2009), Haarzuilens (DLG, 2005) and Eindhoven-Helmond (DLG, 2009), the teams designed a future, which dealt with the effect of climate change and/or the sustainability of the landscape. These SketchShips were originally held on a ship, but for practical reasons are modified in an intensive two-day workshop on the ground.
- The Grounds for Change Charrette *North Netherlands* (Van Dam and Noorman, 2005) aimed to design a spatial plan for a sustainable energy future. A wide range of participants, such as energy experts, designers and students took part in the seven-day event.
- The Bridging to the Future-*Jinze*, charrette (Roggema and Van den Dobbelsteen, 2006) took place in China and brought together international experts in the field of energy and

design to develop, together with Chinese students a spatial plan for a sustainable energy supply.

- In Flagstaff (Arizona) the subject of the charrette was the *urban design for a transect*. The focus lied on the enhancement of urban structures, amenities, urban living and a sustainable zoning of functions across the city centre (Opticon Design and Lisa Wise, 2009). Besides the consultant team, executing the charrette, the public was involved at certain stages of the process.
- Several Grounds for Change charrettes in the *Province of Drenthe* took place in Emmen (lab R+E+M, 2008), Borger-Odoorn (Provincie Drenthe, 2006) and Vries (Provincie Drenthe, 2008). The aim of these, two-day, charrettes was to design together with local stakeholders, energy experts and designers a sustainable energy system.
- The charrettes for the Squamish *Urban Waterfront* development (University of British Columbia, 2004) consisted of two-by-two days, involved a wide range of participants, such as business representatives and citizens and aimed to design an integrated urban (re)development of the waterfront.
- In the *Groningen Climate Proof* project (Roggema, 2009) ten single design charrettes of one day were organised. The scope of the project was to develop a spatial plan, which would anticipate the longer term changes induced by climate change. The combination of scientists and policymakers participating in the design charrettes was the distinguishing factor of this project.
- The planning process of *Vancouver North* aimed to design a precinct, which would be able to reduce GHG emissions with 80% by 2050 and become a zero net emitter by 2107 (Condon *et al*, 2009). A wide range of participants, including the public, took part in the charrettes.
- The design charrettes *INCREASE I and INCREASE II* (Roggema *et al*, 2008; Roggema, 2009; Roggema and Boneschansker, 2010) lasted for a week each and focused on the design of a region which could function without the use of fossil resources in 2050. The pre-selected international participants are high-level experts in the fields of innovation, energy, design and governance.
- In Scotland, the Scottish Sustainable Communities Initiative organised three design charrettes, which were held in *Dumfries, Fife and Aberdeen* (Scottish Sustainable Communities Initiative, 2010). The three sites, despite the fact that they ranged from an urban infill, a whole town development and a greenfield location, were approached through the future design of new places for new dwellings. Specialized international project coordinators in tandem with local experts participated in these design charrettes, in which the public was involved at specific moments.
- In the design charrette for *Belmore Park*, Norwich the focus lied on designing an integrated growth plan according the principles of New Urbanism (Broadland Land Group, 2010). This charrette is shaped as an open invitation to the public to participate and collaborate with the design team.

In Table 1 these charrettes are comprehensively analysed against the following criteria:

- What is the scope of the assignment? What is the time-horizon of the expected outcomes?
- What is the subject of the assignment?

- What is the duration of the charrette?
- Who are the participants?
- And is the general public welcome/involved?

Table 1 Overview of the Characteristics of Design Charrettes

Charrette (country)	Subject	Time-horizon	Length	Participants	Public
Bridging to the future (China)	Energy	30 years	5	Experts, designers, students	No
Belmore Park, Norwich (UK)	New Urbanism, growth	Not defined	8	Designers, consultants, council	Yes
Drenthe Design Teams (Netherlands)	Energy, Climate Adaptation	30 years	3	Experts, consultants, designers	No
Flagstaff (US)	Amenities, planning functions	Not defined	4	Consultant team	Yes
Groningen Climate Proof (Netherlands)	Climate Adaptation	50-100 year	10x1	Scientists, designers, policymakers, local stakeholders	No
Grounds for Change Drenthe (Netherlands)	Energy	30 years	2	Industry, designers, consultants	No
Grounds for Change North Netherlands	Energy	30 years	7	Designers, energy specialists, students	No
INCREASE I, II (Jordan, China)	Energy	50 years	5	Experts, designers, scientists	No
Scotland	Integrated sustainable neighbourhoods, reducing carbon footprint	Not defined	6	Designers, consultants, council	Yes
SketchShips (Netherlands)	Water manage-ment, Ecology, Coastal defence, Archeology and Heritage	Not defined	2	Experts, designers	No
Squamish (Canada)	Urban Waterfront, integrated urban development	Not defined	2x2	Designers, business, council, citizens, students	Yes
Vancouver North (Canada)	GHG-emissions, integrated sustainability, urban design	100 years	Not known	Designers, policy makers	No

From this list of we conclude that design charrettes appear in many different shapes and semblances. Depending on the specific context there are many different ways to execute a design charrette. Differences may lie in the length (ranging from two days to an entire week), the range of participants (specialists and designers only, or all stakeholders and citizens involved) or the type of target (a specific one, e.g. energy, sustainability or an integrated one, which aims for comprehensive urban designs).

6. MODIFYING THE ORIGINAL

If the theoretical frame and the learning from experiences are combined with the specific context in Victoria a tailored design charrette approach has been developed (Roggema, Horne and Martin, 2010). The research project "Design-led decision support for regional climate adaptation" builds on the theory and past experiences, but adjusts it at the same time. In the project a specific iteration has been added. The method used in Victoria consists of five phases: preparation, design charette 1 (visioning), appraisal, design charrette 2 (implementing) and reporting.

After the preparation, in the first design charrette future scenarios for climate adaptation are developed. These scenarios must be seen as charcoal sketches of the future: abstract in scale, but clear in content. The results of the first charrette are then appraised. The quality of the proposed scenarios in terms of their environmental, economic and social value is assessed and this information is used in the second charrette. This charrette aims to design the region in a more detailed way, defines strategic catalyst projects and formulates an investment strategy. Within the research project this design-assess-design approach is used and tested in three case study regions: City of Greater Bendigo (a central Victorian major centre, vulnerable for bushfires), Wellington Shire (a coastal community, vulnerable for sea level rise) and Swan Hill Council (a northern riverside town, vulnerable for river flooding).

Both design charrettes are shaped in a very intensive and efficient two-day meeting. The reason behind this is, apart from the time constraints of individual participants, to create a true intense and highly dynamic session, in which people are more committed and 'into it'. The fact that in regional communities, many people already know each other makes a process of getting to know each other in these cases superfluous.

The standard Victorian charrette program consists of the following key elements: an introductory session in which the urgency of the assignment becomes clear, several design sessions, each of different character, intermediate internal presentation, final design session and presentation of results to an executive panel. Each of the separate sessions is highly visual, makes use of mapping or other visual techniques to ensure creativity and thinking beyond the 'window of no'.

7. KEY SUCCESS FACTORS

The major elements that determine the success of a design charrette can be derived from the Victorian experiences:

1. People. Potential participants, especially the ones that you really want to appear at the charrette, have busy schedules and tight agendas. Therefore it is essential to communicate the importance of the charrette, do so well in advance, make the charrette as short and convenient as possible and approach each individual personally beforehand.
2. Right people. It is not about quantity alone. The strategic key-players in a community, the charismatic group-thinkers and the specific experts in the field are critical in creating a successful team. Intense discussions with people who know the local context well, helps to pre-select the right people.
3. Support. Local authorities are often busy within their own procedural frameworks and the organisation of a design charrette is something that lies outside the core business of a local council. Therefore, it is essential to safeguard beforehand the support of the

local authorities. Often, it is necessary to reconfirm this support along the way. To have personal contacts within the organisation does help to enlarge the supportive base.

4. Time. As mentioned before, potential participants are on a tight schedule. Therefore, it is recommended to organise a short and intense event rather than an outspread one. If the event is short, it increases intensity and this will lead to better results.
5. Reason. A charrette does need to make sense. A purposeless event misses all the goals. In order to let the charrete play a role in the day-to-day projects and planning processes, the content and especially the outcomes of the charrette must be linked to requirements that are asked in the regular processes. Only if this link is safeguarded the charrette is able to solve a problem.
6. Atmosphere. The sphere in which the charrette takes place is important, because in a relaxed, but serious environment people tend to perform best. Therefore, a special venue as well as space to 'lean back' contributes to a pleasant atmosphere. Enough time for (locally produced) lunch and dinner will also support the working environment.

8. RESULTS: THE BENEFITS

Undertaking design charrettes in several places across Victoria reveals that the execution of design charrettes has several benefits. The first, and maybe most important advantage of working in a design charrette, is that it is possible to make complex issues, such as climate adaptation concrete and conceivable. In the context of a design charrette people easily become creative and will come up with proposals that go beyond the expected and accepted.

Another benefit is that boundaries between organisations and people will drop over the course of the charrette. If, in regular circumstances, relations are based on power and particular interests, a charrette environment provides an atmosphere to discuss on the basis of expertise and the content. In general the conversation is a positive one, illuminating the potentials of the future instead of looking back at what went wrong in the past.

Finally, the fact that in design charrettes the visual methodology is practices, people tend to use their left, creative and intuitive brain-side, which, over the length of the charrette replaces the right brain half, which focuses more on the rational, calculatable, thinking aspects. This opens the way to creation of new joint visions on the desired future and this is exactly what is required in dealing with a complex issue as climate adaptation is.

9. CONCLUSIONS

In this paper we have argued that to design for a complex, wicked problem, such as a climate adapted urban setting, a design charrette approach is a suitable approach. The methodology, which includes open space for exchange and flexibility in the answers and strategies developed, meets the demand of a wicked problem.

The design charrette makes it possible to share thoughts amongst the participants in the team and allows them to dream about the desired future. This dream of a climate adaptive future can form the basis for further development as the members of the charrette share their common understanding about what this desired future might contain.

Given the diversity of charrettes one may question if there is a need for a more unified design charrette process. Is it possible to define the 'ultimate charrette'? Or, is the power of the design charrette approach found in the potential to adjust the process as determined by the

specific context in which it is used? Especially if time and resources are limited a shortened version of the original charrette model may be more suitable to meet demands within these limits.

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Uncertainty in Regional Science: Further Conceptualisation at a Macro-Economic Scale

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ABSTRACT

The author's most recent presentations to a regional science meeting focused first on the psychology of regional development and secondly on the relevance of quantum mechanics to the social sciences in general and regional science specifically. Collectively, they illuminated the dynamics of economic behaviour and uncertainty in the complex systems typically analysed in regional science. However, it is now clear that several other extant theories dealing with complexity, chaos, tipping points, information, and socionomics identify many additional sources of uncertainty. This paper tries to link these themes together to develop an integrated conceptualisation of macro-economic uncertainty, and consider its implications for the field of regional science. Large-scale and endemic uncertainty, for example, has major implications for the accuracy of the forecasts we develop, our understanding of contemporary processes as we try to model them, and public policy approaches to regional development. One particularly important policy theme arising from these deliberations is the extent to which development strategies ought to focus largely on steering individual and community adaptive capacities as the main antidote to uncertainty. Welcome back to Lindblom's world of disjointed incrementalism.

INTRODUCTION

> There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know. (Donald Rumsfeld[1])
>
> The future arrives too soon and in the wrong order. (Alvin Toffler, *Future Shock*, quoted in Khanna and Khanna, 2011)

Rumsfeld's famous utterance during the Bush presidency makes an appropriate launch-pad for our discussion here because it draws attention to one of the many sources of uncertainty swirling around regional economies in particular and both economy and society more generally. This article canvasses the sources of uncertainty, their mutual interconnections and implications for forecasting, and the consequent difficulties arising for the market-place and government action to both steer events and construct workable policy.

We shall see that Rumsfeld's appreciation of uncertainty is much too stark and unsubtle, though he managed to make his point clearly by over-simplifying issues, somewhat in line with Occam's razor. His warning to decision-makers is clear across all realms of modern

[1] "Defense.gov News Transcript: DoD News Briefing – Secretary Rumsfeld and Gen. Myers, United States Department of Defense (defense.gov)".

society whether corporate, small-business, regulatory, not-for-profit and social: you're in for an increasingly rough ride. In practice, matters are even murkier than he thought and likely to be much less capable of resolution as we move from Toffler's (1980) third wave, based on transnational information flows, through Debold's inconsequential concept of respiritualisation (see www.worldtrans.org/whole/fourthwave.html), and on to what is, in effect the fifth wave, Khanna and Khanna's (2011) notion of Technik.[2] They say:

> In the hybrid age, what distinguishes societies from one another is not just their geography, their culture, their income level, or other traditional factors, but their capacity to adapt to exponentially changing technological circumstances. We don't live in different places so much as we live in different stages of Technik.

We will meld this wave sequence with Kondratieff's long wave version towards the end of this paper.

To start with, let us take the sources of uncertainty I discussed in Sorensen (2011a) and re-package them in a revised typology to clarify the range variables at work, their accelerating internal complexity, the growing uncertainty about how such variables intersect with each other, and the implications of all this for modelling and forecasting. The earlier work focused on elements of uncertainty embedded in a range of theories developed in both the social and physical sciences: especially economics, socionomics, psychology, and geography on the one hand, and ecology, mathematics or quantum mechanics on the other.

SOURCES OF UNCERTAINTY – A TYPOLOGY

Table 1 presents a personal typology of uncertainty derived mainly from the author's theoretical explorations reported in Sorensen (2010, 2011a). Of course, none of the nine components of uncertainty exists independently of the others, as is shown in Figure 1. Each dimension impacts on the others through often complex circular and cumulative feedback loops, and those impacts are themselves spatially and temporally unstable. The first component, **process uncertainty**, draws on most of the themes discussed in Sorensen (2011a), including:

- intersecting, and uncoordinated, economic waves (akin to *wave-particle duality*);
- unfathomable cause-effect relationships between variables (*entanglement*);
- variables that can take several forms simultaneously and/or switch between them instantly (*superposition*);
- system decay through interaction with its environment (*decoherence*);
- extreme system leverage so that small changes in some elements can trigger large changes system-wide (*chaos*);
- a large number of operating variables whose mutual interactions are difficult to specify or quantify (*system complexity*); and
- sudden system instability (or *tipping points*).

Rest assured that each of these dimensions is becoming more pronounced as economic systems (i) migrate from local to global; (ii) are subject to multiple and often uncoordinated regulatory regimes; (iii) encounter masses of new technologies, which rapidly rewrite regional comparative advantage (Khanna and Khanna, 2011); (iv) find resources have multiple and often shifting uses; (v) interact with ever more complex and dominant macro-environments;

[2] They call Technik the fourth wave also, unaware of Debold's claims.

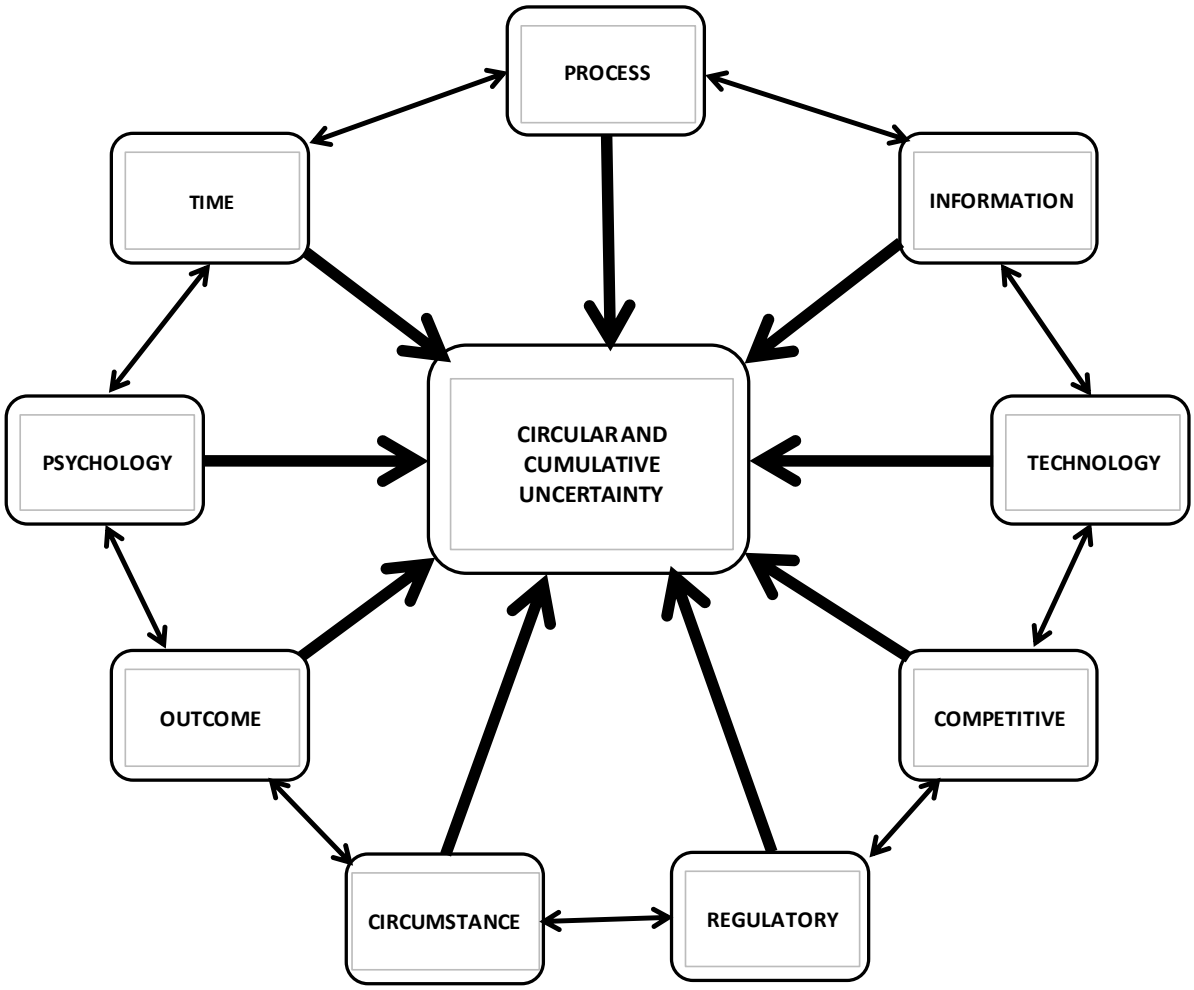
and (vi) experience uncontrollable, but malign, events like the GFC, which have rapidly escalating and damaging impacts unanticipated in far-away regions. Alas, our capacity to embrace these complexities is vitiated by our growing incapacity to simplify them in any significant way by weeding out less important elements.

Table 1 A Typology of Uncertainty

Type	Sub-Categories
Process uncertainty	Contributing variables, their relative importance, interconnections, feedback loops, systemic time lags
	Simplification Uncertainty (ability of analysts to get to the heart of a matter: to distinguish what is important and what is not)
Information uncertainty	Available, but analyst unaware of it
	Unavailable, but analyst is unaware of the need for it
	Available, but analyst aware of it
	Unavailable, but analyst aware of it
	To which we might add both the available and unavailable information will have varying degrees of relevance to our problems / understandings
Technological uncertainty – the key to definition of opportunity sets	The inherent nature of technologies
	Their speed of evolution
	Their potential application to commerce / lifestyle / government
Competitive uncertainty	Quality of organisational knowledge, current and evolving within forecast horizon
	Quality of organisational strategy (stability, accuracy, leadership capacity)
	Number of organisational actors, current and likely
	Regulatory (see below) and financial uncertainties
	Likelihood of simultaneous, but spatially discrete, invention
Regulatory uncertainty	Number of actors
	Extent of conflict and overlap between agencies, local - national - international
	Clarity and stability of enabling laws and regulations
	About the probabilities of specific actions
	The duration of regulatory strategies and revision options
	Quality of actions
Circumstance uncertainty about	Current conditions
	Future possible economic, social and environmental trajectories (forecasting uncertainty)
Outcome uncertainty about	What we want to achieve, and
	How to get there
Psychological uncertainty about	General adaptive cultures or qualities required to best handle outcome uncertainties
	More specific leadership and institutional behaviours required to get from a to b
Time horizon uncertainty	Across most of these dimensions / settings vary according to duration of time-frames under consideration

Source: The author.

Figure 1 Circular and Cumulative Dimensions of Uncertainty



Source: The author.

Information uncertainty is pervasive. We can start by replacing Rumsfeld's simple 2 x 2 matrix shown at the top of Figure 2 by the second 3 x 3 matrix lower down. Neither, though, gets to the heart of the matter, namely the accuracy and quantity of the information available, as shown in Figure 3. Both axes in Figure 3 are themselves multi-faceted. ***Accuracy*** is first a function of *system complexity* and especially both the number of variables in play and their relative weights. The more variables we have, and the greater the discrepancy in their importance, the more expensive and time consuming is our quest for quality information. Secondly, information quality is likely to vary directly with *system stability*. If a system changes rapidly in the form, number, importance, and connectivity of its endogenous variables it will be difficult to find the quality data necessary to specify the system accurately. Fast endogenous change will also likely impact rapidly on inter-system connectivity and on institutional and legal environments.

Thirdly, we must question the *inherent measurability* of many individual system variables and reciprocal interactions between them – in terms of form and scale. Measurability is central to our understanding of process, whether past, present or likely future. Some economic information may even be incapable of accurate measurement, if we accept the Heisenberg interpretation of wave-particle duality (Sorensen, 2011a). Many economic data, such as the

business cycle, or innovation, product, and firm life-cycles, exist in wave format. Even social affairs are subject to fashion waves, which ebb and flow. Such waves have both forward trajectory and wave amplitude and, as with light or other particles, the more know about trajectory and its speed, the less we know about amplitude. Moreover, intersecting economic and social waves are often asynchronous, so that their mutual interactions are likely to differ in magnitude and effect according to their respective phases in the cycles. A fourth worry concerns the *age of available information* relative to its speed of change. Given accelerating technological improvement, and commensurate downstream impact on economic and social change, there are looming difficulties with information quality on this theme alone.

Figure 2 Knowns (Original and Revised Versions)

Known Knowns	**Known Unknowns**
Unknown Knowns	**Unknown Unknowns**

Knowns (Revised Version)

Known Knowns	**Known Uncertainties**	**Known Unknowns**
Uncertain Knowns	**Uncertain Uncertainties**	**Uncertain Unknowns**
Unknown Knowns	**Unknown Uncertainties**	**Unknown Unknowns**

Source: The author.

Our congenital predilection for *state-space partition* (see Fox and Rottenstreich, 2006) raises a fifth difficulty. State-space partition is a psychological term describing our inherent biases in information selection and interpretation, reflecting our personal Weltanschuungen and action preferences. Sixthly, an apparently clear-cut fact or statistic can nevertheless be *ambiguous*. Different analysts may accord it one of multiple interpretations according to their perceptions of:

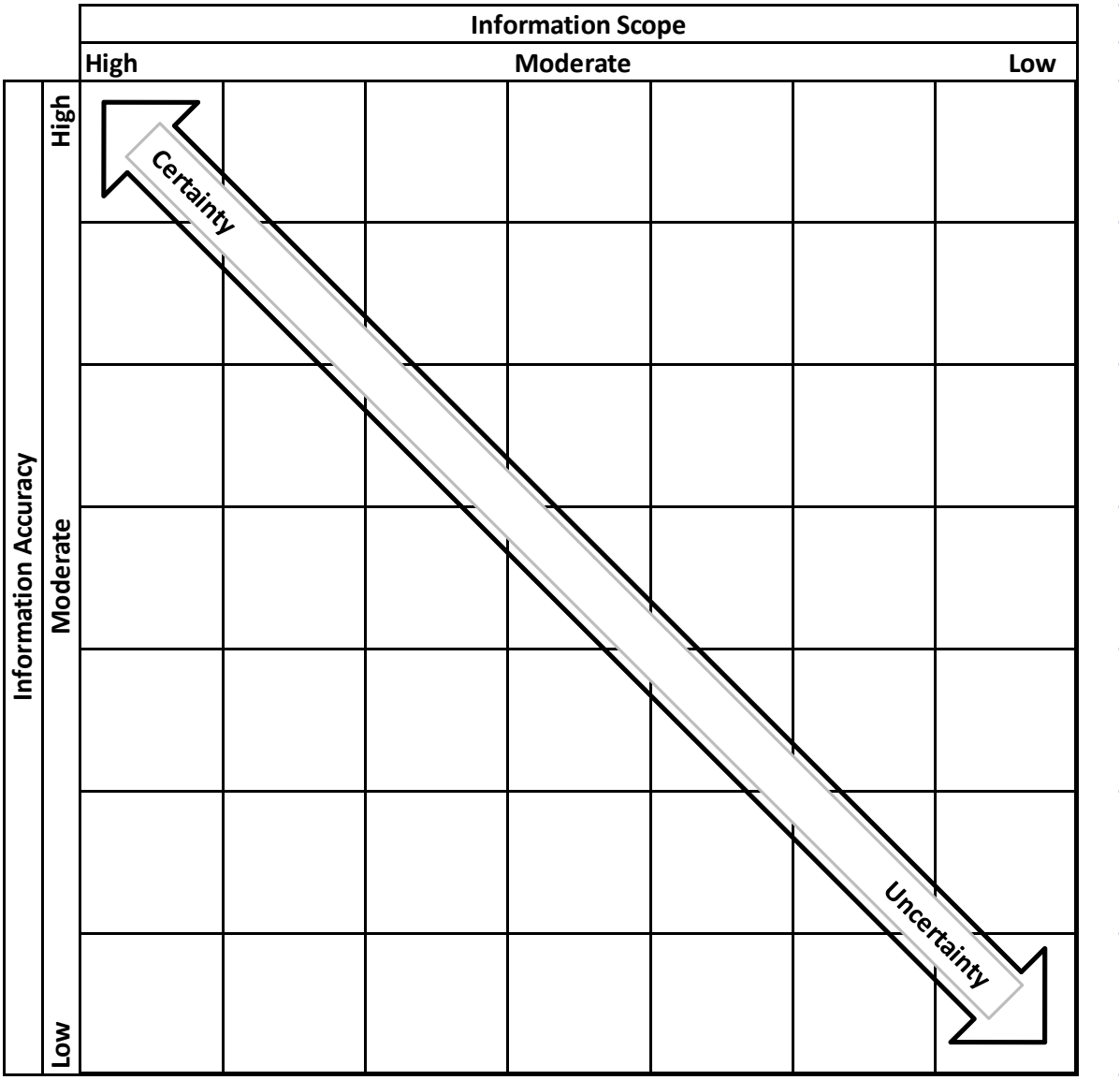
(a) Context, reflecting for example the stage of development in region's economy, society, culture, geography, and resources, or

(b) System structure and the relative importance of the information to an understanding of system processes, or

(c) Observed or conjectured riskiness of systemic threats (technological, financial or competitive).

This particularly applies to perceptions of strong risk, which trigger varying degrees of fear and loathing and impose conservative blinkers. These, in turn, often distort both our assessments of information accuracy and its subsequent analysis.

Figure 3 Information Matrix: Accuracy and Scope



Source: The author.

The seventh filter through which information becomes more uncertain is that of *personal morality*. If my attitudes pertaining to the rules of right conduct (or the distinction between right and wrong) and of ethical practice based on moral principles differs from yours, then it is highly likely that we will assess the value of information and analyse the form and structure of processes in divergent ways. Increasing moral relativism could therefore have the perverse effect of blurring how we perceive and understand our subject matter – in the case of regional science, our knowledge of regional economic conditions and the processes shaping them. Acknowledgement of moral relativism has a long history going back nearly 25 centuries to Protagoras and Herodotus, and more recently to Baruch Spinoza (1632-1677), who notably held that nothing is inherently good or evil, and David Hume (1711-1776), who denied that morality has any objective standard (see http://en.wikipedia.org/wiki/Moral_relativism, accessed 14 October 2011).

If information accuracy is severely impaired for the reasons given, we must also acknowledge problems of **information scope**. The first issue here is our ability to specify all system variables affecting, say regional economies and societies, not to mention the mutual connections between them. I suspect, however, that this is not a major difficulty for regional scientists where, after half a century of analysis, we have a strong handle on the forces at work shaping current and likely future regional economic development. On the other hand, advocates of Occam's razor or Maeda's (2006) Laws of Simplicity think it is important to sort out what really matters from the incidental or trivial in order to improve human understanding or adaptive responses to economic and social problems.[3] The reduction of messy complexity to bare bones essentials requires both strong analysis and sound intuition. Regional science provides both. We seek to simplify reality by identifying crucial operational variables for which good quality information or data are available. The effectiveness of our resulting models can then be tested by retrospective forecasting: the application of forecast models to known conditions perhaps a decade ago and seeing how accurately they predict current circumstance. The greater the accuracy of our forecasts, the more likely it is that we understand the essence of contemporary economic and social processes, and can pull the right policy levers.

The third dimension of uncertainty concerns the development of **new technologies** and, in particular, the speed of their potential economic and social applications or impacts. Those outcomes reside, in turn, in the inherent nature of those technologies and society's ability to grasp, or adapt to, the opportunities they provide. As Figure 4 implies, the pace of technological improvement has accelerated over the last three centuries of the enlightenment albeit in lumpy fashion aligned with Kondratieff's (1924) long waves. Miraculously, this technological acceleration has been accompanied by a parallel, though sometimes more fraught, rise in society's adaptive capacities as indicated in Figure 4 by the miasma of circular and cumulative adoption. The latter has been a huge interactive learning process for communities, governments and the private sector, but has so far delivered stable adaptation (Sorensen and Epps, 2005) – with the major exception or periodic warfare which typically reflects the fault-lines of maladaptation. It is a moot point how long this stability in the face of technological onslaught can continue in Khanna and Khanna's hybrid age. This age is moving well beyond information technology and into:

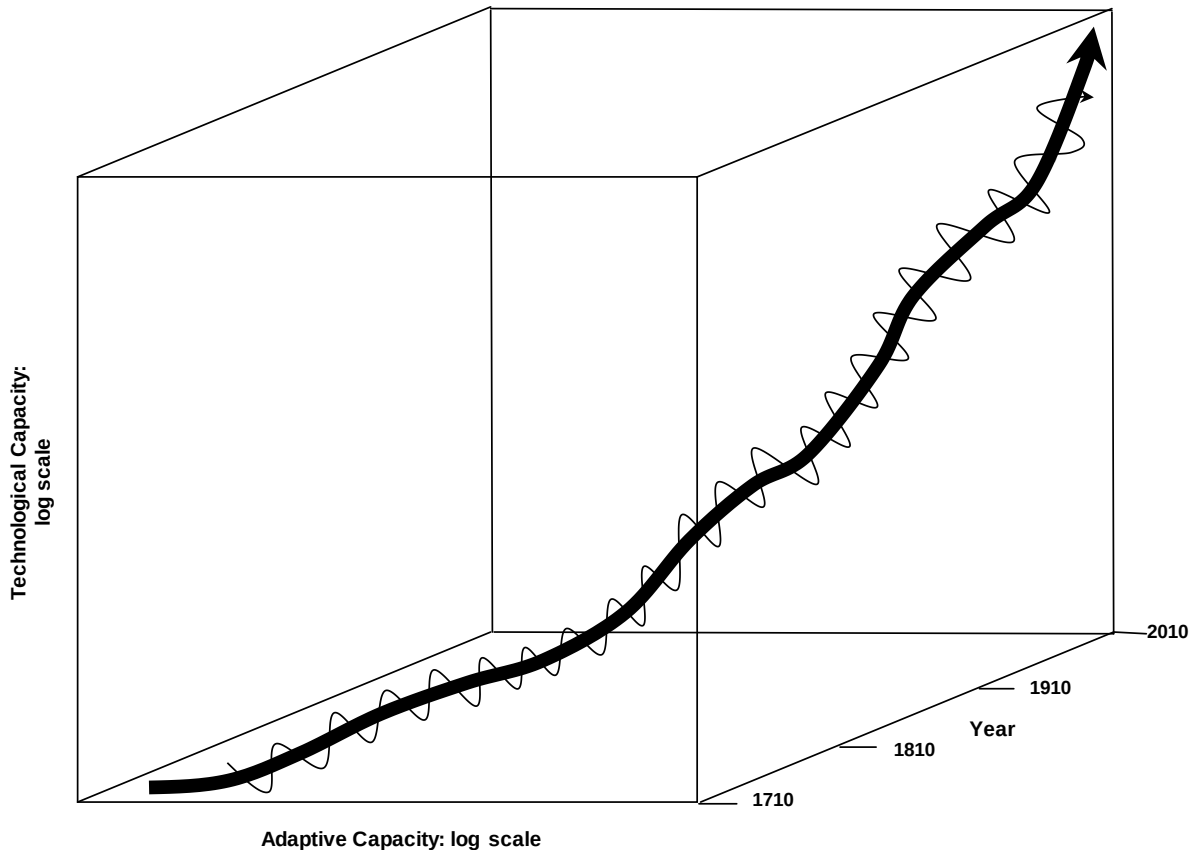
- biotechnologies capable of securing food and energy supplies well into the future
- medical procedures that could extend human life by several centuries

[3] See also http://lawsofsimplicity.com/?tag=laws, accessed 21 October 2011. In effect, less is more.

- nanotechnology and a raft of new materials with all kinds of thermal and strength properties to revolutionise construction and production
- clean technologies designed to reduce waste and pollution
- artificial intelligence and robotics, and
- safer, faster and more reliable transportation of all kinds.

These are likely to re-energise industrial manufacturing, though not necessarily in existing locations. In this process, new hybrid disciplines are emerging, e.g. biomechatronics, and the more technologies we have, the more combinatorial possibilities occur, which will destroy existing business models and government operations, many of which have barely stumbled into Toffler's third wave as the GFC testifies! So the hybrid age will place even more uncertainty on already stressed-out governments and businesses and elevate social and economic adaptiveness to changing circumstance at the pinnacle of desirable attributes. We don't know where we're headed, but the only feasible antidote is to engage with the processes shaping our future. Finally, in Khanna and Khanna's words, "We don't live in different places but in different stages of Technik." Many of us may therefore be nearing the end of conventional citizenship or allegiances and losing attachment to geographical place. Our networks are increasingly linked to technology and lifestyle, and aspatial.

Figure 4 Spiral of Invention, Innovation and Adaptation



Source: The author.

Competitive uncertainty is our fourth type, and it largely concerns market-place competition between the producers of goods and services. Most of the actors are private companies, but

some production is in the hands of private individuals, not-for-profit organisations and governments. Such organisations face uncertainty in both their internal and external environments. A firm's *internal competitiveness* largely revolves around operating efficiency and quality control. These generally depend on high quality and stable business leadership, and more specifically on (i) accurate and contemporary knowledge of one's business realm, (ii) careful cost and quality control, (iii) rapid, adaptive, focused, and well publicised decision-making, and (iv) stable finances. *External competitiveness*, on the other hand, is all about technological leadership, delivering what consumers want (or least creating dynamic markets for one's products like Apple has done), and attractive pricing strategies. In the hybrid world of Technik, producers are likely to confront a succession of nasty external surprises like simultaneous invention, rapid obsolescence or unenforceability of patents, or the sudden emergence of often foreign-owned new competitors with low cost structures. Both internal and external threats are damaging, but the latter are often much more difficult to avoid or control, especially where competitors are numerous and global.

Regulatory uncertainty can greatly affect competitive uncertainty, and is also difficult to avoid or control because the governments imposing regulation have the legal power to do so and often pursue environmental, social or even fiscal ends, rather than commercial ones. The field is also becoming crowded with regulatory actors at spatial scales from the local to the global. Worse still, regulations across regulatory tiers frequently conflict with other, or are poorly framed so that affected parties are unsure of both intent and requirements. On top of this, regulations are sometimes dictated to, or influenced by, ideological commitment so that they change rapidly according to the ideological preferences of the government currently in power. Australia's carbon pricing regime falls in several of these camps. Even where regulatory intent is clear and widely supported, the impacts on business can be drastic. Just ask Australia's manufacturing sector about the double threat posed by the rising A$ propelled by a combination of high Reserve Bank interest rates and soaring commodity prices.

Then we are surrounded by the two components of **circumstance uncertainty**: where we are now and where we're headed. If the first of these is fuzzy and best, the second is diabolically unclear because of all the other uncertainties described so far interacting with each other and our fuzzy foundations. You might ask why knowledge of current conditions is likely to be fuzzy. Let us take Australia's multi-speed economy as an example. Despite the rhetoric coming from the Reserve Bank, our politicians and business leaders about a two-speed economy, which is clearly nonsense, sectoral and regional economic performances differ greatly – driven a wide variety of conditions. These include commodity prices, ore grades, seasonal conditions, global supply and demand for different agricultural commodities, recession in some parts of the world, booming conditions in the BRICS and many other parts of Asia, the relative value of the $A, old manufacturing vs new manufacturing, and consumer sentiment ... just to name a few processes at work. So, regional economic performance is more like a scrambled egg than a soufflé! Needless to say, **outcome uncertainty** – or what we would like to achieve and in what way is even more blurred because of the morass of uncertainty in which we are embedded. While the direction of likely economic and social change is clouded by technological and competitive uncertainty, we should not underestimate the crucial difficulties posed by a myriad of emergent and clashing lifestyle and ideological preferences. Let us take one issue to illustrate the complexities we will have to deal with. Most governments world-wide are alarmed at the looming financial disaster created by rapidly growing numbers of retired people being supported financially by an ever decreasing ratio of workers. Even without the GFC, most Treasurers and Reserve Bank Governors have pencilled in financial black holes emerging by 2020. It might therefore come as a surprise to most people when I say that this is null issue capable of easy resolution once the retirement

age shifts to 70 or 75. It seems to me absurd that we retain in 2011 a retirement age five years younger than that set by Otto von Bismarck in his Old Age and Disability Insurance Bill of 1889. That set a retirement age of 70, which was only reduced to 65 in 1916. Now that male life expectancy is at least a decade longer than in Bismarck's day and rising rapidly, significant increases in the retirement age seem acceptable and imminent. However, doing so will likely have major unintended and unclear spatial impacts on economy and society.

This brings us to a raft of **psychological uncertainties** in regional science. Sorensen (2010) notes more than 40 different aspects of human behaviour having important consequences for regional economic and social well-being and argues, in particular, that adaptive or mal-adaptive behaviours may single-handedly lead to regional growth or decline. If this is so, it becomes important from a policy perspective to identify behaviour sets beneficial to sustainable economic and social well-being and to promote them. Finally, uncertainty is undoubtedly a function of **time horizon**. The longer we look forward into the future, the fuzzier will be our analyses of likely processes and outcomes, or of preferences in respect of aims and strategies. The mathematics is simple. If an annual forecast is approximately 90% correct, its extrapolation to the end of the decade gives us an error term of 0.9^{10} (or about 0.35). In other words, our forecasts will only be about 35% accurate, or about 59% for a 5 year forecast. Given the depth of uncertainty revealed by all nine dimensions discussed here, an annual 10% error term looks rather mild, though that outcome will vary greatly between subject matters. Financial forecasts dealing with the performance of stock markets, individual companies, commodity prices, and exchange rates are notoriously volatile. On the other hand, birth and death rates barely change from one year to the next so that spatial forecasts of natural increases or decreases in population are likely to be accurate. The demographic wild-card is sometimes immigration and emigration, but both are stable for most regions.

DISCUSSION

Uncertainty is massive, multi-faceted, accelerating in diversity and scale, spatially diverse according to local resources and global connectivity, and subject to a range of perceptual and analytical interpretations. And it looks like our forecasting capacity is deeply flawed, indeed increasingly so, despite years of data analysis, model building, ever more powerful computers, and refinement of forecasting techniques. Alas, these conclusions are particularly apposite for regional economics, for three main reasons. The vagaries of geographical space impact greatly on place development and prosperity; and Thomas Carlyle's "dismal science" is notoriously prone to analytical error given the large number of contributory and unstable variables in play,[4] not to mention prophesies of doom that have mostly yet to materialise. Finally, let us suppose that our forecasts were accurate. One suspects that future tidings would be unwelcome to the great majority of people because they threaten change and dislocation likely to remove them from their comfort zone. Such collective conditions increasingly make it difficult to define current regional problems, imagine future options, select effective strategies or policies, harness public support and get the best out of limited resources. We are in Plato's world of becoming,[5] which is work in progress with no clear outcomes, and most long-term blue-print development is surely doomed to fail on account of the preponderance of forecast error just discussed.

[4] Thomas Carlyle was referring to the work of Malthus in arriving at his assessment in an essay entitled *Chartism* (1839).

[5] Plato's dialogue *Timaeus* speculates on the nature of the physical world (a fixed world of being) and human existence which, apart from metaphysical considerations, is largely an emergent world of becoming. The discussants are Socrates, Timaeus of Locri, Hermocrates, and Critias.

Far from destroying concerted public action to promote regional development, this analysis points to its reformulation along no less than 10 interconnected lines shown in Table 2. The table summarises succinctly what amounts to a potential national agenda to maximise the pace of local change and adaption, subject to a variety of financial and environmental constraints. Governments have a clear responsibility to protect high quality environments from private action over the long term, and mediate resource use conflicts between private parties. The current fight between farmers and coal seam gas producers is a case in point where the rights of the parties and compensation procedures are insufficiently clear. On the financial side, governments have been notoriously poor at explaining what range and quality of public services regional communities are entitled to as a matter of community or even universal service obligations and then funding those services appropriately. The provision of such services is a delicate balancing act with a large variety of other potential outlays, several of which are listed in Table 2. These include funding research and development and staffing educational services designed to improve community adaptability. Australian governments are also under considerable pressure to cap their share of national GDP to simultaneously minimise taxes and prevent their budgets falling into deficit.

Most of the provisions in Table 2 relate to increasing regional adaptive through a three pronged strategy. One is to increase the adaptive capacity of all elements of community: individuals, businesses, governments, and social institutions. This in involves changing people's long-term behaviour sets in favour of welcoming, embracing, and adapting to change. Sorensen (2010) elaborates on the nature of those behaviour sets, but critical elements include knowledge of the future and the opportunities it brings, together with good quality local leadership, life-long education, and relevant work-place skills. Perhaps, too, we should become a lot better at publicising the large number of good news stories from regional locations, which could be a more pronounced media responsibility. In other words, success can breed success, but only if we're aware of it!

The second strand in the strategy involves providing regional communities with the technological and other innovative tools to give them comparative advantage in strutting the world stage. The key here lies in boosting research and development outlays. Responsibility is divided between governments and the private sector, according to their ability to raise the necessary funds. For example, the private sector may have little incentive to engage in some aspects of pure research where the pay-offs in terms of commercial products or services are often not readily apparent. However, pharmaceutical companies have such large markets for IP protected drugs that they are willing to fund considerable high quality and fundamental research work. Likewise, a long list of companies with deep pockets in the mining and IT sectors are able to outlay large sums on basic research. However, many scientific discoveries concerning new materials and their properties have depended on military or space budgets funded largely by the likes of the US and EU. As Sorensen (2011b) points out, much agricultural research and development relies significantly on public funding despite its demonstrably large return on investment. This partially reflects the large number of widely scattered, small-scale and cash-strapped producers in many agricultural sectors. It would be difficult to organise such producers to come together, decide on a research program, and fund it, so governments take on much of that task while extracting some producer input through levies on output. Moreover, a diverse range of climatic and soil conditions also conspire to make the needed research region-specific rather than apply to everyone in a commodity sector. That said many agricultural inputs – for example, machinery, seeds, fertilisers and chemicals are supplied by corporations able to fund R &D independently. In the case of rural regions, the R & D inputs are spatially scattered and help diversify local economies.

Table 2 Regional Development Strategy / Policy Options

	Option	Aim	Actions	Responsibility [1]	Notes
1	Increase Theoretical Research	Australia maintains leadership role in global basic research central to perceived long-term national interests: e.g. agriculture, minerals, energy, environment, medicine, transport, ICT, educational services.	Requires appropriate institutional structures, funding, and legal (IP) protection	Active partnership between F, P + fiscal settings favouring long-term and often speculative basic research	Regional universities can play an important role in some of this research
2	Increase Applied Research	A continuous stream of high quality applied research is critical to the quality, productivity and global competitiveness of existing and potential core industries (see #1). This includes adapting foreign technologies to local circumstance.		Active partnerships between F, S, P. States have an important role given their contrasting economies	
3	Ensure Efficient Venture Capital Markets	Rapid technological adoption arising from 1 & 2 requires effective capital backing for start-up enterprises or for innovative, and often small, businesses.	Establish pools of venture capital accessible by small enterprises	Best left to the private sector, aided by F fiscal concessions	
4	Generating Future Orientation	These actions are central to facilitating more rapid adaptation to changing circumstances, and are closely interconnected. Those used to analysing or conceptualising the future are likely to be less antagonistic towards it. Strong local leaders, who help shape and popularise feasible visions for their communities, can also improve both local willingness to embrace change and adaptive capacity. Both those dimensions are tied close to the general quality of life-long education and opportunities to acquire or update work-specific skills. Finally, one of the keys to strong future oriented local action is place as much responsibility for local development as possible on regional actors rather than remote government authorities less attuned to local circumstance.	These look to be the realm of (i) modern social networking, (ii) focus by television and print media on what's shaping the future and successful approaches to adaption, and (iii) insistent education (see #7 below)	Promoting future orientation and contributing leadership is a **whole of society task** involving all tiers of government, private media, educational institutions, economic and social leaders all promoting a can-do culture	The last thing we need is the fear- & scare-mongering, which is the flavour of 2011. We need vision and how to achieve it.
5	Enhancing Leadership				
6	Localising Responsibility (Subsidiarity)				
7	Enhanced Education and Skill Sets		Improve the future focus of life-long and trade education	This requires a coordinated national programs agreed to by all providers	
8	Investment in Strategic Infrastructure	Includes transport (and the 21st century equivalent ICT); education and health services; utilities (water, energy).	Clear guidelines on universal service obligations	Priorities set collectively by all tiers of government and private enterprise in consultation and reviewed frequently. Clarity on scheduling and paying for necessary works	
9	Resource Protection / Development	Central for both local development and quality of life over the longer term. Endemic resource use conflict requires development of clear protocols to resolve dispute.		The protocols to indentify and handle disputes require whole of society agreement.	
10	Optimise Jurisdictions for Development	This concerns the creation of a set of territorial units fit for optimising their development prospects. Current jurisdictions (S, L) inadequate in many cases.	A combination of (a) research and (b) national inquiry	All tiers of government + submissions from P interests	
	Notes	[1] Tier of Government (F, S, L); Private (P) and Community (C)			

The third and final component revolves loosely around infrastructure. We have already discussed the importance of physical infrastructure and the difficulties in delivering it, but two other elements bear close scrutiny: government jurisdictions and environmental management. The former is a somewhat fetid issue involving wrangling over two contrasting aims – institutional resources and efficiency and the importance local action or responsibility. Australia's often thinly populated rural regions make this theme hotly contested. Larger, possibly more efficient, and better funded jurisdictions often cover large territories, with Council administration remote from many residents. State governments in Queensland, South Australia and Western Australia have baulked at merging tiny (in population) jurisdictions in their parts of Remote and Very Remote Australia for this reason. Perhaps it matters little retaining small local government jurisdictions in remote Australia where development prospects are mostly thin or strongly localised, as in the Pilbara. Governments' other main infrastructure role lies in environmental management and conservation, and this is less problematic than most other heads of consideration discussed here. The conservation of regions of great national or global significance for their visual beauty, rare ecologies or significance in human history is widely accepted and a potential spring-board to local development if handled well and of sufficient stature. Most of these resources are locked up in National Parks, but governments also promote wild-life refuges and corridors in attempts to preserve habitats of rare and endangered species. Some land-owners are known to attempt to clear such refuges on their properties for agricultural production, though it is becoming increasingly difficult to do so undetected via remote sensing, and there is little sympathy for miscreants. The landcare movement is also widely supported and effective in developing local resources endogenously. All tiers of government also have a hand in trying to resolve private disputes over the competitive use of resources, including water, which has multiple uses, and mineral or gas extraction from under good quality agricultural land, with its potential to destroy aquifers. Water supply is clearly part of rural infrastructure and needs careful monitoring and regulation.

CONCLUSION

The multitude of uncertainties in the Technik age discussed here is growing daily in importance and in their power to disrupt faster and on larger scales than ever before (Khanna and Khanna, 2011). But society appears to have little or no capacity to alter the path of events, partly because it is deeply fractured itself and many social groups or business interests have a strong incentive to seize the opportunities provided to rewrite the structure and function of both economy and society. Consequently, there is no way that any of Australia's regions can draw a line in the sand and opt for the status quo. Indeed, many of those regions have such thin resources and little financial clout that they are among the first to be run over by the unconstrained technological juggernaut. Indeed, the only credible action seems to be to bend with the way in which the technological wind is blowing and seize the opportunities provided to the best of one's ability. Governments' have limited capacity in that regard; their powers are uneasily spread across all tiers; and, even within tiers, their powers are highly dispersed among competing departments.

The agenda outlined above is therefore likely to be difficult to implement on many grounds, not least because of deeply split responsibility, scarcity of funds, and lack of debate over how best to allocate the moneys available. Perhaps, the optimum strategy is to work nationally towards a permanent and maximally adaptive society in which change is largely welcomed and promoted and those damaged by it are compensated, at least initially, by social security until they are able to re-orient themselves to new realities. This would be a largely individualist society where private citizens, businesses, and institutions fend for themselves

and compete in the marketplace for ideas, goods and services. It cannot be a collective endeavour because the future is so uncertain and awash in a host of unresolved opportunities. Regions that are home to adaptive people could no doubt make their way in such a world; while those whose residents are attached to some past golden age will probably expire of their own volition. Ça va, as the French say! Welcome back to Lindblom's (1959) world of disjointed incrementalism, the prime adaptive technique available to business and communities to deal with the wicked problems (Rittel and Webber, 1973; Lazarus, 2009) and social messes discussed here.

We have also linked together, perhaps for the first time, the visionary long waves of both Kondratieff and Toffler on the one hand and the more short-term economic waves more analogous to quantum mechanics on the other. This author is suddenly alarmed! We inhabit a hugely uncertain world with rapidly arriving but fuzzy futures, to paraphrase Toffler's opening quotation. If much of this is barely understood by the great bulk of the electorate, what is the future of democracy? How can three political parties represent maybe 20 interest sets, perhaps a quarter of which are irrevocably destined for extinction? Perhaps this disjuncture lies behind much of the turmoil surrounding global economic and social management and regional science's slow retreat from regional econometrics.

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Workforce Challenges for the Rural and Remote Northern Territory Nursing and Midwifery Workforce: Establishing an Action-oriented Research Culture to Improve Workforce Outcomes

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ABSTRACT

Background: The idea of an action-oriented workforce research culture is to engage nurses and midwives in research around workforce issues. Policy efforts to address the continuing challenges of workforce shortages and high levels of staff turnover in remote regions such as the Northern Territory (NT) of Australia may benefit from the involvement of nurses and midwives themselves in both formulating the 'problems' and suggesting responses. While this approach is common in clinical research, little attention has been paid to engaging nurses and midwives in conducting workforce research. **Methods:** This paper reports findings from a qualitative study. Data were collected using semi-structured interviews with a sample of NT nurses (24), midwives (3) and their managers (18). Data analysis was undertaken using the concept of grounded theory. **Results:** Four trends emerged from the collected data: (i) interview participants identified a range of workforce-related challenges and expressed interest in researching these issues; (ii) clinical and cultural research questions were of equal importance; (iii) there was a perceived lack of organisational support around practitioner-led research; and (iv) growing local research capacity was believed to have potential in identifying new and innovative insights into old and long standing workforce (as well as clinical and cultural) challenges specific to remote jurisdictions. **Conclusion:** Building workforce research capacity in the context of short-staffed, highly diverse and transient workplaces such as the nursing and midwifery workforce of the NT requires extensive organisational support structures. The concepts of organisational knowledge creation and organisational learning may assist health care facilities in building research capacity, and facilitating the engagement of practitioners in workforce research.

INTRODUCTION

The idea of encouraging staff to undertake research has been shown effective in the context of clinical research, where research 'from the floor' leads to enhanced clinical practice by nurses and midwives. A similar action-oriented research approach may drive the identification of new and adaptive approaches to workforce problems specific to remote regions.

This paper explores how the engagement of nursing and midwifery staff in research dealing with workforce-related issues might best occur in a remote context like the NT, and what benefits such an engagement might bring to workforce policy and practice. The research involved qualitative interviews with key informants from the NT nursing and midwifery workforce. We explore current workforce issues as perceived by a sample of NT nurses and

midwives and address the potential of organisational knowledge creation and organisational learning strategies in tackling these issues.

The NT Context

The attempt to solve workforce issues by engaging practitioners in research might be of particular relevance to remote jurisdictions such as the NT. Protracted workforce shortages date back to the 1990s, and the current nursing and midwifery labour force continuously struggles to deal with high rates of workforce turnover, an ageing of the workforce, and growing numbers of internationally qualified staff (Garnett *et al*, 2008; Department of Health and Families, 2009). Many of these challenges have been attributed to the NT's tropical and desert climate, distance and isolation from major urban and educational centres, and an excess burden of disease among the Indigenous population (Garnett *et al*, 2008; Weymouth *et al*, 2007). Despite a substantial decrease in workforce turnover rates in recent years, high levels of staffing shortages have remained for at least three decades. Past workforce strategies such as the recruitment of agency nurses and midwives have not only proven costly, but were largely unsustainable (Garnett *et al*, 2008).

Carson (2011) has noted that workforce principles applicable to other jurisdictions might not be relevant in the NT due to high rates of Indigenous population, high non-Indigenous population turnover and an unusual demographic situation within the nursing and midwifery workforce. Martel *et al*. (2011) suggested an 'age-crater' of mid-career nurses in the NT, as fewer nurses return to the profession after having children than is the case elsewhere. Little has been done to engage practitioners in research addressing these challenges. Much of the knowledge within the NT nursing and midwifery workforce is imposed on staff and consequently, there is a need for more appropriate use of generated knowledge. The idea of engaging nurses and midwives in workforce research may assist health care facilities in creating solutions to workforce issues more applicable than were those developed in the past.

Research Capacity Building in the Literature

The previous decade has seen an increased awareness of practitioner research, and a substantial body of literature on research capacity building has emerged particularly in the health care arena. Internationally, governments and health care organisations developed innovative ideas for fostering the engagement of practitioners in research and demonstrated commitment by implementing strategies specifically targeting moderately research-intensive professions such as nursing. A range of capacity-building models were introduced including clinical nurse researcher positions, research mentor roles, research skill training, research performance indicators or clinical chairs (Richardson, 2005; Chan *et al*, 2010; Gething and Leelarthaepin, 2000).

While strategies for building research capacity received a great deal of attention in clinical settings (Pearson, 2004), little is known about the establishment of practitioner research within workforce-related issues. Crookes and Davis (1998) noted that nurses and midwives have responded to workforce changes more so than being successful in shaping or influencing them, and nursing has seen very little success in establishing or articulating major workforce research priorities. Data on the current health research workforce are difficult to access, and while Brown and Sorrell (2009) urged health services to not only research clinical questions, but also their own business and workforce processes, there are no examples of models relating to the engagement of nursing and midwifery staff in workforce research. Despite the increasing public and professional awareness for workforce research, and the call for clinicians as well as managers to justify change by providing evidence, little incentives exist for health services to foster change. Innovation is—in many cases—personally driven, and

few nursing policy documents acknowledge research capacity building as a major priority (Pearson, 2004).

Strengthening Organisational Responsibility

Research capacity building is dependent on the extent to which the individual and collective research ability of an organisation is being promoted (Frontera *et al*, 2006). The ability to create innovative knowledge through research is of particular relevance to knowledge-intensive professions such as nursing and midwifery. Despite the availability of knowledge-creating strategies, few health care organisations actively promote research, and consequently, dedicated resources are limited (Pearson, 2004).

Nonaka (1994) has urged greater investment in knowledge creation, arguing that a culture of critical practitioner inquiry may increase both the competitiveness and adaptability of an organisation. The concepts of organisational knowledge creation and organisational learning may assist health care facilities in fostering innovation, and enabling mechanisms through which knowledge can be created and shared.

It is widely understood that much of the knowledge in nursing and midwifery is based on tacit understandings created through experience. To generate new knowledge, the continuing exchange between tacit and explicit knowledge is required (Nonaka, 1994). The engagement of nurses and midwives themselves in this process might assist in revealing tacit knowledge in particular, and better research support might be a pathway to do so within a formal framework.

While knowledge creation (i.e. socialisation, externalisation, internalisation or combination of tacit/explicit knowledge through dialogue, group reflection, mentoring or the use of information technology) is carried out by individuals (Nonaka, 1994), the concept of organisational learning may enable health care facilities to share and transfer generated knowledge to the wider organisational context (i.e. practitioner-generated knowledge informing workforce policies).

To facilitate both organisational knowledge creation and organisational learning, health care facilities need to re-think existing knowledge processes and shift them in a more strategic direction. This shift remains difficult because traditionally, organisations are concerned with the processing of information and their focus centres primarily around problem-solving activities based on external information (Nonaka, 1994; Berta *et al*, 2005).

Creating knowledge from inside the organisation remains a substantial challenge, and the engagement of practitioners themselves in this process is particularly unexploited. Despite the availability of knowledge creation and sharing strategies, the incapability of workplaces to recognise those strategies, and the ongoing need for on-the-ground staff, remain major obstacles to implementation. This research has attempted to explore opportunities for the engagement of nursing and midwifery staff in research dealing with workforce-related issues, and sought to investigate benefits such an engagement might bring to workforce policy and practice in remote regions such as the NT.

METHODOLOGY

Design

The study used a descriptive qualitative design. A qualitative approach was deemed appropriate to explore the most pressing local-based workforce challenges as perceived by a sample of NT nurses, midwives and managers, as well as investigate research interest into these issues. Data were collected between the period of December 2010 and May 2011, using

qualitative semi-structured interviews as a data collection tool. The sample for the research was self-selected. Key informants were recruited via e-mail; an information sheet and invitation letter were sent to all public hospitals and health services in the NT. Those nurses and midwives interested in participating in the study were asked to contact the Chief Investigator directly. Further interviewees were recruited using a snowball sampling strategy. In total, 45 people volunteered to participate in the study.

Ethical Considerations

Ethics clearance was obtained from Charles Darwin University Human Research Ethics Committee (H10068). Different consent forms were developed for clinicians and nursing and midwifery managers, and all participants gave signed informed consent prior to being interviewed.

As the research was supported by the NT Department of Health (DoH), the main employer of nurses and midwives in the Territory, collected data were kept by the Chief Investigator only and could not be seen by the Office of the Principal Nursing and Midwifery Advisor unless de-identified. The NT DoH did not participate in data collection or analysis, and knowledge of who had agreed to participate in the research was held by the Chief Investigator only. To ensure decisions about participation in the research did not impair any existing relationship between the participant and their employer, no names were recorded in any transcripts or publications from the study and interviewees were not named against specific quotations.

Data Collection

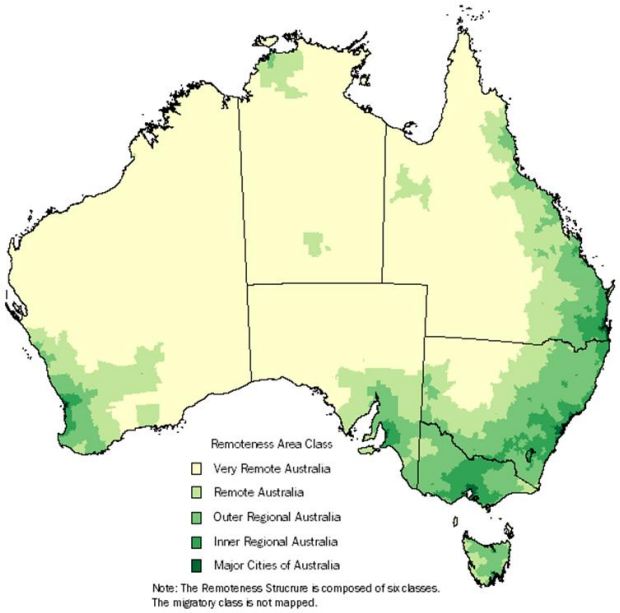
Interview participants (n=45) held current nursing (n=24), midwifery (n=3) or management positions (n=18) in Darwin, Katherine, Alice Springs, Gove (Nhulunbuy) and two Indigenous communities. Clinicians were employed in a range of different practice settings including NT hospitals, Community Health, and Indigenous communities. Managers were employed in both senior and line management positions in NT hospitals, Community Health, and Remote Health. The majority of participants (n=43) were interviewed face-to-face. The following table shows interview participants by their location of practice.

Table 1 Interview Participants

Location	Nurses	Midwives	Managers	Total
Alice Springs	9	0	4	13
Darwin	3	3	7	13
Gove (Nhulunbuy)	9	0	3	12
Katherine	1	0	4	5
Indigenous Community	2	0	0	2
Total	**24**	**3**	**18**	**45**

According to the Australian Standard Geographical Classification (ASGC) Remoteness Structure introduced in 2006, all interview settings but the Outer Regional area of Darwin are Remote or Very Remote areas with limited access to goods and services such as health care. Therefore, this paper addresses challenges relating to the establishment of practitioner research within the remote setting.

Figure 1 ASGC Remoteness Structure of Australia



Source: Australian Bureau of Statistics (2011).

Two different sets of interview guides were developed for clinicians and their managers. Nurses and midwives were interviewed to obtain their views on the most pressing, local-based workforce issues confronting remote NT, experience with research into these sorts of issues, previous experience with other research, and attitudes towards the conduct of research (i.e. levels of interest and enthusiasm). Nurses and midwives were encouraged to share their opinions on necessary support when conducting research while working in (remote) NT and the challenges that may arise within workforce-related research. Moreover, personal research interests and questions were investigated.

Nursing and midwifery managers were encouraged to speak about their previous research experience, and the role of research within their current workplace. Managers were also encouraged to give their opinions on the engagement of nurses and midwives in workforce research, and ascertain their personal research interests. Interviews further investigated ideas on professional development strategies required to motivate nurses to address workforce issues, and concluded by investigating concrete strategies for creating an action-oriented research culture to address continuing gaps in workforce efficiency.

Data Analysis

To categorise meaningful themes emerging from the gathered data, taped interviews were transcribed and thoroughly reviewed. Data analysis commenced during the data collection and transcribing process, and evolving themes were further discussed with other respondents. Data analysis was conducted using the concept of grounded theory. Interview transcripts were coded in two phases: using an open coding approach and re-coding of identified groups using NVivo software. Groups were then categorised to identify common themes from the collected data. Patterns and common themes appearing from this analysis were collated under subheadings in the findings section of this paper.

Limitations

Results from this research discuss perceived benefits for, and challenges of, practitioner research according to a sample of 45 clinicians (nurses/midwives) and their managers. These results do not represent the views of the NT nursing and midwifery population as a whole.

FINDINGS

Research Orientation within the NT Nursing and Midwifery Workforce

Existing research efforts within the NT nursing and midwifery workforce were unanimously described as 'ad-hoc' and 'personally driven'. Despite the observation that nursing and midwifery managers have previously had exposure to, and/or experience with research, few managers stated that they were actively involved.

Four managers (n=18) declared they had carried out research projects themselves. The majority of those projects were related to clinical issues—only one manager had conducted workforce-related research. All remaining participants had consulted research studies to inform their practice, and here too, clinical research was prevalent.

The most common evidence found within the workforce was described as 'professional judgment and wisdom'. A substantial cohort of nurses—and in particular those belonging to the 'baby boomer generation'—were trained under a hospital-based system. Managers noted that those nurses and midwives are largely unfamiliar with research, and comprehensive educational support programmes were requested.

The research experience of clinical staff was moderate; two nurses (n=24) stated that they were previously engaged in workforce-related research, and three nurses and midwives (n=27) declared that they were part of clinical research projects. However, none of the participants had carried out a project themselves or had been involved in department-supported research around issues of concern within their current workplace.

It was observed that university and/or hospital-based education affects nurses and midwives' levels of enthusiasm and confidence towards engaging in research. Those interview participants with tertiary education levels indicated greater interest in conducting research. Conversely, nurses and midwives trained under 'the old hospital system' assessed their confidence levels as rather poor and terms such as 'intimidating', 'daunting', 'challenging' and 'overwhelming' were initial responses to research. Comprehensive programmes of support and education were requested to build research skills.

Research orientation within the workplace – and particularly on hospital wards – was described as insufficient and participants stressed that exposure to, and interest in, research was in most cases personally driven. These findings were not applicable to public health nursing settings, where it was perceived that staff holding a public health degree had wider exposure to, and therefore greater interest in, conducting research. Support programmes were requested to update existing knowledge.

Better support structures were seen as a major requirement and participants suggested the establishment of research mentor positions to assist nurses and midwives in conducting research. Despite the perception that the NT has sufficient supervision capacity to guide nurses and midwives through their research, a formal and consistent partnership agreement between practice and university facilities was lacking.

Most Pressing Workforce Issues as Perceived by Interview Participants

Managers identified a range of workforce-related issues; acknowledged as most pressing were ongoing staffing shortages, changes in workforce demographics, and an increasingly multicultural workforce. Managers perceived challenges in the development of management and leadership skills within their workforce and reported continuing difficulties in attracting, recruiting and retaining specialist nurses (particularly emergency department and intensive care nurses) and midwives.

Central Australian health services reported high proportions of internationally qualified staff, the majority of whom speak English as a second language. Most dominant challenges in this context were language barriers, the transition of nurses and midwives into the Australian health care system, and the impact of culture on both workplace practices and interaction with patients. It was noted that culture not only strongly influences hierarchy and decision-making processes, but also impacts on the attempt to building management and leadership skills within the workforce.

Language proficiency was seen as a primary challenge, and culturally appropriate training, as well as a dedicated transition programme for internationally qualified nurses and midwives into the Australian health care system were requested. High proportions of Indigenous clients across the NT intensify language challenges; recognising that many Indigenous people do not have English as a first language. Suggestions were made for programmes dealing with culture and communication in general, the transition into the NT health care system, and the context of remote practice in the NT. It was observed that existing programmes do not sufficiently address those issues.

Major concerns also existed due to rising levels of violence in communities and subsequent distress about staff safety. Managers feared that a short-staffed working environment, the amount of overtime, and an increasing burden of (chronic) disease in communities would considerably affect the burnout rate among their staff. Despite the attempt to engage Indigenous people in nursing and midwifery roles, an approach reported to positively influence Indigenous health behaviours, numbers of community members in nursing or midwifery roles remain small.

Nursing and midwifery staff themselves identified a range of existing workforce issues, both within their local-based work environment and the NT nursing and midwifery workforce more broadly. General issues and challenges ranged from existing staffing shortages, to recruitment and retention difficulties, geographical isolation, high rates of workforce turnover and transient workplaces. Burnout cases had reportedly increased, and travel distances to and from communities were ongoing challenges. A major concern was the lack of appropriate preparation in relation to working with Indigenous clients. It was widely perceived among interviewees that staff is not adequately prepared for Indigenous health issues, and consequently were overwhelmed and emotionally burdened.

While a multicultural workforce can create an environment of mutual learning and innovation, appropriate cultural training need to be provided. Despite the observation that workforce research has potential in addressing existing challenges, and creating new solutions to long standing workforce problems, interviewed nurses and midwives were critical about their ability to engage in research. It was perceived that better organisational and financial support would facilitate research engagement.

Establishing Nurse and Midwifery-led Research into Workforce Issues

The establishment of a research culture was seen as a challenge among interview participants as NT nursing and midwifery research priorities were not evident, and support structures for the engagement in research lacking. To promote a research culture, suggestions were made for a register or database including research tool kits and guidelines, showcasing existing research projects and promoting available funding opportunities.

Nurses and midwives in Remote Health acknowledged existing options for study support such as remote workforce grants, subsidies for Internet costs or the entitlement to four weeks study leave per year. Research mentor positions were a major requirement; however, no funded research-only nurse or midwifery positions could be identified within the NT workforce.

For a research culture to develop, managers emphasised not only the need to establish better partnerships with universities and offer introductory research workshops, but also the need for an individual driver responsible for coordinating the development process around research. A mentor might assist nurses and midwives in finding scholarships suitable for their needs and putting in applications for those. Different models for establishing research mentor positions were suggested (e.g. creating a half-time position or buying in mentor support from a university).

Participating nurses, midwives and managers generally expressed positive opinions about the development of a research culture, and it was believed that a framework around research might positively affect patient outcomes. Investment in professional development was not only seen as a pathway to foster research, but as a strategy to value staff. Interview participants raised concerns about their ability to narrow down research questions to manageable research topics and believed training in writing skills is required, particularly for internationally qualified nurses and midwives. Managers acknowledged existing collaborations with Australian universities and other institutions, and the positive impact multidisciplinary partnerships could have on the establishment of a research culture.

Investment in research might create a competitive advantage because the remote NT nursing and midwifery context and high proportion of Indigenous clients pose some unique research questions within the health care setting in Australia. For example, a large number of remote communities located in the NT are still affected by trachoma, an infectious disease of the eye eradicated in all developed countries but Australia. The NT further accommodates the sole provider of health care services in the western parts of the region adhering to the principle of Indigenous community control.

Incentives and recognition were seen as vital in attracting research interest, and support for nurses and midwives in showcasing and publishing their research was required. One suggestion was made for integrating research as a vital part of the yearly Nursing and Midwifery Awards held by the NT DoH. Despite the need for flexible research engagement and comprehensive support structures, guidelines were requested ensuring that supported research creates a return on investment for the organisation (e.g. being collaborative and informing workforce policies).

Personal Research Interests

Interviewed nurses and midwives identified a range of workforce-related research questions and expressed interest in researching these issues. Suggestions were made for a collaborative framework between the NT DoH and universities to set up workshops introducing nurses and midwives to the concepts of research, walking them through narrowing down their personal

research question, developing a proposal, obtaining ethics approval, collecting data as well as analysing and disseminating the research.

Despite participants' interest in workforce-related issues, clinical and cultural challenges were determined to be of equal importance. Topics included workforce issues such as combining skills attained through nursing and midwifery, cultural competence, engaging Indigenous people to become nurses and midwives, safety and quality issues, and the effects of mental health programmes on alcohol abuse and violence issues in communities.

Other workforce-related research interests revolved around occupational health and safety, new approaches to recruitment and retention, the credibility of job sharing options in hospitals, and burnout of midwives in caseload midwifery models. Culturally related research questions dealt with organ donation, the engagement of Indigenous people in becoming nurses and midwives and perceived rising numbers of teenage pregnancies in Indigenous communities. Clinical research interests were into trachoma and pertussis, suicide among Indigenous people and research into the safety of homebirth in communities.

Fostering Practitioner Research Engagement: What is Required?

Major requirements for the establishment of a research culture were management and mentor support, peer support, skill training, the backfilling of positions, as well as financial support and recognition. Several nurses expressed their interest in Masters by Research studies, although age was seen as a major obstacle to professional development activities. Two interview participants stated that their age would keep them from engaging in research. Both nurses were hospital-trained and currently in their mid-50s.

The idea of meeting inspirational and experienced researchers was seen as a potential facilitator for the research engagement of nurses and midwives. However, without high-level support, it was perceived that the development of an action-oriented research culture would not be feasible. Most importantly, the development of a bottom-up approach to research will require the allocation of financial resources.

DISCUSSION

The NT has experienced protracted workforce shortages dating back to the 1990s, and past strategies to tackle these issues (e.g. the use of agency nurses and midwives or overtime hours by existing staff) have not only proven costly but were largely unsustainable. The attempt to engage practitioners in conducting workforce (as well as cultural and clinical) research might facilitate the creation of new and innovative insights.

Knowledge within the NT nursing and midwifery workforce is primarily imposed on staff and consequently, there is a strong need for more appropriate use of generated knowledge. What greater investment in practitioner research might do is foster critical thinking and problem-solving abilities of the workforce, and assist in creating solutions to workforce problems adaptive to the remote nature of the NT.

A growing body of literature on research capacity building in health care has urged nurses and midwives to not only react to workforce changes, but also actively shape and influence them. While the benefits of supporting practitioners to conduct research have experienced at least some recognition in clinical settings, the potential of engaging practitioners in workforce-related research has yet to be recognised by health care organisations.

This study identified workforce research interest among a sample of 45 NT nurses and midwives as well their managers. Interview participants suggested a range of knowledge creation strategies that align with those strategies presented in the literature (e.g. exchange of

tacit/explicit knowledge through mentoring or the use of information technology such as databases). Recommendations such as the establishment of a work group around research development, the introduction of research mentor roles, and a comprehensive research partnership between existing research institutions in the NT will require the incorporation of research as a vital part of the strategic agenda.

While the remote nature of the NT presents some challenges to the engagement of practitioners in research, most prominent the ongoing need for 'on-the-floor' personnel in the context of short-staffed, highly diverse and transient workplaces, the call for evidence to justify both workforce policy and practice strategies is becoming a key factor for health care organisations globally. Remote jurisdictions are no exception, but the continuing struggle to deal with staffing shortages and high rates of workforce turnover have largely hindered a focus on research.

CONCLUSION

Creating responses to nursing and midwifery policy and practice issues through research requires a greater focus on organisational support structures, as well as the re-evaluation of existing knowledge processes. In particular, the relationship between imposed and generated knowledge needs to be re-assessed, and shifted towards the engagement of staff in direction setting for the organisation. The creation and sharing of knowledge using software or the establishment of research mentor positions might assist in building more adaptive approaches to workforce problems attributed to the remoteness of the region. Despite challenges to building research capacity in remote jurisdictions, it is these regions that might profit from practitioner-generated insights into long standing workforce problems.

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