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Exploring the ACIS Community through the Analysis of Co-authorship across Institutions

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Abstract

This research employs a social network analysis (SNA) approach to study the longitudinal changes in co-authorship and affiliations of authors, who published in the Australasian Conference on Information Systems (ACIS) from 2001 to 2011. The research explores the structural patterns of co-authorship at the institution and individual author levels, and found research collaboration tend to occur between authors in the same regions and institutions. Descriptive findings further revealed key authors with rich and diverse co-authorship ties, as well as the tendency of authors to collaborate in silos within institutions. A longitudinal SNA method was performed to statistically deduce the changing patterns of co-authorship and affiliations from a sample of the authors in this 11-year period, which complements the descriptive findings. The discussion of our findings results in recommendations to improve the ACIS community's productivity and in directions for future studies concerning the applications of SNA in examining research collaboration.

Keywords: research collaboration, co-authorship, social network analysis, stochastic actor-oriented modelling

1 Introduction and Background

Since 1990 the Australasian Conference on Information Systems (ACIS) is the yearly academic meeting place for the Australasian Information Systems (IS) community, in particular its Australian and New Zealand members. We are interested in the history and development of this community and its members' collaborations as articulated and manifested through their co-authorship and affiliation patterns of their publications as presented at the conference.

Understanding why authors choose to collaborate with others produces theoretical and practical insights about important mechanisms of social networks, such as the tendencies to self-organise or create centre-periphery structures (Cheong and Corbitt 2009; Wagner and Leydesdorff 2005a, 2005b). Moreover, the consequences of research collaboration between authors can be explored, such as their impacts on the authors' performance or influence in their fields (Abbasi et al. 2011, 2012; Acedo et al. 2006). As a result, practical recommendations in terms of research policies can be made to improve research productivity (Abbasi et al. 2012; Hâncean and Perc 2016; Wagner and Leydesdorff 2005a).

Our study has two objectives. First, in line with others (Cheong and Corbitt 2009a, 2009b; Vidgen et al. 2007) we examine the structural collaboration patterns, but not only between individual researchers (Cheong and Corbitt 2009a, 2009b; Vidgen et al. 2007) but also at the institution level. Second, we aim at statistically deducing the changing patterns in terms of the authors' research collaborations and affiliations over the investigated period. While doing so, we demonstrate the analysis of a two-mode network (Hanneman and Riddle 2005) that describes both the participants' co-authorship and their affiliations at university level by using a longitudinal SNA method called stochastic actor-oriented modelling (SAOM) (Steglich et al. 2010).

While insights based on the whole period of existence of ACIS would be even more helpful, we had to limit our study due to practical reasons to the period from 2001 to 2011, as the proceedings for these 11 years are the only ones which are centrally archived and online available on the AIS Electronic Library (http://aisel.aisnet.org/acis/). While we are aware of this limitation and are working on preparing the information on the remaining conferences in the same format, we believe that our results based on this snapshot are a valuable first step into a deeper understanding of the ACIS community.

2 Research Approach

When the relationships between individuals and their structures are recognised to hold important implications, social network analysis (SNA) is often applied to study them (Borgatti et al. 2013). The SNA research approach focuses on analysing the relationships and interactions between network actors as the main unit of analysis, which enables investigation into the actors' environment and its impacts on the actors' perceptions and behaviours (Borgatti et al. 2013; Hanneman and Riddle 2005; Otte and Rousseau 2002). The use of SNA in the social sciences is not new (Borgatti and Foster 2003), and researchers in the information science field have employed SNA methods to study structural patterns of research collaboration (Otte and Rousseau 2002).

SNA research studies are contextual since they often focus on the relationships between members of a certain community (Borgatti et al. 2013); prior network studies about research collaboration have put emphasis on specific research fields (Acedo et al. 2006; Hâncean and Perc 2016), or research communities comprising members of specific universities (Abbasi et al. 2011) and contributors to journals (Abbasi et al. 2012). Vidgen et al. (2007) and Cheong and Corbitt (2009a, 2009b) have investigated the structural patterns of research collaboration between authors at conferences, the former researched the European Conference on Information Systems, the latter the Australasian Conference on Information Systems and the Pacific Asia Conference on Information systems.

In this research, we analysed a two-mode network, of which the first mode focused on ACIS participants and their co-authorship ties, while the second mode described the institutions that these ACIS participants belonged to in every year. We collected data about co-authorship and university membership of ACIS participants by using a web crawler to automatically retrieve information from the online proceedings archived on the AIS Electronic Library (http://aisel.aisnet.org/acis/); the web crawler collected information about the title of the published paper, the publication's year, its authors and their affiliations. Cleaning the collected data, especially the inconsistent authors' names and affiliations, was a time-consuming task that had to be done manually. The final dataset contained 1462 authors and 298 affiliations, which include research and teaching institutions and other types (e.g., research centres, consulting firms).

To study the patterns of co-authorship and the changes in affiliations of our ACIS authors' sample, we devised a two-step analysis strategy. First, we performed a descriptive analysis by visually presenting, examining, and interpreting the overall network of consolidated data and statistics of the network features across the 11 years. Second, we formulated a model to describe the patterns of the network evolutions based on our descriptive analysis, and we tested this model statistically by applying stochastic actor-oriented modelling (SAOM) as a longitudinal network analysis method.

SAOM is a predictive network analysis method that deduces mechanisms of the networks' evolution from longitudinal data (Snijders et al. 2010; Steglich et al. 2010). When performing SAOM, researchers examine three possible patterns of changes in network ties that can potentially occur during a time period (Ripley et al. 2017). These patterns include the creation of new ties, and maintenance or dissolution of existing ties. We performed SAOM by using a R statistical package called RSiena (version 1.1-307) (Ripley et al. 2017).

3 Analysis and findings

The distribution of authors by the number of times they have published in ACIS proceedings is shown in figure 1. Two out of 1462 authors, i.e. Dubravka Cecez-Kecmanovic and Graeme Shanks, have published at ten out of the eleven conferences as compared to a majority of 1035 authors who have only published once. The total number of papers was 1146, and there were 177 authors who were sole authors and 226 papers that were single authored.

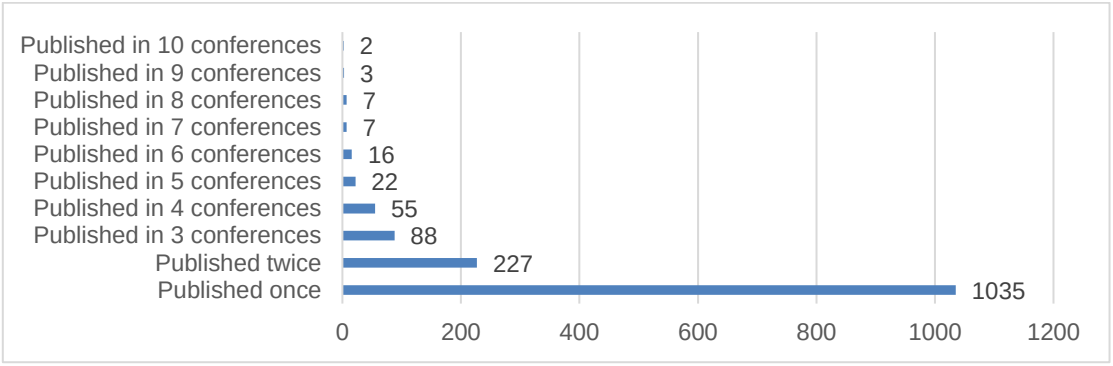


Figure 1. Distribution of authors by number of times publishing in ACIS proceedings (2001 to 2011)

3.1 Co-authorship at the institution level

We firstly examined the co-authorship patterns at the institution level. Figure 2 illustrates the network of co-authorship between universities (in Australia and New Zealand) and other types of institutions from 2001 to 2011. Moreover, we coded affiliations such as research centres (e.g., CSIRO) and consulting firms (e.g., SAP, Westpac, Ernst & Young) as "Industry". Likewise, teaching and research institutions that are outside of Australia and New Zealand were coded as "Overseas". The boldness of the ties and the nodes' sizes denote the number of co-authorship ties, with bolder ties and larger nodes indicating stronger collaboration intensity.

Figure 2 shows that universities tended to collaborate with those in the same region, and cross-region collaboration were rare. Universities in Australian states such as Victoria (e.g., RMIT, Monash, University of Melbourne) and New South Wales (NSW) (e.g., University of Wollongong, University of NSW) frequently co-authored with each other in ACIS conferences. There were a few noticeable cross-region co-authorship ties as well, such as the ties between Monash University and the Open Polytechnic of New Zealand, Curtin University and University of NSW, or University of South Australia with University of Southern Queensland.

Table 1 shows the number of co-authorship ties between the regions and types of institutions; the numbers on the diagonal represent the sum of ties between a region/type of institution and itself. In line with figure 2, the states of Victoria (VIC) and New South Wales (NSW) stand out with 190 and 90 co-authorship ties between their members, i.e. inter-institutional co-authorships in their region. Moreover, international academics from overseas also made great contributions to ACIS while collaborating with each other, which resulted in a total of 146 co-authorship ties.

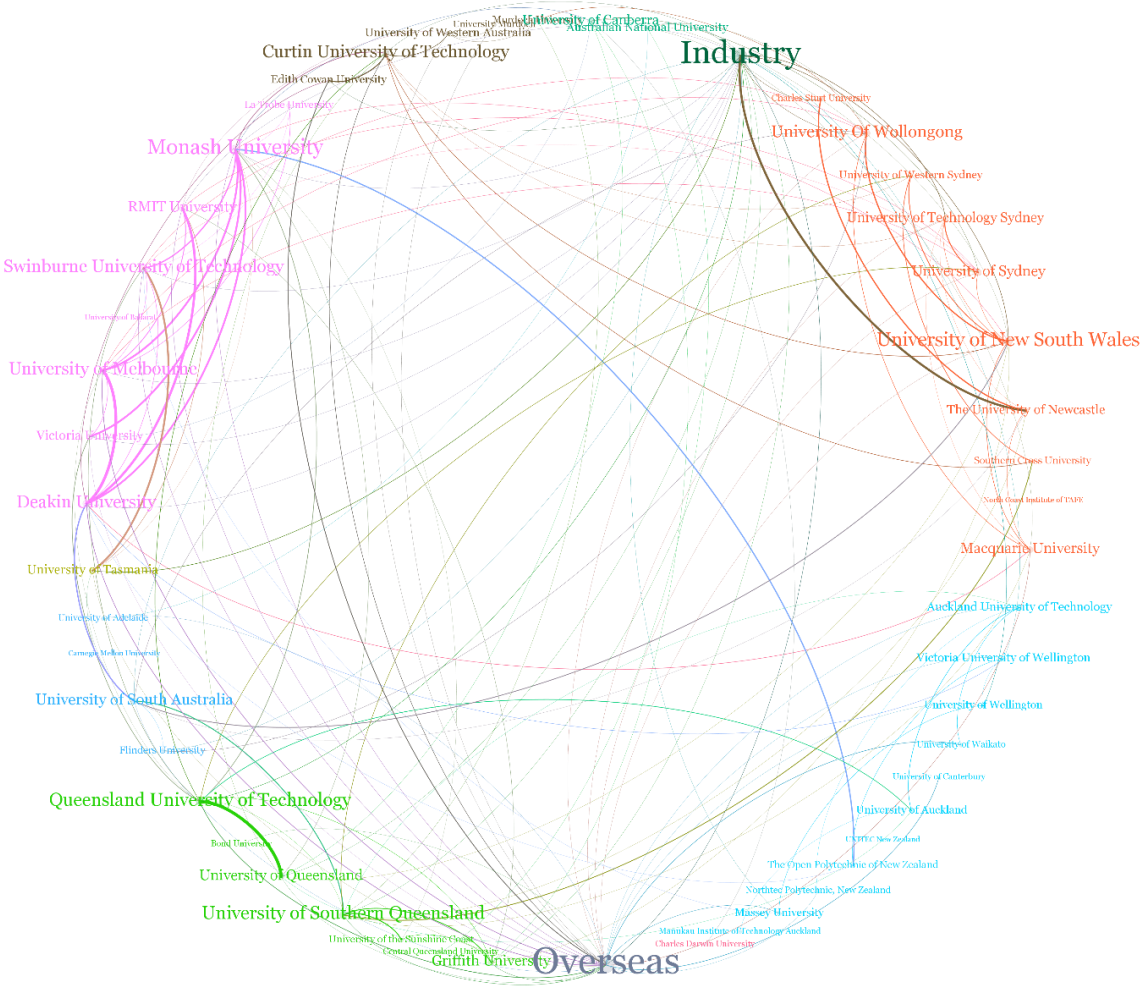


Figure 2. Co-authorship network at the institution level (2001 to 2011)

The Australian states that have collaborated the most with authors in the industry were VIC, NSW (University of Newcastle in particular), and Queensland (QL). Of the international authors who published in ACIS, many of them were also industry practitioners. Moreover, New Zealand (NZ) universities tended to collaborate with themselves and only Australian universities in Victoria.

	ACT	Ind.	NSW	NZ	NT	Ove.	QL	SA	TAS	VIC	WA
ACT	0										
Industry	1	4									
NSW	5	30	90								
NZ	0	12	0	24							
NT	1	0	0	0	0						
Overseas	0	43	37	32	0	146					
QL	3	28	15	6	0	57	72				
SA	1	2	10	0	0	5	6	2			
TAS	0	4	0	0	0	1	0	1	0		
VIC	3	46	14	12	0	57	17	8	16	190	
WA	0	2	10	0	0	17	5	0	0	8	22

Table 1. Co-authorship ties between regions

3.2 Co-authorship patterns at the individual author's level

To quantitatively evaluate the collaboration patterns between authors, we examined three network features, namely density, average degree, and fragmentation. Density reflects the connectedness of the network, which is calculated by dividing the number of actual ties by total possible ties (Borgatti et al.

2013). All networks of co-authorship have density values below 0.015 (1.5 per cent), as shown in figure 3. The stable trend of the co-authorship networks being very sparse implies that authors rarely published with each other and especially with new people in the conferences.

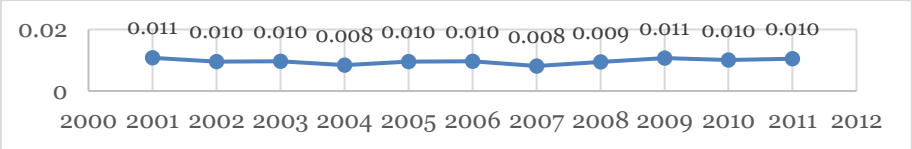


Figure 3. Density of co-authorship networks

Average degree informs the number of connections possessed by a node on average (Borgatti et al. 2013). As shown in figure 4, ACIS 2001 has the lowest average degree value (1.46), whereas ACIS 2010 has the highest average degree value (2.66). In other words, an author publishing in ACIS 2001 would have one co-author on average, while those publishing in ACIS 2010 had about two to three co-authors. Overall, figure 4 shows an upward trend in terms of average degree, which means there were more authors publishing in the conferences over time.

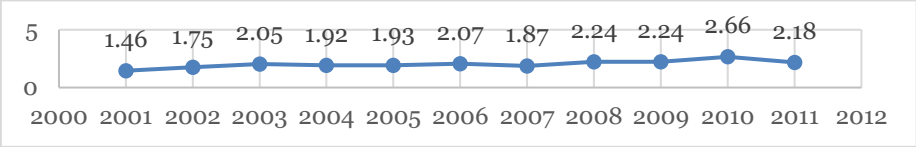


Figure 4. Average degree of co-authorship networks

Fragmentation describes the overall connectedness of a network, which is calculated by dividing the number of components (i.e., groups of well-connected nodes) by the number of nodes (Borgatti et al. 2013). Higher fragmentation values imply that there are more separate groups in the network. The vertical axis of figure 5 shows that the co-authorship networks are very fragmented, of which the least fragmented network (i.e., of ACIS 2010) has a fragmentation value of 0.978. However, such highly fragmented levels are understandable, since each isolated node (i.e., sole author) is counted as a component and contributes to the equation that calculates fragmentation.

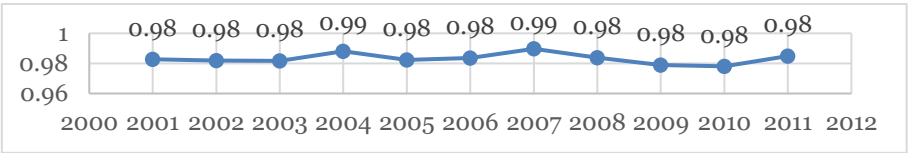


Figure 5. Fragmentation of co-authorship networks

Figure 6 shows the giant component (i.e., the most connected group) of the network containing consolidated co-authorship ties between individual authors from 2001 to 2011. This giant component represents 45.58 per cent of the whole network; it included 681 authors. A node's colour indicates the author's institution membership as recorded the last time when they published in ACIS. Moreover, grey nodes are authors who belonged to institutions having minor presence in the network. On average, each author in this consolidated network had about three to four collaborators (average degree=3.606). Network density was low at 0.005, which suggests that co-authorship ties overall were rare. This means that researchers publishing in ACIS did not co-author with many people but rather stayed with their cliques throughout the period of 11 years. Moreover, it reflects that there were many sole authors and isolated pairs in the network. In contrast, the clustering coefficient was high at 0.751, which implies that there was a high tendency to cluster or form triads in the network. Another common pattern in the network is that authors tended to collaborate with colleagues from the same institutions.

It is interesting to observe that there were institutions represented as large and cohesive groups of co-authors, such as the groups led by Michael Rosemann (University of Queensland), Graeme Shanks (University of Melbourne), and Brian Corbitt (RMIT University). On the other hand, there were institutions that were represented by multiple groups of smaller sizes, such as the Monash University of author groups led by Frada Burstein and Julie Fisher, and the University of Tasmania's group fronted by Peter Marshall, or the Massey University's groups headed by David Parsons and Alexei Tretiakov.

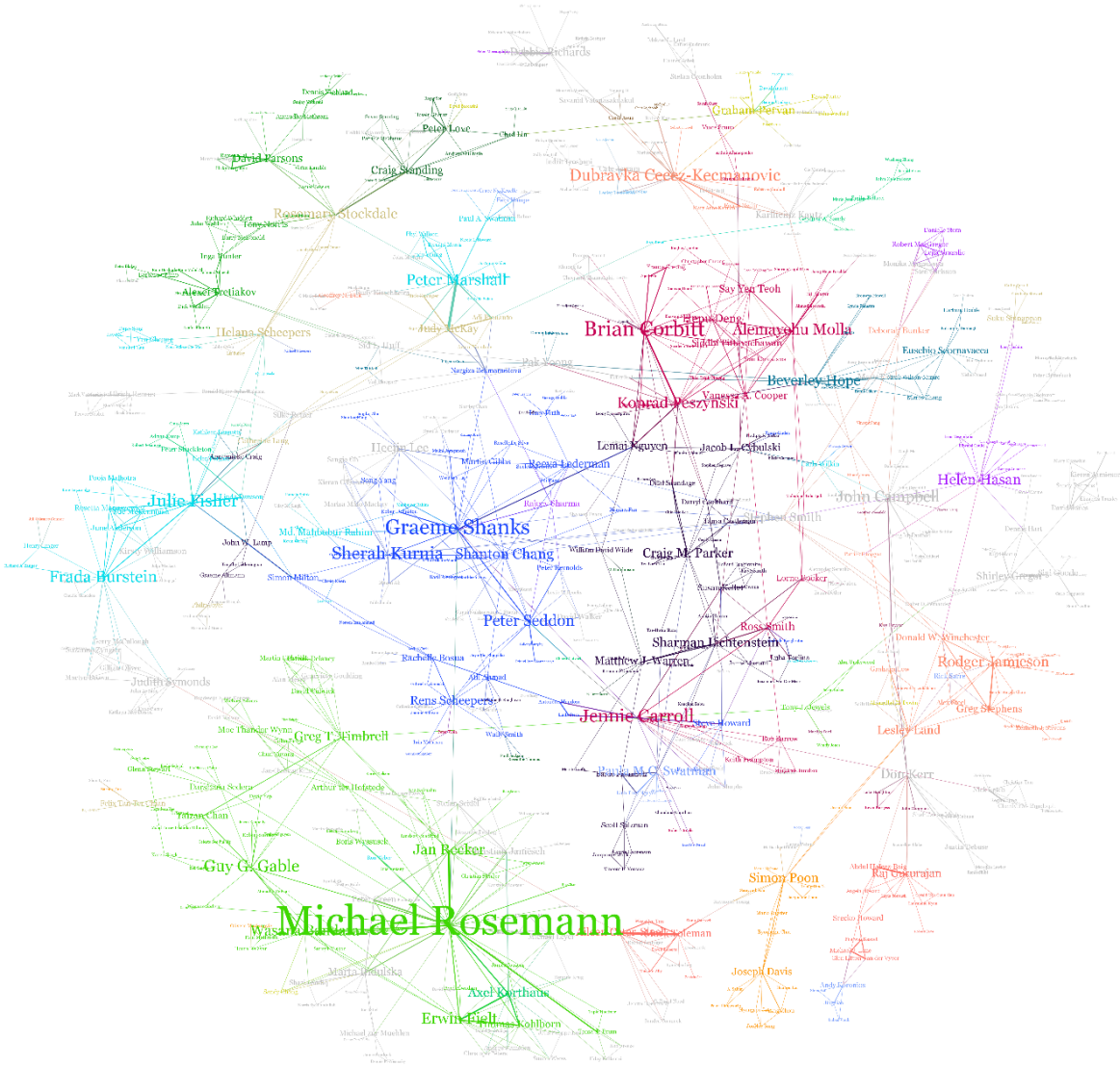


Figure 6. Network of consolidated co-authorship ties from 2001 to 2011[1]

Furthermore, there were institutions that did not have cohesive groups but were represented by key authors who had co-authorship ties with other institutions, such as Deakin University with key authors including Craig Parker and Sharman Lichtenstein. Likewise, there were authors of institutions that, despite not having a large presence in the network, held the crucial role in linking separate groups of different institutions together. Examples of these authors with brokerage roles were Rosemary Stockdale (Swinburne University of Technology), Simon Poon (University of Sydney), Lemai Nguyen (Deakin University), and Dubravka Cecez-Kecmanovic (University of NSW). Since these authors had published with people from different institutions before (e.g., Simon Poon with Joseph Davis and Lesley Land; Lemai Nguyen with Graeme Shanks and Konrad Peszynski), they could introduce authors of separate groups to each other when needed. Furthermore, they would have access to more unique information and skills, due to their diverse contacts.

3.3 Exploratory SAOM

We learned from the descriptive analyses that researchers rarely co-authored with others, as reflected by the low densities in figure 3. Authors tended to form clusters, especially with those in the same institutions. Based on these observed patterns, we developed our model for co-authorship patterns to include the parameters and their effects as summarised in table 2. The last two parameters were included to explain less observable patterns regarding the authors' decision to change institutions as a result of their roles in the publications and co-authorship behaviour.

[1] An interactive, online network of co-authorship is available through this link: http://duydangpham.com/ACIS/

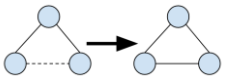
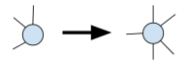
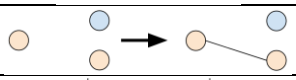
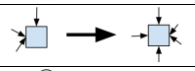
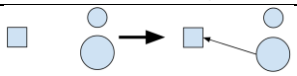
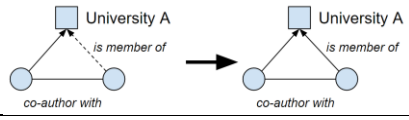
Parameter	Effect	Illustration
Transitive triads	People co-authoring with the same person tend to co-author with each other as well	
Degree popularity/activity	People with many co-authors tend to gain more co-authors	
Same institution -> co-authorship	People tend to co-author with others who belong to the same institutions	
In-degree popularity	Institutions having many members tend to gain more members	
Author's role	The impact of an author's role (1st, 2nd, 3rd, or 4th author) on the tendency to remain at an institution	
Co-authorship -> same institution	People tend to join the institution where their co-author belongs to	

Table 2. SAOM parameters

A major challenge to SAOM is missing data, which can make the model produce biased results (Ripley et al. 2017). Missing data in network analysis can be caused by the respondents leave the network or refuse to provide information; our dataset was impacted by the former. As shown in figure 1, 71 per cent of the authors in the dataset published only once during the period from 2001 and 2011. This might be due to quite a number of universities during this period had started to stop funding academics to attend conference and to discourage academics from publishing in conferences.

Since these authors joined and left the ACIS community very quickly, their changes in the decisions to establish, maintain, or dissolve co-authorship ties over time cannot be evaluated. Therefore, they were discarded from the SAOM analysis. Table 3 shows a small excerpt of this dataset containing the authors who published at four conferences and above. The binary values indicate the years in which the authors published their papers.

Author's name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	No of papers
Dubravka Cecez-Kecmanovic	1	1	1	1	1	1	1	1	1	0	1	**10**	**20**
Graeme Shanks	1	1	1	1	0	1	1	1	1	1	1	**10**	**19**
John Campbell	1	1	1	1	1	1	1	1	0	0	1	**9**	**13**
Michael Rosemann	1	1	0	1	1	1	1	0	1	1	1	**9**	**34**
Jenny Carol	1	1	0	1	1	1	1	1	1	1	0	**9**	**18**
<105 authors omitted>													
Nargiza Bekmamedova	0	0	0	0	0	0	1	1	1	0	1	**4**	**4**
Alexei Tretiakov	0	0	0	0	0	0	0	1	1	1	1	**4**	**8**

Table 3. Excerpt of dataset containing 112 authors who published in at least four conferences

We attempted to perform SAOM analysis on the authors who had published in at least three out of eleven conferences, but the model failed to explain the trends in the data since the amount of missing data (i.e., those who only published three times) was still large. The working solution was to perform a SAOM analysis on a sample of 112 authors who published in at least four out of eleven conferences. This solution allowed us to achieve a reasonable number of authors to produce a meaningful analysis, while ensuring the analysis can be reliably carried out.

The estimated results of the model's parameters (in log odds ratios) are summarised in table 4. The t-convergence ratio (TC ratio) of each parameter is lower than 0.1, which reinforces that the model converged successfully. The interpretations of these parameters are discussed below; they reveal the patterns of network changes in the dataset.

Parameter	Estimate (Std. Error)	TC ratio
Density (co-authorship network)	-4.02*** (0.36)	0.03
Transitive triads	2.64*** (0.52)	0.02
Degree popularity/activity	0.01 (0.09)	0.04
Same institution -> co-authorship	1.52*** (0.26)	0.04
Density (two-mode network)	-3.24*** (1.23)	-0.01
In-degree popularity	0.39 (0.35)	<0.01
Author's role (endowment effect)	0.64*** (0.20)	<0.01
Author's role (creation effect)	-0.50*** (0.21)	-0.02
Co-authorship -> same institution (endowment)	-0.46 (0.51)	0.01
Co-authorship -> same institution (creation)	3.98*** (1.59)	0.01

Note: *** p-value < 0.05

Table 4. SAOM results

The "density" parameters of both networks (i.e., the one-mode network about co-authorship and two-mode network about co-authorship and institution membership) have significant and negative estimates (-4.33 and -3.05). These negative estimates indicate that it was rare for a person to co-author with multiple people (i.e., reflects the number of sole authors) and to belong to a different university each time they published over the 11-year period. The rarity of co-authorship ties is reflected in the low densities over the years as shown in figure 3. Moreover, figure 6 displayed only the most connected group (i.e., giant component) in the network, which represented 46 per cent of the whole network. This means the remaining 54-per cent portion comprised isolated nodes and pairs, which highlights the rarity of co-authorship ties overall.

The significant and positive "transitive triads" parameter indicates that when two people co-authored with the same person, they tended to co-author with each other as well. This leads to the formation of transitive triads, or sets of three connected nodes in the network. For example, Foud Ngam and Dubravka Cecez-Kecmanovic did not co-author with each other but both had Karlheinz Kautz as the common co-author in 2006, and two years later Ngam and Cecez-Kecmanovic co-authored with each other. Another example is Brian Corbitt and Konrad Peszynski both had Lemai Nguyen as the common co-author in 2005, and the three of them co-authored together in 2006. While there was insufficient data to explain the underlying mechanisms of this behaviour, a potential explanation is that the formerly disconnected researchers were introduced to each other by their common co-authors such as Kautz and Nguyen.

The "degree popularity/activity" parameter, if significant and positive, postulates that people who have many co-authors will accumulate more co-authors over time. In our case, the estimate of this effect is not significant, which implies that such behaviour had no specific patterns. For example, Michael Rosemann had one to two co-authors from 2001 to 2004, increased to six co-authors from 2005 to 2006, but reduced to two afterwards again. On the other hand, people who belonged to the same institutions had a strong tendency to co-author over time, as supported by the significant and positive "same institution -> co-authorship" parameter. This is consistent with our visual analysis of figure 6.

The "in-degree popularity" parameter explains whether institutions tend to accumulate members over time. Since this parameter is not significant, there were no patterns about this behaviour. Next, the two parameters "author's role" and "co-authorship -> same institution" explain the authors' decisions to maintain or change their institutions, as influenced by their roles (i.e., 1st, 2nd, 3rd, or 4th author) and co-authorship at a previous point in time. For these parameters, we modelled two effects, namely the "endowment" and "creation" effects. Specifically, the "endowment" effect detects the authors' tendency to maintain the existing ties to their current institutions, whereas the "creation" effect accounts for the tendency to create ties to new institutions (Ripley et al. 2017). We coded our data about the authors' roles as ranging from 1 (i.e., 4th author) to 4 (i.e., 1st author), so to assign the heaviest weight to being the 1st author. As a result, the effect about the author's decision to maintain or create ties was proportionally affected by the weights assigned to the author's role. The "author's role" parameter achieved significance for both "endowment" and "creation" effects, of which the former was positive and the latter negative. These results indicate that when the author's roles became more important, with 1st author being the most important role, they tended to maintain their existing affiliations and avoid changing to new ones. For example, Jayne Clarke, who constantly held the 1st author role from 2001 to 2004, remained in the same university during this period[2].

[2] An alternative explanation might of course be that such a first author was a PhD candidate during this period.

In contrast, the author's decision to change institutions was found to be affected by their co-authorship ties, as indicated by the significant and positive "creation" effect of the "co-authorship -> same institution" parameter. This indicates that when two people were connected by a co-authorship tie and one of them had a tie to an institution, the other person who did not have a tie with that institution would be likely to establish one. For example, Nargiza Bekmamedova's affiliation was with Swinburne University in 2007 (apparently as a PhD candidate), and after co-authoring with Graeme Shanks later on, her affiliation changed to University of Melbourne. Another example is Rachelle Bosua and Rens Scheepers, whose affiliations were Swinburne University and University of Melbourne in 2002, then after their co-authorship in the same year, Rachelle Bosua was found to have the same affiliation with Rens Scheepers in 2004 (i.e., University of Melbourne).

4 Discussion

The findings which we acquired from performing the descriptive analyses at the institutional level and the individual author level, and from a statistical test on a sample of authors, allow us to discuss the nature of co-authorship and institutional membership of ACIS participants. We compare our interpretation of the findings with the most relevant study to ours by Cheong and Corbitt (2009a), which also analysed the co-authorship network between ACIS participants, in their case from 1990 to 2006.

We agree with their study that the ACIS community has the potential to attract new authors, as we also observed that the number of authors grew over the years. We also found a giant component (i.e., most connected group in the network) that represents 46 per cent of the community, which is similar to their study in the period 1990–2006. This finding suggests that the nature of the ACIS community has not changed much over time, and there were authors who frequently contributed to the conferences. However we found Cheong and Corbitt's (2009a) claim about the healthy status of the ACIS community not supported. First, although the community indeed attracted more contributors over time, most of them left very quickly, i.e. those who published once or twice. Second, the descriptive analyses revealed that co-authorship occurred selectively and primarily within the same regions or institutions. In fact, even within the same institutions, we found smaller groups of authors that exhibit core-periphery structures. Moreover, the densities of the networks were generally low, and the level of fragmentation did not exhibit stable improvements. Overall, the ACIS community appeared to favour operating in silos. However, these features of the ACIS community should not be only interpreted as negative. For instance, some of the ACIS participants may be international PhD graduates who return to their home countries after joining the ACIS community for a brief period. These international PhD graduates can further facilitate the collaboration between members of the ACIS community and academics across different regions, and enable the community to have influence in these regions.

Our descriptive analysis is supported by the statistical SAOM analysis on a sample of authors who frequently contributed to the ACIS community, i.e. those who published four times at ACIS and above. Specifically, the results indicated that there were no patterns regarding the accumulation of co-authors over time, and people tended to form separate clusters instead of reaching out to new collaborators. Cheong and Corbitt's (2009a) interpretation was that even when the key authors left the network, the community would not fall apart since other key authors would continue to maintain the community. However, we contend that with such strong tendency for authors to form their own clusters, when key authors (e.g., Michael Rosemann) departed the network, the community (e.g., Queensland University of Technology–the green cluster in figure 6) broke into smaller clusters (e.g., led by Guy Gable, Greg Timbrell, and Jan Recker and Erwin Feilt). Unless these leaders (or their group members) would decide to collaborate in the future, we believe that the clusters would continue to maintain their separate existence. A solution to prevent such clustering is that the key authors need to utilise their academic leadership and link the leaders of those smaller clusters together before they leave the network. Moreover, incentives and programs to facilitate collaboration across regions or institutions are needed. For example, major conferences such as the International Conference on Information Systems (ICIS) and Academy of Management (AOM) conference organise tracks and sessions where participants can submit research ideas and jointly write papers during the conference. Such incentive can potentially be organised by ACIS to facilitate research collaboration while retaining participants.

Most recently, Smyth et al. (2016) conducted a SWOT analysis of the IS academic discipline in Australia. In this analysis, they identified collaboration with the industry as both a strength and opportunity for the Australian IS community. However, the declining number of industry links was also perceived as an emerging weakness (Smyth et al. 2016). Our descriptive analysis depicted in figure 2 showed that co-authorship ties between universities and industry practitioners were weak and unbalanced during the examined 11-year period, just as Smyth et al. (2016) discussed. While our

network displayed only collaboration with industry practitioners that was explicitly recognised by written co-authorship, the unbalanced network ties suggest that some universities would need to increase their research collaboration with the industry. Moreover, Smyth et al. (2016) regarded the collegiality of the ACIS community as a constant strength, which enables cooperation between IS academics in Australia. Our descriptive findings agree with their finding about the strong cooperation ties between Australian universities, but mainly within their own states (e.g., Victoria, NSW, and Queensland–see figure 2).

We also found a tendency of academics to join their co-author's institutions as a possible result of their collaboration in ACIS. If such phenomenon would be accurate in the larger population of ACIS authors, there are practical implications to be considered. First, it suggests a method for young academics as job seekers to increase the diversity of their collaboration with academics from different institutions to improve their employability. Moreover, they may seek introductions to reach other academics from key persons in the co-authorship network. Second, institutions would need to be aware of such phenomenon, since cross-institutional collaboration can certainly bring benefits such as expanding networks and amassing unique expertise, but there is the risk of losing talents. Nonetheless, we caution that our findings were derived from the sample of authors who were frequent participants of ACIS, especially those that have published at at least four out of 11 conferences. In addition, there may be authors who indicated their affiliations on the publications that were in fact not their primary affiliations at that time (e.g., publishing as visiting or adjunct academics). To this end, we encourage future studies to examine this effect in other contexts and with more diverse samples.

The SNA approach has analytical capabilities that expand beyond descriptive analysis to identify key actors and clusters in the networks and includes methods that support inferential analyses (Borgatti et al. 2013). For instance, Broekel et al. (2014) identified four statistical methods, including SAOM, gravity modelling, multiple regression quadratic assignment procedure, and exponential random graph modelling (ERGM), that enable sophisticated investigations into behaviours related to transferring knowledge via research collaboration. Our review of literatures that had employed SAOM to investigate dynamic networks of research collaboration showed the number of studies pursuing this direction is scarce, which suggests exciting opportunities to make contributions to this area. With the secondary dataset that was retrieved from a public source such as the AIS electronic library, we could only perform analyses on a limited set of variables that describe basic researcher attributes such as co-authorship, affiliations, and roles in publications. A further step to maximise the utility of this dataset would be conducting text analysis to extract additional variables about the researchers' interests and keywords from their publications' abstracts. Then, inferential analyses such as SAOM can be performed on these variables to further explain researchers' decisions to collaborate. Furthermore, data about other types of relationships (e.g., supervisor-student) and personal attributes (e.g., tenure, seniority) can be collected via surveys to enrich the potential findings. Further research including the ACIS community's co-authorship patterns during the entire history of the conference, in international conferences as well as national and international journals would also strengthen our understanding.

5 Conclusion

Throughout this paper, we demonstrated the applications of the SNA methods to study research collaboration in two ways, including descriptive analyses at two levels (i.e., institutions and individual authors) and statistical analysis on a two-mode network by using the SAOM method. Findings from these analyses complement each other and suggest that ACIS participants tended to collaborate in silos, especially with those in the same institutions and regions. Moreover, it appeared that academics changed affiliations to their co-authors' institutions as they co-authored papers together, and continued to collaborate with their new colleagues in research. To further improve the ACIS community, we recommend incentives that can be organised during the conferences to facilitate collaboration and retain participants. Moreover, key academics with rich and diverse connections in the co-authorship network hold crucial roles in sustaining the community and increasing its productivity. On this basis, these key academics–in the investigated period these were among others Michael Rosemann, Graeme Shanks, Brian Corbitt, and Dubravka Cecez-Kecmanovic–are encouraged to utilise their leadership and facilitate collaboration between the next generations of IS scholars.

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