

커뮤니티 기반 지식 네트워크: 호주 사례 연구

Community-based Knowledge Networks: an Australian case study

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ABSTRACT

This paper reports on a structural view of a knowledge network comprised of clubs and organisations expressly concerned with cultural activities in a regional Australian city. Social network analysis showed an uneven distribution of power, influence, and prominence in the network. The network structure consisted of two modules of vertices clustered around particular categories of creative arts and these modules were linked most frequently by several organisations acting as communication hubs and boundary spanners. The implications of the findings include 'network weaving' for improving the network structure and developing a systemic approach for exploring the structures of social action that form community-based knowledge networks.

Key words: community networks, social network analysis, cultural clubs and organisations

I. Study background**

1. Cultural clubs and organisations

This paper discusses a social network analysis of the knowledge network among clubs and organisations that provide cultural activities, facilities and festivals in an Australian regional city. Community-based clubs are locally based independent associations run by volunteers (Smith, 2000). In the Australia, community-based clubs are a common feature of the creative arts and sports in many towns. Importantly, the arts clubs (hereafter 'clubs') provide cultural activities and cultural buildings for their members, local residents, and tourists to enjoy. The management capacity of a club including its financial capacity, human capacity, and structural capacity decides the success of the group over time (Sharpe, 2006). The sustainability of community culture

relies on these local clubs and their abilities for sharing knowledge and cooperating in the holding of events, sharing of financial, human, and physical capacities, and in their requests for public money. To improve their individual organisational capacity and to achieve jointly helpful outcomes the clubs set up knowledge networks formed by intergroup links of varying strength.

Also, in the Australia, there are non-profit services and for-profit businesses that provide goods, services and training for arts clubs and their members. These include civic services attached to city government; commercial businesses selling specialised goods and services; and colleges and universities offering training and accreditation (hereafter 'organisations'). In turn, these organisations and the clubs set up links to exchange knowledge and information for their mutual advantage. By setting up links, these various kinds of vertices (clubs and organisations) form a knowledge network around cultural activities, festivals and places.

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In this study, social network analysis (SNA) was used to examine a knowledge network formed among arts clubs and related organisations in 'Plateau Town,' a small city in regional Australia. These clubs in Plateau Town provide a busy annual calendar of performing arts productions, visual arts and crafts exhibitions, and festivals for public enjoyment combined with weekly, fortnightly, and monthly activities for their members. In addition, various civic, commercial, and educational organisations present exhibitions, festivals, and performances; and sell goods and services to club members. Together, the clubs and organisations provide cultural events, museums, and theatres for the local residents of Plateau Town; and share knowledge for their mutual benefit. Understanding the structure of this knowledge network provides a means for analysing and improving community-level cultural services in 'Plateau Town' and in similar communities.

2. Social network analysis

Social network analysis is characterised by the acceptance of its structural paradigm across diverse disciplines and by its emergence as a key focus in contemporary social science research (Freeman, 2004). Social network analysis is an interdisciplinary field where method is central, methodologists are esteemed, and reporting methodological developments is a trait of leading journals. Sharing a common method, social network analysts work on empirical research and on substantive theories in diverse disciplines (Butts, 2007). Social network analysis can examine and interpret the pattern of links connecting varying kinds of social actors such as individuals, clubs and organisations. Four features typify social network analysis (Freeman, 2004):

- It is driven by the insight that the structure of links among social actors is significant for each actor and for the networks that they form.

- It uses observed data.
- It uses the visual representation of data extensively
- It depends on the application of mathematical and computational models.

Although, key ideas in social network analysis may have a methodological currency across various disciplines the researcher has to understand the meaning of relational data in their individual field. This requirement applies equally to community studies, where social network analysis has been limited, and to researchers in other fields (Butts, 2007) where the method has been more widely applied.

II. Method

1. Study setting and sample

The research took place within the Plateau Town local government area, a prosperous regional community of approximately 90,00 people situated several hours' highway travel from the state capital. In the year before semi-structured interviews were conducted for the study, field research combined with searching community service directories, local telephone directories, local newspaper back issues, and Internet sources identified 49 clubs and organisations in the Plateau Town cultural knowledge network. These included 31 clubs involved with the creative arts and 7 commercial businesses, 7 education providers, and 4 city government services (See Table 1).

2. Data collection and analysis

The network analysis applied in the study used the relational data collected by a census of all members of this network. Individual interviews were completed with respondents who represented a vertex (group or

organisation) in the network. During 49 separate interviews, an alphabetical list of the vertices was provided and the respondents had the opportunity to label their group or organisation's links with each of the other 48 vertices. Respondents could indicate two types of relational links. A *strong link* set up by regular knowledge exchange between office bearers or staff and by cooperative events between the two vertices. On the other hand, a *weak link* set up by occasional knowledge exchanges or by the office-bearers or staff casually attending the events of the other vertex. This technique identified 143 *strong links* and 217 *weak links* among the 49 vertices in the network. The relational data was analysed by preparing datasets representing *strong links* (143), and *weak links* (217) and *all-links* (360) and entering these into Ucinet social network analysis software (Borgatti et al., 2002).

III. Results

1. Network density

Density is the quantity of lines in a network graph, expressed as a proportion of the maximum possible number of lines (Scott, 2000). This is a socio-centric network metric that considers the structure of the entire network (See Figure 1). Due to the exponential rise in possible links as the number of vertices increases in a network, density relates inversely to network size. In the network the total number of possible links between the 49 vertices, excluding self-links, was 2352. However, the network exhibited an all-link density of 0.153, a network strong link density of 0.0607 equal to 40% of all-links, and a network weak-link density of 0.0923 equal to 60% of all links. Within the guideline, that density in graphs would not exceed 0.5 (Scott, 2000) the network was low to moderate in density.

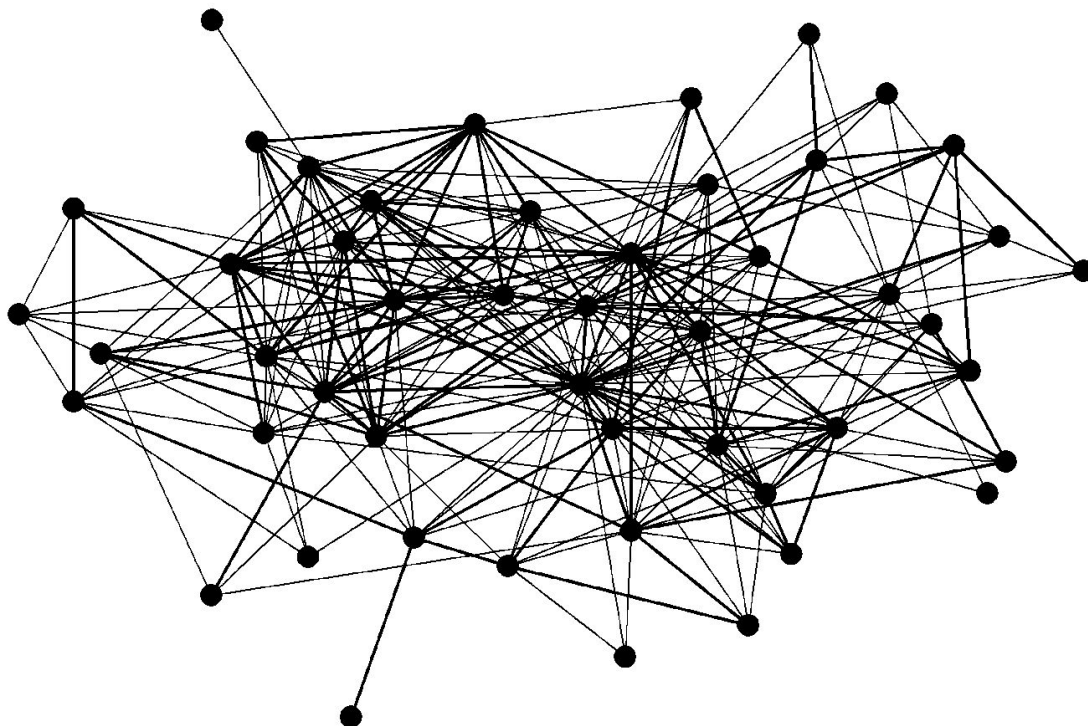
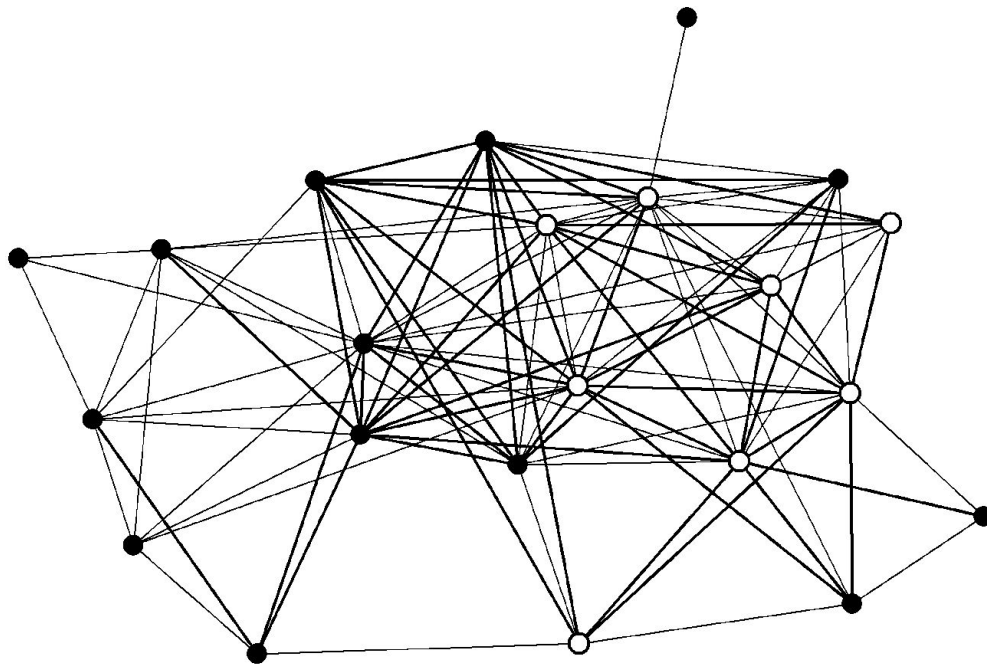


Figure 1 Graph of the Plateau Town cultural knowledge network: All-link density of 0.153

Collective arts module - 22 vertices & 148 links - density 0.32



Individual arts module - 29 vertices & 164 links - density 0.202

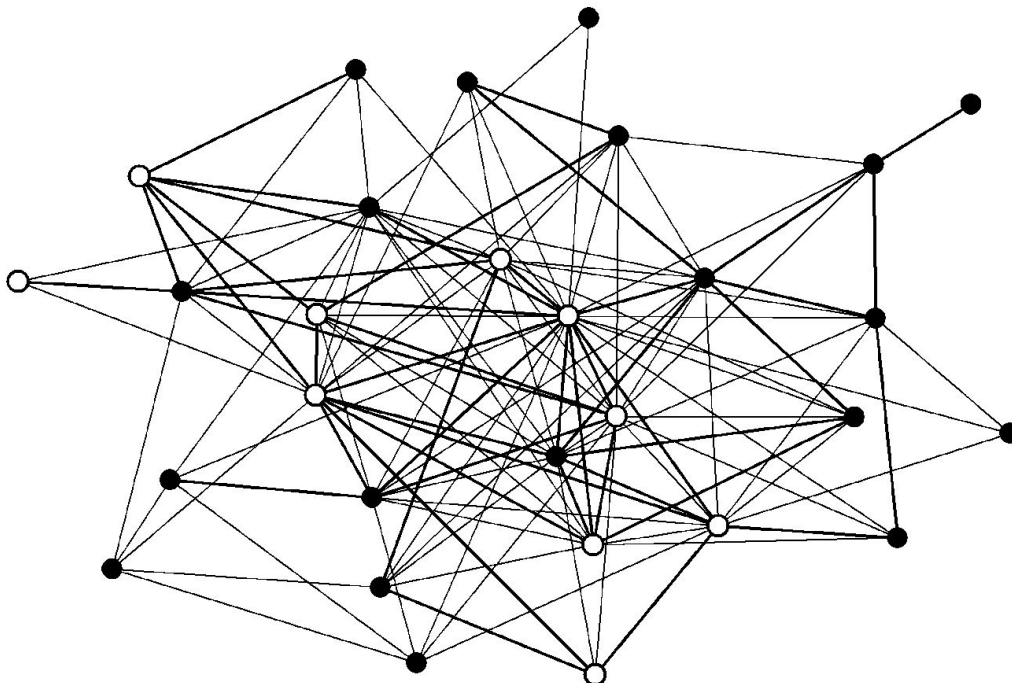


Figure 2 Graphs of network modules

clubs = solid vertex

organisations = clear vertex

Line thickness indicates link strength

2. Network modules

Further analysis of the density data revealed the network was comprised of two modules of vertices. A *module* is a cluster of vertices closely linked to each other that is discrete from the rest of the network (Csermely, 2006). In the network each module formed around clubs and organisations concerned with a limited number of creative artist categories. For example, the *collective arts module* involved actor, dancer, and musician vertices; and the *individual arts module* involved craft practitioner, community cultural worker, visual artist, and writer vertices. These two modules had several vertices in common: an educational organisation - the University Holiday School that provided residential short course in creative arts programs and; a city government organisation- the Civic Grants Committee that provided small cash grants to clubs and local artists and performers.

The density of all-links among the 22 vertices in the collective arts module was 0.32 and the density of all-links among the 29 vertices in the individual arts module was 0.202. The collective arts module exhibited a moderate density and the individual arts module a low density. Comparison of the links within and between modules revealed that the network density and cohesion was substantially reliant on the links between the two differing vertex types of clubs or organisation and that it was less reliant on links between the clubs themselves or the organisations themselves. At network level, the proportional distribution of all-links by vertex type showed that 22% occurred among clubs and that 24% occurred among the organisations whereas 54% occurred between clubs and organisations. At module level a similar distribution of links occurred. Thus, the structure of the network was characterised by the links between the clubs and the organisations.

3. Degree, centrality, betweenness and centralization

3.1 Degree centrality

So far, the relational data has discussed the density within a simple undirected network that ignores the direction of links between vertices. In a directed network the degree centrality of a vertex is the total number of links with immediately adjacent vertices; the outdegree of a vertex is the number of links sent to immediately adjacent vertices; and the indegree of a vertex is the number of links received from immediately adjacent vertices. A vertex with high degree centrality is powerful as it can readily access knowledge and resources, is more informed about relevant issues, and easily establishes alliances within the network (Degenne and Forse, 1999). A vertex with a high outdegree is influential as it can make its opinions known to a greater number of vertices. A vertex with a high indegree is prominent as links to it are important for a greater number of vertices. Overall, by considering the structural characteristics of the individual vertices these three measures support an ego-centered analysis to the network (de Nooy et al., 2005).

3.2 The centrality of organisations

In the Plateau Town network, the City Gallery and the University Holiday School were the only vertices within the five highest degree centrality indices that also appeared within both the highest outdegree and indegree indices. Their appearance in all three centrality measures suggested that their central network locations were powerful, influential, and prominent. The Civic Grants Committee, the City Theatre, and the Technical Education College only also appeared in the highest indegree indices suggesting their central network locations were more prominent than influential. Whereas

<i>Vertex</i>	<i>Degree</i>	<i>Outdegree</i>	<i>Indegree</i>	<i>Betweenness</i>	<i>Vertex</i>	<i>Degree</i>	<i>Outdegree</i>	<i>Indegree</i>	<i>Betweenness</i>
Civic Gallery*	36	32	17	25.17	Fanzine	10	5	8	4.82
Uni. Holiday School	25	16	21	11.73	Upstairs-gallery	9	5	7	0.74
Civic Theatre	21	13	20	4.70	Quilters	9	7	5	1.10
Civic Fund	21	0	21	6.69	Music-shop 2	9	8	5	0.64
Music-shop 1	19	17	10	4.48	Art-shop 1	9	5	8	0.32
Theatre Friends**	17	12	11	5.29	University Junior Academy	8	5	7	0.023
TAFE College	17	8	14	3.18	Potters	8	5	5	0.80
Sinfonia	17	14	11	1.38	Community Mural	7	7	3	0.04
Uni. Arts Centre	16	11	10	2.93	Youth Theatre	6	5	4	0.27
Arts Connect	16	14	10	1.94	Craft-shop 1	6	6	3	0.156
Uni. Visual Arts	15	3	15	3.11	Country Buckle	6	6	2	0.06
University Theatre	15	7	11	1.97	Active-writers	6	5	4	0.02
Photographers	15	13	6	1.47	Woodcrafters	5	1	4	0.22
Arthouse	15	12	11	1.20	Rock Hounds	5	4	1	0.26
University Music	14	11	11	0.39	Open-gallery	5	5	0	0.034
Spinners	14	14	2	2.63	Craft-shop 3	5	4	3	0.07
Eisteddfod	14	11	12	0.80	Country Hat	5	2	4	0.28
City Brass	14	12	10	1.69	Open Stage	4	4	0	0.08
Choristers	14	8	13	0.99	Folk Union	4	2	3	0.10
Art-shop 2	14	9	10	1.42	Embroiders	4	1	4	0.06
Playhouse	13	8	10	0.57	Graffiti-crew	3	3	0	0
Jazz Shack	11	0	11	1.31	Craft-shop 2	3	2	3	0
Moviemakers	11	9	4	1.36	Machine Knitters	2	0	2	0
Hill-writers	10	8	3	0.55	Teen-writers	1	1	0	0
					Ballroom	1	0	1	0

Table 1 Network degree, indegree, outdegree, and normalized betweenness in the Plateau Town cultural knowledge network

* Organisations shown in bold type. ** Clubs shown in normal type

the Music Shop only also appeared in the highest outdegree indices, suggesting that its central network location was more influential than prominent. The appearance of the community arts group, textile craft group, musical theatre group, and photography group in only the five highest outdegree indices suggested that their network locations were influential but without matching levels of prominence. The appearance of the University Visual Arts Department in only the five highest normalized indegree indices suggested that its network location was prominent but without a matching level of influence. In these three centrality measurements, the organisational vertices held the central positions of influence, prominence, and power in the network whereas the cultural group vertices held only lower ranked influential positions (Table 1).

3.3 Betweenness centrality

Betweenness centrality stresses the importance of a vertex to the communication flow across the network by considering the proportion of all the paths between other pairs of vertices that include the vertex (de Nooy et al., 2005). In the study, betweenness was based on directed all- links. The vertices with the five highest normalized betweenness degree centrality were, in descending order, the City Gallery, the University Holiday School, Civic Grants Committee, the City Theatre Friends club, and a youth community arts project. The City Gallery achieved the highest betweenness centrality with an index more than twice of the next highest scoring vertex. Overall, the City Gallery was the primary knowledge hub for the network.

3.4 Centralization

Centralization measures can assess the extent to which an entire network focuses on a limited number of vertices (Scott, 2000). Degree centralization,

outdegree centralization, indegree centralization, and betweenness centralization that consider the structural characteristics of the network as a whole were used to show a socio-centered view of the network (de Nooy et al., 2005). Analysis found a degree centralization of 54.5%, an outdegree centralization of 52.4%, and an indegree centralization of 29%. There was extensive degree centralization so positional benefits in the network were dispersed inequitably. Likewise, there was extensive outdegree centralization so influence was dispersed inequitably also. However, with a lower indegree centralization there was less variation in the distribution of prominence. The betweenness centralization index of 24.3% was also low and suggested that there was limited structural constraint on liaisons between vertices and the power of the intermediary positions held by some vertices were restricted.

IV. Discussion

1. The Plateau Town cultural knowledge network

The Plateau Town cultural knowledge network consisted of two modules of vertices clustered around particular categories of creative arts (see Figure 2). The modules connected, in most part, by their frequent links with several central vertices acting as communication hubs and, in lesser part, by occasional links between vertices in each module acting as boundary spanners. Each module provided a local social world for the members of the clubs who were also the customers, students, or visitors of the organisations in each cluster. The modules linked together as a network provided a regional social world for the creative arts in 'Plateau Town'. The social network analysis metrics of density, centrality, and centralization provided an understanding of the network structure among the 49 vertices. First,

the three general characteristics of density in this network were the majority of heterogeneous links between the dissimilar vertex types of clubs and organisations; the predominance of weak links, and the variation of link characteristics in the two network modules.

Thus, the network cohesiveness and knowledge exchange were substantially reliant on the density of links between the dissimilar vertices of clubs and organisations (see Figure 3). Second, the primary hub for network communication was the City Gallery and the secondary hub was the University holiday School. The City Theatre held a prominent position in the network with an unrealised capacity for a broader role in knowledge exchange. Both the City Gallery and the University Holiday School had multiple local links in both network modules whereas the City Theatre had links more limited to the collective arts module only. However, all three organisations were significant boundary spanners holding multiple links between the two network modules. Third, the degree centralization index showed there were few vertices with a high-level of power in the network. Thus, the network structure still allowed knowledge exchange between vertices without relying on the significant communication hubs.

Overall, the network displayed the five general patterns noted in all effective networks (Krebs and Holley, 2006).

- In each module vertices with common features, objectives, and governance were linked closely. This is the 'birds of a feather flock together' or homophily principle (McPherson et al., 2001). This occurred in the collective arts module and in the individual arts module. A characteristic of the Plateau Town network was the clubs and organisations flocking together in each module.
- The network was diverse. Each module linked a

varied range of vertices and inter-module links made innovative connections possible network wide.

- The network was strong as other pathways existed for unimpeded communication between most vertices if a communication hub broke down.
- Essential to network success, there were prominent vertices at network level and at module level acting as hubs spreading knowledge quickly by multiple direct links; as brokers liaising between detached network parts; and as boundary spanners bridging clusters of vertices.
- The short pathways of indirect links between most vertices lessen delay and distortion of information in the network.

2. Improving community-based knowledge networks

Applying network analysis to improve knowledge exchange and prompting collaboration between vertices is called *network weaving*. Typically undertaken by a development agency or by community activists, this process helps to change a network through four stages. Starting from some scattered fragments to a single hub-and-spoke then to a multi-hub small-world format and finally to a core-periphery network (Krebs and Holley, 2006). The Plateau Town network is a multi-hub small world network typified by the vertices clustering in each module and the inter-module links set up by the key communication hubs. By sharing knowledge coalesced around cultural activities, further network development is possible for the benefit of the club members, community residents and tourists. coming to enjoy cultural events.

By network weaving the local cultural clubs and organisations in Plateau Town, can understand their power, prominence, and influence of their positions and

by setting up better links, they can improve their knowledge exchange and management capacities. For example, the City Gallery, the City Theatre, and the University Holiday School can substantiate their role in local cultural development to their stakeholders, and commercial organisations can identify unfulfilled business links. Through these changes to their knowledge network improvement is possible in local cultural activities, facilities, and festivals. Overall, using network analysis for understanding their knowledge network increases the opportunities for better communication among the clubs, the organisations, the broader community of Plateau Town, and the city government. In this way, the network can move forward to the core-periphery structure that emerges after various hubs undertake a long period of network weaving (Krebs and Holley, 2006). As the cultural knowledge network develops, opportunities arise for better cultural experiences for club members, local residents and for tourists.

V. Conclusion

Integrating social network analysis into community studies extends research opportunities. This includes researching the interpersonal links among club members sharing common cultural interests. It also includes researching the small clubs, the social networks, the cultural clubs, the volunteer and cultural services organisations, the tribes, the social worlds, and the social movements that are the organisational basis of cultural participation (Stebbins, 2002). Producing social science data requires interpreting distinct data types. Variable analysis is appropriate to attribute data whereas network analysis is appropriate to relational data. Investigating the structure of social action, a key interest of the sociological tradition, is possible by producing and examining relational data (Scott, 2000). This applies to community studies where the research

focus of method is usually attribute data and variable analysis, thus, introducing relational data and social network analysis broadens the possibilities for exploring and theorising the structures of social action that are the basis of community-level knowledge exchange.

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