

## Developing Communities and Their Innovative Capacity by Adopting a Small Worlds Networking Approach

Carmen Reaiche Joham\* and Stephen Boyle\*\*

*To prosper, developing communities in particular need to be socially and economically innovative. There is, therefore, a need to design an appropriate system for appreciating and improving the innovative capacity of communities. Merely counting examples of innovation from the recent past raises definitional issues. It also provides no advice on how to redesign a community to expand its capacity to exploit innovative ideas. This paper argues that the small worlds social networks concept can provide a collaborative interpretation of idea generation and exploitation. The degree of presence of a small worlds network can be demonstrated diagrammatically and by using particular network metrics. This paper explains how and why this system can be used to develop idea exploitation capacity and assist developing communities to expand their innovative capacities. Two regional towns in Australia are used as an illustration to provide evidence of the appropriateness of this system.*

### 1. Introduction

Innovation is usually defined as the successful exploitation of ideas (Pittaway et al., 2007). For those who believe in progress, social system governance includes encouraging the generation and exploitation of innovative ideas (Plowman et al., 2003, Van de Ven, 1980). Developing communities as open systems needs to be innovative and meaning-exploitative, to survive changes in their environment (Brown and Karagozoglou, 1989). Schumpeter (1942) assumes this in his design of capitalism. Idea exploitation drives the competitive evolution of new products and services; when traded, this provides a way out of poverty. Economists, sociologists and politicians therefore herald idea exploitation as the key to social and economic progress. However, those entrusted with encouraging idea exploitation in communities often struggle with how this is to be achieved (Pittaway et al., 2007). Part of their problem is that for an idea to be exploited, it needs to be socialised.

The problem of encouraging idea exploitation in a developing community can be seen as one of managing the means and motives. The means includes both resources and ideas. The lone creative genius explanation of idea generation is thought problematic. The alternative is that ideas are generated by social interaction (Bailin, 2003). This works by the interaction causing a clash of assumptions (Mitroff and Emshoff, 1979) between peoples with diverse backgrounds or different expertise. However, a clash of assumptions can also result in aggression, so this social interaction needs to be of a particular form to alleviate any concerns.

The motive part of the intelligence adage, when applied to the issue of the way to encourage idea exploitation, is more than being about enthusiasm. It is also about developing a sense of purpose, vision or identity (Hatch and Schultz, 1997). These drive a will to act (Klein, 1999). This sense of identity must relate to social interaction. The problem then becomes one of how to generate a sense of collective idea exploitation identity that does not lead to excessive competition or collaboration weakness.

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\*Dr. Carmen Joham, School of Management, University of South Australia, Australia  
Email : [carmen.joham@unisa.edu.au](mailto:carmen.joham@unisa.edu.au)

\*\*Dr. Stephen Boyle, Academic Director/ Deputy Head of UniSA College, University of South Australia

## **Joham & Boyle**

The small world literature (Watts, 1999) argues that the effective idea sharing networks necessary for innovation need to be of a small worlds structure. These have dense (social capital) clusters, connected by a few weak ties (structural holes). Having accepted that this particular structure is preferable, its presence can be depicted graphically and by using particular network metrics. The main contributions of this paper are the introduction of the small worlds theory as a social networking framework system and how this system can be used to depict the idea exploitation capacity in any social system or community. From a process point of view, two case studies of regional towns are presented as an illustration of this critical system as a catalyst for idea generation and innovative collaboration. This includes how their idea exploitation networks were collated and depicted. In addition, the significance of this paper also lies in demonstrating this approach as an innovative system for thinking about idea exploitation capacity.

The paper is structured as follows: firstly the paper explores the literature around ideas, networks and community innovation. It then looks at network structures and in particular small worlds, giving an explanation of how to calculate and measure the connectedness of the network under exploration. The paper then describes the research project and methodology and provides evidence of existing networks in two regional towns in Australia to demonstrate the appropriateness of the framework. Finally the paper discusses how social systems that demonstrate greater networks are in a much better position to exploit idea generation and sharing, resulting in the development of new innovations and wealth creation opportunities.

## **2. Literature Review**

### **2.1 Ideas, Networks and Community Innovation**

Balin (2003) presents the argument that not only must we strive to understand novel idea emergence as a rational act, but that historically, ideas can be seen to flow from community interaction. The resource-based theory of innovation (Fleming et al., 2007) argues that groups and communities that are more intensely resourced and demonstrate knowledge sharing, will be the more innovative. The generation of ideas contributes to the knowledge required to trigger innovative activities. This explains why London is more innovative than Bolivia. Under this theory, need is not the mother of invention but rather it is the result of access to research time, finance, knowledgeable people, equipment, infrastructure and information. For example, regions with large electronic, research and chemical industries are found to produce more patents than rural areas, as are cities. The social network view of innovation (Pittaway et al., 2007) counters this resource-based view by pointing out that key resources are often relationships.

Regardless of whether we are innovating or not, humans are social beings. We are significantly influenced by those around us (Heidegger, 2008). An invention, a new recipe or a clothes fashion change are examples of an individual changing a group's behaviour but if we are honest, one person usually makes very little difference on the long term behaviours of a community. This 'get along, go along' behaviour seems motivated by our very strong 'inclusion' needs; we need to belong to some group (Schutz, 1966). In the 20<sup>th</sup> century our development of conceptual ideas like democracy, individuality, progress, creativity, change and invention help to develop a community respect for idea exploitation. These act to establish a purpose for our social systems, an identity based on generating

## Joham & Boyle

these collective conceptual ideas (Heidegger, 2008). These are ideas shared by millions of people. They give our networks their purpose, as well as their and our identity.

A system is a network given purpose by these collectively conceptual ideas. In the communities of practice language (Wenger and Snyder, 2000) identity emerges from a social system, which then determines how it interprets events that occur around it. Weick (1995) calls these images for sensemaking, Argris and Schon call them theory in practice (1996), pluralist systems thinkers call it intent or purpose. In social networking language, the network people respect determines their identity. When this identity is to exploit an idea then that is how they will determine how to interpret and respond to any problem situations they confront. Managing the idea exploitation capacity of a community might therefore include managing interaction with successful groups that highly respect idea emergence. As mentioned earlier, the problem becomes one of how to structure these social interactions critical for developing communities' innovative capacity.

The design or structure of a community network determines what resources are available for idea exploitation to occur. There is some evidence that networks need to allow interaction with those who have had extensive, positive, and relevant idea exploitation experiences. This means networking not only into the knowledgeable but also those with the right identity (Bessant, 1993). Bessant reported that, both in the UK and the US, prior experience in idea exploitation made a difference to subsequent exploitation patterns. A lack of access to this experience often leads to poor outcomes while communities that have explicitly managed a system to support idea exploitation have been successful.

### 2.2 Network Structures: Small Worlds

The above is not arguing that more and more networking (collaboration) is preferable. Time and weakness in community communications limits the amount of networking that is feasible. We cannot network with everyone; collaboration weakness will set in. There is a need for networking advice that does not just demand more and more networking, nor can it encourage isolation. The right balance must be reached. However what needs to be avoided is a very centralise network (restrictive cliques) where idea exploitations are evaluated by a singular power elite with their own particular concerns and interests foremost in their minds. This appears to be a common pattern with developing communities. However, at the other extreme, a decentralised network, with little specialisation, where everyone knows everybody else and everyone's expertise is similar it is also not particularly beneficial.

The compromise between these two extreme forms of networks can be found in a small worlds structure. Moreover, the presence of this structure can be depicted graphically and by using established network analysis metrics. This paper will now demonstrate how this metric can be operationalised to represent idea exploitation capacity.

The small worlds network structure appears to have evolved in nature as the optimal structure to arrive at a compromise between the benefits of having intense collaboration teams and the benefits of having feelers into other intense collaboration teams or high social capital cliques (Buchanan, 2002; Jiang *et al*, 2012). This type of network provides an effective communications structure, and explanation of how to design networks that avoid the problems of stagnated cliques and paralysis from servicing too many relationships.

## Joham & Boyle

The small worlds research (Watts, 1999; Killworth and Bernard, 1979; Matsuo et al., 2001; Buchanan, 2002; Richardson and Lissack, 2001; Granovetter, 1983) provides structure to the social network research (eg. Mizuchi, 1994; Durrington et al., 2000; Scott, 1996; Cross et al., 2002) suggesting the social network structure is an optimal structure for idea sharing. This concept has been found in human groups, in the natural environment, and in biological self-organised systems. In addition, the knowledge sharing literature is increasingly seeing social networking as central to knowledge updating in dynamic environments (Schenettler, 2009; Hansen, 1999). While there have been many applications of small worlds networks (for example see Inaltekin, Chiang and Poor, 2014) this approach has not been applied to innovation specifically. This paper seeks to address this gap by applying the small worlds network theory to small business innovation within rural communities.

The small-worlds phenomenon provides a system for conceptualising and depicting idea exploitation by small groups of people working in one particular project cluster, and occasionally sharing with other groups of people working within a different project cluster (i.e. weak ties). This is supported by the channels theory of knowledge sharing (Hare, 1976), highlighting that we can have direct two way knowledge sharing with only a limited number of people due to the exponential growth of knowledge sharing channels given an increase in people. With 3 people wishing to communicate with each other freely there are only three knowledge sharing channels that have to be kept open (A to/from B, A to/from C, and B to/from C). For 4 people there are 6, and for 5 there are 10 channels that have to be serviced. For some people maintaining these channels may mean not just exchanging pleasantries, but also being able to physically get to them (same time, same place). Having to service a lot of channels can become time consuming and as a result collaboration weakness can set in. Therefore, the sparseness of the number of ties is a strength of the organisational form as everyone does not have to maintain ties with everyone else all the time.

Small Worldness (Watts and Stogatz, 1998) is measured by comparing: (1) the average number of links (L) in the shortest path between any two nodes; and (2) the extent to which nodes are clustered together, (C being the clustering coefficient).

So for example if there were 226,224 nodes (n) and that *on average* each had 61 connections to other nodes then the graph *could* be represented by the following metrics:

$$L = \ln(226,224)/\ln(61) = 2.99$$

$$C = 61/226,224 = 0.00027$$

Rather than be called an averaged connections graph it is called the *randomised* graph.

The resulting graph can then be compared to the L and C of a graph which records the *actual* connections people (nodes) have in some identified context. If we are using the example of a town with a population of 226,224 then the randomised L and C uses the average number of people everyone knows. Some people could know hundreds of people and others only a few; the average in the example here is 61. The L and C average or randomised calculations are compared with how many people each person actually knows, be it hundreds or only a few. Fortunately, there are network analysis programs like UCINET which will do the calculations and graph the network to provide L actual and C actual.

## Joham & Boyle

Assuming the metrics come out as:

L actual = 3.65 compared to L random = 2.99

C actual = 0.79 compared to C random = .00027

As L actual and C actual are significantly greater than the random figures, the network can be said to exhibit signs of being a small worlds network. Establishing this metric for any idea exploitation network might be considered as a way to provide a means of measuring, or depicting, innovative capacity where innovation is considered to be about idea exploitation. As said above, the advantage of being able to depict idea exploitation capacity is that it opens the door to being able to encourage it. Actions that drive the metric upwards improve the small worldness of the system. In the example above, there is a very high level of clustering, therefore this could be dissipated a little, or alternative cliques encouraged as a means of increasing idea exploitation.

For idea exploitation to occur, a centralised network would require all ideas to pass through a central node. This process enables the mindset of those controlling that node to dominate the entire network. As a result, centralised networks tend to fail in dynamic and intense environments (Burt, 2001). On the other hand, a distributed, totally decentralised, network, as often advocated for the Internet, suggests all nodes be connected to all nodes. However, this is too demanding for a social network. Also, there is little evidence of the long term success of decentralised networks to maintain their focus on one task (Jones, 1996). The limitations of the various models discussed demonstrate the need for an alternative model to facilitate a more dynamic and less intensely populated complex social system. The small worlds network approach provides a more appropriate model to study such decentralised social networks. As Watts (1999) points out, a few correctly placed individual links can significantly improve the connectivity of a network. This enables ideas to travel around the network while maintaining only a limited number of links (relationships). In dynamic environments, a small worlds network also offers the opportunity for rapid refocusing on ever changing tasks. This might explain why nature has selected it in natural systems including social insect communications (Metcalf, 2005).

### 3. Research Method

It has been explained above why and how the small worlds network can be used to measure innovative capacity, or to depict a social system's capacity for idea exploitation. The film industry has been explored in this way (Watts, 1999) through mapping names on the credits from various movies. Innovator's names on patents have also been used (Fleming et al., 2007), as have company board directors. The study undertaken for this paper was initiated by a State Government looking at ways to encourage economic development in regional townships through improving idea exploitation. Whilst Florida's (2002) ideas had been considered, the State's preference for measurable planning targets meant they were rejected as un-operational. As well as providing an experimental base for deciding how best to depict idea innovation capacity, the study was interested in residents' input into the design of local idea exploitation infrastructure.

Many Australian regional towns are dominated by relatively large farming, fishing and/or mining industries, however given the interest in the growth of the town centre itself, these industries were not included. This study, therefore, decided to determine the small worlds

## **Joham & Boyle**

metric for idea exploitation in the town centre business community. Two towns, each with a population of about 20,000 people were chosen, as both had been reported as being innovative in an Australian Bureau of Statistics (ABS) annual survey. However, for the first town, this acknowledgement was mainly due to the upsurgeance of successful replacement agricultural industries after a significant rural downturn. In the other town, the idea exploitation was largely associated with the fishing industry. Both towns are many hours drive from towns of similar or larger population, so have developed their own independent social and business networks. However, they were large enough for dense town centre clusters and weak ties to occur.

Many of the participants for the study were selected randomly from prior analyses of an Innovation Award archive and businesses or people cited repeatedly in the local newspapers. The newspapers were monitored over a period of four months prior to initial contact. Some participants were contacted using introductions from other participants. The resultant participants included people from the public service, industry and local community organisations. The local government officials were much more responsive and helpful at the first town than the second.

Two researchers undertook a two week visit to the region during which personal interviews, familiarisation with local public documents, cold-call interviews with town centre businesses and a focus group session took place. In the first town, forty-three Local Government officials and business managers from a range of industries and backgrounds were interviewed. In the second town, thirty four interviews were conducted, more with business people than local government officials. Most interviews, except for the cold-call on shop front businesses, were conducted in a local coffee shop or government offices. In the first town, interviews, which were pre-planned to last an hour, generally took two to three hours due to participants' enthusiasm. In the second town, the average time was much less. The focus groups ran for approximately four hours. Interview participants were given the opportunity to discuss any issues they considered necessary. Attention was given to identifying existing community meeting places where business ideas could be discussed with the intent of progressing them. Stories of what had and had not happened at these places were discussed, including the use of different idea exploitation infrastructures. As mentioned, previous research had located connected names using movie credits and inventors listed on patents. This research used self-prioritised attendance at idea exploitation forums. These places, such as the council offices, rather than people, became the nodes on the network.

The ABS result that their town was innovative was used as the introduction. Participants were then asked how they defined and reacted to the term 'innovation' and why they thought their town was innovative and collaborative; both historically and going forward. Next, they were asked where business owners might go to discuss any exploiting ideas they had started to think about. An example used was the idea to fund a fast bus service from adjacent cities to encourage day trippers.

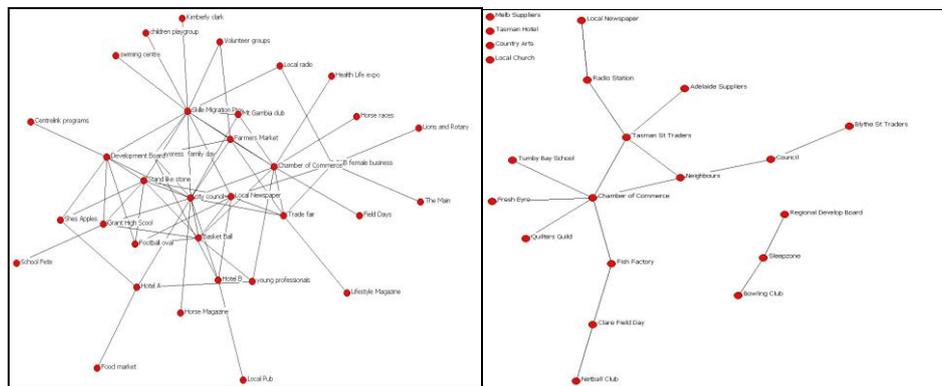
### **4. Findings and Discussion**

From the responses, it was possible to identify idea exploitation places (nodes). Next, it was possible to identify which of these places were linked by different people attending the same place. People who go to more than one place provide an opportunity to diffuse ideas they heard at one meeting to another and so on through the social network of the

## Joham & Boyle

town. The network nodes can therefore be seen as representing the main places used for between-group idea exploitation. Of course, other places may also be used but only those reported are included here. The links represented in the two towns' network diagrams below (Figure 1 showing town one and town two) are those idea exploitation places that were linked by the same people visiting both. Again, only reported links are used. From the interview responses, a pattern of where people met and who went to which meeting place emerged. The network diagrams do represent, if not perfectly, those patterns. For example, the line between the swimming centre (top left of town one) and the skilled migration program indicates that someone said they go to both these locations. This means that an idea mentioned in one location could easily be carried to the second location.

**Figure 1: Network diagram for town one (left) and town two (right)**



The network goes some way to represent the social life of idea exploitation in the towns and does reflect the picture that emerged from the interviews. The mapped network also provides input to assist in determining the role of government in a bottom up approach to regional idea exploitation. Having drafted the idea exploitation network, it can be measured for conforming to the metric of a Small-Worlds Network. Above, it was suggested this is the theoretical optimum structure for ideas to be well shared by a community. The metrics recommended to identify Small-World-ness are:

- an 'average shortest path' somewhat greater than random and
- a clustering coefficient somewhat greater than random.

For the first town there are 34 nodes and on average 2.6 connections per node:

Actual average shortest path (L) 2.4: Compared to a random of 3.7

Clustering coefficient (C) 0.4: Compare to a random of 0.08

This suggests that while well clustered, the average path length between meeting places was below random. The network does not display the small worlds phenomenon but is close to doing so, therefore meeting places might not share ideas as well as they might. This can be seen visually in the graph in Figure 1. Where improvement could be gained if the nodes around the edge of the graph were more directly linked to each other. For example in town one, if the local radio organised regular idea exploitation sessions with people who attended the swimming club, Government centre: *Centrelink*, the children's

## Joham & Boyle

playgroup, the food market and the volunteers group then ideas would have more chance to spread and utilise other peoples' input.

The idea exploitation network as shown in town one is also useful in appreciating the centrality and effectiveness of certain locations or events. The City Council's open forums and the local newspaper articles appear to play a central, if somewhat different, function for sharing and/or exploiting ideas. The Town Hall provides resources to encourage a forum for interactively developing ideas with an experienced panel. The newspaper publishes articles airing ideas inviting interested parties to respond. The Farmers Market and the shop 'Stand Like Stone' were also important as ad hoc locations for talking to people in an informal atmosphere. These locations and events were identified by local business people as where they liked to go, and where they found useful. It is thought that this forms the basis of adding further events for idea exploitation in the community.

For town two a very different network emerged. The small worlds statistics for this town were:

Meeting place nodes = 21:

Average number of connections per node =  $32/21 = 1.5$

Actual Avg path = 2.8      random = 7.5  $[\ln(n)/\ln(k)]$

Actual Cluster coeff = 0.07      random = 0.07  $(k/n)$

Both statistics are not greater than random so the network is not close to displaying the small worlds phenomenon. This network metric also reflects the researchers' impressions from the interviews. For example, many participants were unimpressed with the local government's facilitation of idea exploitations and were almost bemused by the suggestion of public places to share, let alone exploit, ideas. They were in a much more guarded, hostile frame of mind than those participants in town one.

This analysis suggests any form of improved networking between businesses would improve the idea exploitation capacity of these businesses. In particular, the setting up of business idea exploitation forums by the town council should be encouraged as a starting point for the interaction between businesses and the development of a network.

Overall, while neither town depicted small worlds networks in their purest sense, town one was much closer to the concept than town two. At the same time, participants in town one expressed greater affiliation and identity with the town and with the networks they identified. The concept of knowledge and idea sharing was more familiar to these people and this was demonstrated in the mapping of the network and the metrics gained. The results suggest that town one is in a much better position than town two to further exploit these idea sharing capacities and enhance their innovation capacities.

## 5. Conclusion

This paper has explained why and how small worlds networking can be used to design a system for depicting innovative capacity. It includes graphics and metrics that can be used to see and calculate present activities. Doing so provides the means to develop an innovation strategy for that community by encouraging it into a small worlds structure.

## Joham & Boyle

This structure can provide the means and motive for idea exploitation. Finding funding is about networking with those who have financial capital. Finding knowledge is about networking with those who have the intellectual capital. The motive or intent to innovate is seen to be also the result of social influence; a perception of a competitive environment. As identified above those social systems that demonstrate greater networks are in a much better position to exploit idea generation and sharing, resulting in the development of new innovations and wealth creation opportunities.

A limitation and challenge in using this depiction of small worlds system to measure idea exploitation capacity is in selecting appropriate nodes and linkages to represent an the overall social system. One alternative approach in mapping the system would be to use individuals as the nodes. If and when they speak to each other about idea exploitations, links are created that could be captured. However, this approach would breach the assumption that idea exploitation is about group socialisation of ideas, rather than individual to individual socialisation. Therefore, it would seem preferable to construct the node representation of an idea exploitation community using meeting places where ideas are discussed by groups of people. Wanting to encourage a semi-decentralised system suggests encouraging numerous different group meeting places rather than one central location; as suggested above this could include a network of idea exploitation forums. In this study, the linkage between these idea exploitation forums was provided by participants saying they visited both forums. Future researchers may wish to explore alternative ways of defining the linkage between these meeting forums.

The small worlds metric therefore does seem worthy of further consideration as one possible system for conceptualising and depicting the idea exploitation capacity of a community. Of course, there is a need for further experimentation on preferable means of identifying and representing both nodes and linkages. Perhaps, the main advantage of the small worlds system for depicting idea exploitation is that it immediately provides advice on how to develop an innovation strategy, one that focuses on developing an effective idea exploitation network.

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## Joham & Boyle

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## Joham & Boyle

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