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Exploring the management information systems discipline: a scientometric study of ICIS, PACIS and ASAC

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Abstract This study examines the identity and development of the management information systems (MIS) field through a scientometric lens applied to three major global, regional and national conferences: International Conference on Information Systems (ICIS), Pacific Asia Conference on Information Systems (PACIS) and Administrative Sciences Association of Canada Annual Conference (ASAC). It adapts the conference stakeholder approach to the construction of the identity of the MIS discipline and analyzes the proceedings of these three conferences. The findings suggest that the MIS field has been evolving in terms of collaborative research and scholarly output and has been gradually moving towards academic maturity. The leading MIS conference contributors tend to establish loyalty to a limited number of academic meetings. At the same time, relatively low levels of repeat publication in the proceedings of ICIS, PACIS and ASAC were observed. It was suggested that Lotka's and Yule-Simon's bibliometric laws may be applied to measure and predict the degree of conference delegate loyalty.

Keywords Management information systems · Conference · ICIS · PACIS · ASAC · Lotka's law · Yule-Simon's law · Productivity · Loyalty

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Introduction

The purpose of this study is to analyze the proceedings of three major management information systems (MIS) conferences, the International Conference on Information Systems (ICIS), Pacific Asia Conference on Information Systems (PACIS) and MIS Division of the Administrative Sciences Association of Canada Annual Conference (ASAC), in order to identify trends in research output, co-authorship distribution, most productive authors, and productivity patterns. The results offer valuable insights on the past, present and future of MIS as a distinct academic field.

Management information systems is a relatively new academic discipline with its own tradition and history. It is a professional, applied field concentrating on strategic, managerial and operational usage of various types of information technologies at societal, organizational, group and individual levels. It draws upon several reference disciplines, such as cognitive psychology, computer science, economics, operations management, organization theory, and engineering (Culnan 1987; Baskerville and Myers 2002; Katerattanakul et al. 2006). Since its birth, MIS scholars have explored the past, present and future development of the field (Dearden 1972; Mason and Mitroff 1973) in order to understand the discipline's identity (Sidorova et al. 2008). In the 1980s, frameworks guiding MIS research appeared (Ives et al. 1980). In the 1990s, the field became more formalized; for example, a classification scheme for MIS research was introduced (Barki et al. 1993), and diversity issues within the discipline were debated (Benbasat and Weber 1996; Robey 1996). Later, the focus has shifted to the quest for an "IT Artifact," search for identity and establishment of MIS research relevance (Benbasat and Zmud 1999; Davenport and Markus 1999; Orlikowski and Iacono 2001; Agarwal and Lucas 2005; Benamati et al. 2007). However, despite its history of over 30 years, the field has not acquired a distinct identity as a well-established reference discipline (Benbasat and Zmud 2003) that is partially due to the relatively frequent change of research directions and technological advancements.

In order to understand the construction of identity of the MIS field, it is critical to explore its intellectual core by analyzing the cumulative body of knowledge rather than looking at its individual works (Holsapple 2008). For this, scientometric approaches, principles, and techniques may be utilized. Whereas most previous MIS scientometric projects concentrated on journals (e.g., see Palvia et al. 2007), the proceedings of well-recognized MIS conferences received less attention. To have a richer perspective of the domain, it may be advantageous, however, to also examine conference proceedings (Serenko et al. 2009), since these typically represent a broader range of research themes, some of which will not get into leading MIS journals. The underlying assumption of this approach is that a scholarly discipline is based on the entire body of knowledge existing in various outlets, including conference proceedings, and not only in a small set of top journals where articles are usually published by a small group of leading researchers. To this end, the present project adapts several scientometric approaches to analyze works presented at three major MIS events: ICIS, PACIS and ASAC (MIS division) with the purpose to better understand the discipline identity. For this, the framework for the conference stakeholder approach to identity construction of the MIS discipline was adapted and used as a lens of analysis.

The rest of this paper is structured as follows: the next section presents literature review and research questions. The third section outlines the methodology and the fourth section reports on the findings. The last part offers implications, limitations, and conclusions.

Literature review and research questions

Theoretical background

The identity of the MIS discipline has been traditionally characterized from two perspectives: normative and descriptive (Neufeld et al. 2007). The normative approach establishes heuristics, rules, directions, and boundaries of the discipline. The descriptive method reports on the actual activities of MIS researchers and depicts the observed state of the field by viewing the domain as an aggregate of dynamic and continuously changing scholarly outputs. In this project, the descriptive method is followed because it is better suited to the empirical examination of the discipline's publication outlets.

Specifically, the field of scientometrics offers valuable insights on how to conduct descriptive studies of a scientific domain. Scientometrics is a distinct, respected and well-established scholarly domain; its objective is to study and analyze science. It emerged from classical works of prominent researchers, such as Robert King Merton, Derek J. de Solla Price and Eugene Garfield (de Solla Price 1963; Garfield 1972, 1979; Merton 1973, 1976). Scientometrics allows researchers to explore the state and evolution of a scholarly domain in depth. For example, they may analyze research topics, identify popular research methods, discover research anomalies, conduct opinion surveys, study research productivity, and observe author collaboration processes.

The value of scientometrics has been already recognized in MIS (Straub 2006), and numerous projects have been conducted (Vessey et al. 2002; Lowry et al. 2007) with most analyzing the articles published in a select set of leading journals (Palvia et al. 2003, 2004). Recently, some researchers also started exploring the body of knowledge in conference proceedings (Chan et al. 2006; Xu and Chau 2006; McLaren and Mills 2008). As such, conference proceedings are a relatively unexplored area that deserves a closer attention for several reasons. First, it takes several years for a researcher to move from an idea to a journal article. Some outlets have up to two years of a backlog. As a result, journals can present obsolete findings that are already well-known to both researchers and practitioners (Booker et al. 2008). In contrast, conferences allow scholars to share and promote their ideas earlier. Second, some MIS journals do not accurately represent the entire field since they are too specialized; for instance, some outlets favor specific topics or methodologies. There is a relationship between the identity of the journal, the location of the author, and the place where the project was conducted. Sometimes, specific countries are overrepresented in particular outlets (Whitley and Galliers 2007). For instance, most MIS Quarterly contributors tend to be from the USA. In contrast, international conferences can have more diverse audiences and therefore are more representative of general MIS research. Third, scientometric studies tend to focus on a limited number of top-tier outlets and ignore the body of knowledge existing elsewhere, especially, in conference proceedings.

Therefore, the present project is a scientometric investigation of papers published in the proceedings of three representative MIS conferences: ICIS, PACIS and the MIS Division of ASAC. ICIS is a major international conference providing the highest quality scholarship in the discipline. This annual event, sponsored by the Association for Information Systems, attracts several thousand attendees from up to 100 counties. Given that acceptance rates rarely exceed 10%, publishing in the ICIS proceedings is considered a major achievement in someone's academic career. PACIS, also sponsored by the Association for Information Systems, is a premier MIS conference attracting hundreds of academics, students and practitioners from the Pacific-Asia region. The MIS Division of ASAC is a major scholarly meeting for MIS faculty and students in Canada with the acceptance rate

around 30%. In the MIS circles, ICIS is known globally, PACIS is well-regarded in the Pacific-Asia region, and ASAC is well-recognized in Canada. It was believed that the analysis of these different events (i.e., international, regional, and national) may offer valuable insights on the state and evolution of the broader global MIS discipline.

In this project, the conference stakeholder approach to the identity construction of the MIS discipline was adapted and used as a lens of analysis (Scott and Lane 2000; Sidorova et al. 2008). According to the suggested framework (Fig. 1), MIS conference identity is the core component since it influences the behavior of all individuals who are directly or indirectly associated with the event. Identity is developed as a result of interactions among various stakeholders. The most *influential stakeholders* include conference organizing committees, track chairs and co-chairs, proceedings editors and sponsors. Through a continuous process of collaboration and negotiation, they set the rules, policies, and traditions that shape the conference direction with the purpose of conveying a desired conference image. *Internal stakeholders*, including academics, students and practitioners, consider the conference image; they take into account personal research interests, career impact, networking opportunities, and geographical location. They are influenced by *external stakeholders*, including industry, prospective students and funding institutions, and form the reflective reappraisals of the conference by making decisions whether to submit a paper, serve as a reviewer or attend the event. Therefore, the actual MIS conference identity is formed by combining two key factors, desired images and reflected reappraisals, which in turn form the overall identity of the MIS discipline.

It is unfeasible to investigate all facets of the proposed framework in a single study. Therefore, the present investigation focuses on three important areas that relate to reflected stakeholder reappraisals: (1) overall research output and co-authorship distribution;

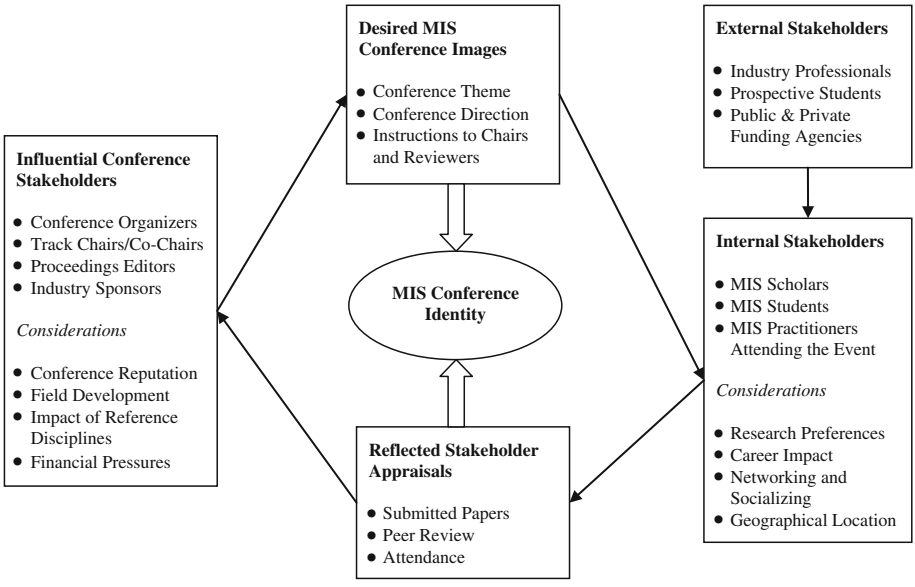

Fig. 1 The framework for the conference stakeholder approach to identity construction of the MIS discipline (adapted from Scott and Lane (2000) and Sidorova et al. (2008))

(2) author productivity; and (3) the applicability of major scientometric laws, such as Lotka's and Yule-Simon's laws to MIS conferences.

Research questions

Since the birth of the modern science from the heyday of the Scientific Revolution in the seventeenth century, scholars have proposed new theories, conducted experiments, and challenged dogma. As a result, the cumulative body of knowledge has been growing exponentially (de Solla Price 1961, 1963). The MIS field also boasts a variety of academic journals, books, and conferences. But what is the trend with respect to the number of papers appearing in the proceedings of three representative conferences: ICIS, PACIS and ASAC? It is expected that this number continuously grows and reaches a saturation point determined by the capacity of each event. It may be assumed that conference organizers attempt to accept as many papers as possible, but try to maintain a certain level of quality and operate within specific constraints. This would give their event maximum exposure and convey a positive scholarly image of rigor.

Co-authorship is also an important phenomenon that has been widely explored in the scientometric literature (Narin et al. 1991). There is often a positive relationship between a scholar's productivity and his/her tendency to collaborate with others (Inzelt et al. 2009). Multi-authored works can be of higher quality and cited more often (Levitt and Thelwall 2009). As a scientific domain matures, the average number of authors per publication increases (Lipetz 1999). First, researchers are able to gradually establish their collaboration networks. Second, if a field develops, the body of knowledge grows, new techniques emerge, and the standard for paper acceptance rises (Serenko and Bontis 2004). Third, in a developed field researchers tend to specialize in narrow areas, and collaboration is required when they publish on complex issues. If the major conference stakeholders conduct a rigorous review process to improve the image of their conference, a trend towards the publication of multi-authored papers should emerge. Therefore, it would be interesting to observe the evolution of an overall conference research output and cooperation patterns of MIS scholars:

Research Question 1: What are the trends in an overall research output and co-authorship distribution at ICIS, PACIS, and ASAC?

The investigation of research productivity has been a frequent topic of scientometric investigations in MIS (Chua et al. 2002; Huang and Hsu 2005; Truex et al. 2009). Knowing the most productive conference contributors is important for several stakeholders. Conference organizers may use this information in their promotional campaigns to instill loyalty. Organizing committees may identify scholars with expertise in specific research areas and invite them to serve as Track Chairs, Co-chairs or reviewers. Doctoral students may want to know who to approach for career advice. Academic institutions that fund their faculty's trips to particular conferences may want to see the impact of their investments. Traditionally, scientometric projects list most productive individuals:

Research Question 2: Who are the most productive authors at ICIS, PACIS, and ASAC?

In addition to research trends, outputs and authorship distribution patterns, several laws, such as Lotka's and Yule-Simon's law, may explain author productivity. They are recognized and applied in various scientific domains (Chung and Cox 1990; Kuperman 2006), but are rare in MIS (Nath and Jackson 1991). Lotka's law (Lotka 1926) suggests that there

is a relationship between the number of publications p and the number of all authors $f(p)$ in a certain field:

$$f(p) = C/p^n \quad (1)$$

where C and n are non-negative constants and $p = 1, 2, 3\ldots$ According to this law, an approximate number of authors with a certain frequency of publications can be predicted. The number of scholars producing a certain number of papers is a fixed ratio to the number of individuals publishing only a single article (Egghe 2005). For instance, during a specific period, there may be approximately 1/4 as many authors with two papers as there are single-paper authors, 1/9 as many with three, 1/16 as many with four, etc.

The Yule-Simon's law comes from a class of distributions first proposed by Yule (Yule 1924) and later explicated by Simon (1955). According to this rule, the frequency distribution is:

$$p(x) = (\alpha + 1)\Gamma(x)\Gamma(\alpha + 1)/\Gamma(\alpha + x + 1) \quad (2)$$

where $\Gamma(x)$ is the Gamma function and $\alpha > 0$ for $x = 1, 2, 3\ldots$ Similar to Lotka's law, Yule-Simon's law predicts the values of a distribution where the number of observations is rapidly decreasing and, therefore, may predict the distribution of authors by number of papers published (Chung and Cox 1994).

There are several implications of applying these laws to MIS conferences. First, the obtained distributions of publication frequency visualize how consistently individuals contribute to each event. For example, Lotka's law predicts that 60% of all authors contribute only once to the body of knowledge. If this prediction is confirmed for a particular MIS conference, this implies that a majority of all delegates attend this conference only once during a particular timeframe. The n-value derived through the application of Lotka's law to a particular conference corresponds to the extent of loyalty of conference delegates. There is a negative relationship between n and loyalty; the lower n is, the more frequently individuals publish their papers in the conference proceedings. Second, the obtained publication frequency distributions may help conference organizers compare their event with those of the competitors and make adjustments to their promotion strategies. Therefore, the following research question is proposed:

Research Question 3: Does the frequency of publications of authors at ICIS, PACIS, and ASAC follow Lotka's and Yule-Simon's laws?

Methodology

The proceedings of the MIS Division of ASAC (1974–2008, excluding volumes for the 1978–1980 period which were missing), PACIS (1993–2008), and ICIS (1980–2008) were examined. 32 proceedings were identified for ASAC, 11 for PACIS (the periodicity of PACIS has been between 1 and 3 years), and 29 for the annual ICIS.

Two independent researchers collected the following data for each conference: author's name, affiliation, article title, number of authors, and publication year. The *observed frequencies* of the author names were compared to the *theoretical frequencies* produced by Lotka's and Yule-Simon's laws. To measure author productivity, a straight count method was employed: each author received a score of one for each paper regardless of the total number of authors. Data were assessed longitudinally based on the following periods: 1974–1990 (DOS-based applications); 1991–2000 (Graphical User Interface and Windows OS); and 2001–2008 (electronic commerce, enterprise resource planning, and knowledge management).

To test Lotka's law, numbers of authors having one, two, three, etc. publications were calculated and compared to those produced by Lotka's law (Eq. 1) according to the methodological approaches in similar works (Newby et al. 2003; Burell 2004; Rowlands 2005). Given controversies regarding the per se applicability of the initial formula suggested by Lotka (having the value of the constant $n = 2$), several index values to produce a better fit of the theoretical law to the observed distribution were also tested (Bonnevie 2003). An index $n = 2$ was applied initially, and aggregated errors were calculated as weighted sums of squares of differences between the observed frequencies and those predicted by the theoretical law. The C coefficient corresponded to the number of authors with only one paper.

The Yule-Simon law was tested by using the procedure described by Kuperman (2006). The value of the frequency distribution function was calculated according to Eq. 2 for each value x corresponding to the number of publications. The value was then corrected with the total number of authors taken into account. Similarly to Lotka's law estimation, different values for the coefficient α were tested to obtain the best fit.

Results

Overall research output and co-authorship trends

Figure 2 shows a general increase in the number of papers published in the proceedings of these conferences with the largest values attained in 2008 for ASAC and ICIS (23 and 207 manuscripts, respectively) and in 2004 for PACIS (222 manuscripts).

Figure 3 presents the trend of the cooperativity index, calculated as the ratio between the total number of authors and the total number of papers at each conference for each year. It was observed that there has been a steady increase in cooperation at each conference. Therefore, MIS researchers have been gradually increasing their cooperation and producing more multi-authored works. By 2008, at ICIS and PACIS each paper was written by 2.5 researchers on average, and at ASAC by 2.07 (see Table 1).

Most productive authors

A total of 392; 2,291; and 2,368 authors published at ASAC, PACIS and ICIS, respectively. For each conference, by far the largest percent of authors had just one contribution: 72.19% at ASAC, 73.59% at PACIS and 69.38% at ICIS. The remaining categories of

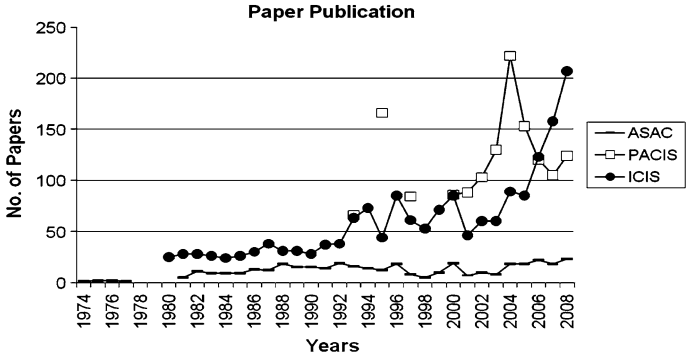

Fig. 2 Number of papers published over time

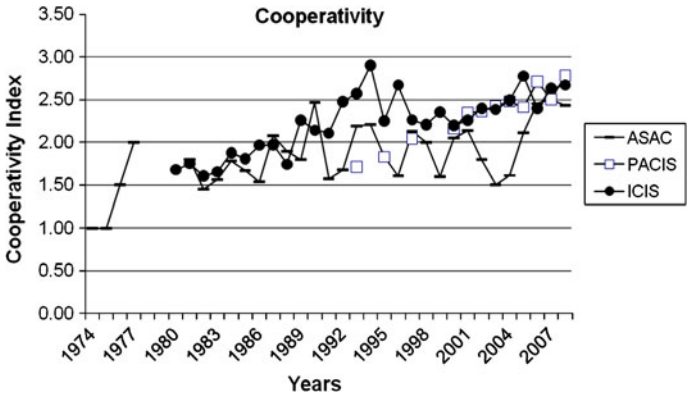

Fig. 3 Co-authorship distribution over time

Table 1 Average number of papers and average cooperativity distribution for three historic periods

Period	Average no. of papers/conference			Average author cooperativity index		
	ASAC	PACIS	ICIS	ASAC	PACIS	ICIS
1974–1990	8.71	n/a	28.64	1.68	n/a	1.86
1991–2000	13.50	100.50	61.00	1.89	1.94	2.40
2001–2008	15.50	130.63	103.50	2.07	2.50	2.50

authors had generally between 2 and 10 contributions, with very few above 10. Table 2 lists 30 most productive authors.

Lotka's and Yule-Simon's laws

Table 3 outlines the observed and predicted distribution of frequencies for Lotka's law for author count with the optimal value of the index n. Since Lotka's distribution index found in various studies generally ranged between 1.5 and 3 (Bonnevie 2003), successive trials for the index n varying between these extreme values were conducted. The index corresponding to the smallest aggregated error for each data set was recorded as 'optimal' (i.e., that provides the best fit).

Table 4 presents the distribution of observed and predicted frequencies by Yule-Simon's law with the optimal value of the index α. To have at least five records in each cell, a cut-off point of ten contributions was used, and authors having between eight and ten papers were grouped together. Several values between 0 and 1 were tested for the parameter α; for each of them, the aggregated errors were calculated as suggested by Burell (2004).

Implications, limitations and conclusions

The purpose of this study was to identify trends in research output, co-authorship distribution, most productive authors, and authors' productivity patterns at three major MIS conferences: ICIS (international), PACIS (regional) and ASAC (national). The framework for the conference stakeholder approach to identity construction of the MIS discipline was used as a lens of analysis. Several important implications emerged that warrant discussion.

Table 2 Most productive authors

ASAC		PACIS		ICIS	
No. of papers	Author	No. of papers	Author	No. of papers	Author
23	Sid Huff	18	Brian Corbitt	21	Andrew Whinston
20	Suzanne Rivard	16	Guy Gable	19	Erik Brynjolfsson
15	Brent Gallupe	15	Kwok Kee Wei	19	Hock Hai Teo
12	Deborah Compeau	13	Chih-Ping Wei	19	Kwok Kee Wei
10	Henri Barki	13	Paul Jen-Hwa Hu	16	Benn Konsynski
10	Andrew Gemino	12	Doug Vogel	16	Kalle Lyytinen
9	Francois Bergeron	11	Lihua Huang	16	Bernard Tan
9	Alain Pinsonneault	11	Mohammed Quaddus	15	Jay Nunamaker, Jr.
8	Anne-Marie Croteau	10	Fu-ren Lin	14	Gerardine DeSanctis
8	Guy Paré	10	Darshana Sedera	14	Ramayya Krishnan
8	Louis Raymond	9	Hock Chuan Chan	14	Ron Weber
7	Yolande Chan	9	Ting-Peng Liang	13	Sirkka Jarvenpaa
7	Albert Dexter	9	Shan Ling Pan	13	Tridas Mukhopadhyay
7	Barbara Marcolin	9	Thompson S. H. Teo	13	Vallabh Sambamurthy
7	James McKeen	8	Taizan Chan	13	Richard Watson
7	Malcolm Munro	8	Junichi Iijima	13	Robert Zmud
7	Blaize Reich	8	Weiling Ke	12	Blake Ives
7	Shouhong Wang	8	Matthew K. O. Lee	12	Sandra Slaughter
6	Norm Archer	8	Shirish C. Srivastava	11	Ritu Agarwal
6	Benoit A. Aubert	8	Theerasak Thanasankit	11	Rajiv Banker
6	Carmen Bernier	8	Yunjie Xu	11	Izak Benbasat
6	Wynne Chin	7	Huaping Chen	11	Hock Chuan Chan
6	Drew Parker	7	Robert Davision	11	Kevin Crowston
6	Jean Talbot	7	Sigi Goode	11	Lorin Hitt
5	Len Fertuck	7	Ingoo Han	11	William King
5	Lin Gingras	7	Atreyi Kankanhalli	11	Raghav Rao
5	Richard Glass	7	Sherah Kurnia	11	Jon Turner
5	Chris Higgins	7	Ho Geun Lee	10	Cynthia Beath
5	Alexander Serenko	7	Sang-Yong Tom Lee	10	Bin Gu
5	Betty Vandenbosch	7	Kai H. Lim	10	Vijay Gurbaxani
		7	Peter Marshall	10	Kenneth Kraemer
		7	Mikko T. Siponen	10	C Ranganathan
				10	Abraham Seidmann
				10	Iris Vessey

Implication I: The MIS field has been making progress and, very likely, has not yet reached saturation

There has been a global natural growth in the number of MIS conference publications. The volume of proceedings papers at all three events has been growing, reaching the record number of 207 and 222 publications for ICIS (2008) and PACIS (2004) respectively. The

Table 3 Lotka's law tests

Author productivity	ASAC (optimal $n = 2.21$)		PACIS (optimal $n = 2.46$)		ICIS (optimal $n = 2.26$)	
	Observed no. of authors	Expected no. of authors	Observed no. of authors	Expected no. of authors	Observed no. of authors	Expected no. of authors
1	283	271.54	1686	1714.13	1643	1670.33
2	43	58.69	347	311.54	364	348.72
3	21	23.95	128	114.90	148	139.48
4	15	12.68	50	56.62	72	72.80
5	6	7.75	26	32.70	43	43.97
6	6	5.18	22	20.88	23	29.12
7	7	3.68	11	14.29	16	20.55
8	3	2.74	7	10.29	14	15.20
9	2	2.11	4	7.70	11	11.65
10	2	1.67	2	5.94	7	9.18
11	0	1.36	2	4.70	9	7.40
12	1	1.12	1	3.80	2	6.08
13	0	0.94	2	3.12	5	5.07
14	0	0.80	0	2.60	3	4.29
15	1	0.68	1	2.19	1	3.67
Total	390	390	2289	2289	2361	2361

Table 4 Yule-Simon's law tests

Author productivity	ASAC (optimal $\alpha = 0.36$)		PACIS (optimal $\alpha = 0.41$)		ICIS (optimal $\alpha = 0.60$)	
	Observed no. of authors	Expected no. of authors	Observed no. of authors	Expected no. of authors	Observed no. of authors	Expected no. of authors
1	283	293.92	1686	1712.05	1643	1680.26
2	43	67.11	347	404.26	364	453.70
3	21	18.72	128	114.99	148	139.52
4	15	5.67	50	35.30	72	45.27
5	6	1.79	26	11.30	43	15.12
6	6	0.58	22	3.71	23	5.14
7	7	0.19	11	1.24	16	1.77
8–10	7	0.02	13	0.14	32	0.22
Total	388	388	2283	2283	2341	2341

volume of ASAC papers quickly reached the division's full capacity at around 20 publications per event. At ICIS and PACIS, a remarkable growth has been noticed since 2000. Despite the economic slowdown, decline in student enrollment and competitive job market for PhD graduates, the interest in Management Information Systems academic research has been booming. It is likely that this growth will continue in future. On the one hand, the key conference stakeholders may want to continue inviting and accepting more papers that would give their event more exposure. On the other hand, they should work within certain constraints to ensure the acceptance of manuscripts meeting quality standards.

Implication II: The MIS discipline has been moving towards academic maturity

The average number of authors per paper has been gradually increasing from the lowest value of 1.68 (ASAC 1974–1990) to 2.50 (ICIS and PACIS 2001–2008). Institutional, national and international collaboration is frequently promoted in academia because it allows researchers to increase their overall productivity, share their expertise, acquire necessary skills, excel in narrow domains, conduct specialized work, join resources through the division of labor, feel colleagueship and boost motivation (Fox and Faver 1984). In most fields, there is a positive relationship between the number of authors and an article's citation impact, especially, in cases of international collaboration (Bordons et al. 1996; Persson et al. 2004; Levitt and Thelwall 2009). Overall, an increase in cooperation patterns has been traditionally considered a possible indicator of academic maturity and professionalization of a scientific domain (Mantena 1970; deB Beaver and Rosen 1978), and this phenomenon was observed at MIS conferences. However, future research should compare cooperation patterns observed for key conferences with those in top journals before drawing conclusions on the academic maturity in the MIS field. It is also necessary to monitor co-authorship trends. If for example, the author cooperativity index will stop growing at some point, it may be a sign of the discipline's full maturity.

Implication III: The leading MIS conference contributors tend to establish loyalty to a limited number of academic meetings

In this study, the list of top 30 contributors to the proceedings of each conference was constructed. It was observed that only two individuals appeared in the top lists of PACIS and ICIS (i.e., Kwok Kee Wei and Hock Chuan Chan). Therefore, productive scholars develop loyalty to a limited set of scholarly events and contribute to them regularly. Several factors may drive their decisions. First, geographic location of a conference is critical since individuals are more likely to attend an event closer to their place of residence. Second, conference type (i.e., international, regional or national) attracts the attention of academics with different research interests and preferences. For example, researchers interested in MIS issues in Canada are likely to submit papers to ASAC which is considered a domestic top conference. Third, financial or time constraints may limit some scholars to only a few select conferences per year. Fourth, after participating in a particular conference, some individuals may establish a network of like-minded regular attendees, who may influence their future attendance decisions. It is very likely that some scholars pick a conference or two they become comfortable with. They further develop certain loyalty to this conference and continue publishing in its proceedings (in some cases more than 20 papers). It is critical for the conference organizers to understand the factors affecting the loyalty of the regular conference contributors to better market, promote, and position their event. They should also compare the desired image of their conference with the actual representation from the participants' perspective.

Implication IV: Low levels of repeat publications in ICIS, PACIS and ASAC proceedings

It was observed that the percentage of authors with only one contribution, 69.38% for ICIS, 73.59% for PACIS and 72.19% for ASAC, were much higher than those predicted by Lotka's and Yule-Simon's laws (60 and 50%, respectively). This demonstrates that a majority of all authors contribute to the proceedings only once. It is possible that these

conferences have high paper acceptance standards and, therefore, the vast majority of the scholars were able to participate only once. Some doctoral students, who represent a significant proportion of all attendees, may leave academia after graduation. Faculty members from predominantly teaching schools may contribute only once to meet the minimum tenure & promotion requirements. When most participants change every year, it may be difficult for the organizers to establish a desired image of their event. It will also require extra efforts and expenses to promote the conference. In contrast, industry sponsors who support a specific academic conference annually may appreciate the fact that most participants change in order to maximize the exposure to their brands, products or services.

Implication V: With respect to conferences, Lotka's and Yule-Simon's laws could be applied to measure the degree of conference delegate loyalty

The obtained author count distribution frequencies did not follow the theoretical predictions outlined by Lotka's or Yule-Simon's laws. Since no calculation of a coefficient for the MIS field was found in the literature, and even the verification of Lotka's law for MIS research is an issue still under debate (Nath and Jackson 1991), we attempted to fit Lotka's law to three datasets from three distinct conferences. In each case, we found n values above the theoretical value of 2.00 suggested by Lotka to produce the best fit between observed and predicted distributions: 2.26, 2.46 and 2.21 (Table 3).

The same remarks can be made about Yule-Simon's law. We did not find previous research applying this distribution law in MIS. We demonstrated that the law is roughly applicable and found 'optimal' values of the parameter α. However, a visual inspection of Tables 3 and 4 shows that Yule-Simon's law provides a worse fit than Lotka's law. As previous research showed, Yule-Simon provided a good fit for situations where the first data category (i.e., $x = 1$) represents approximately 50% of all data set (Chung and Cox 1994). Since in our datasets the percent was between 69.38 and 73.59%, the fit was poorer than that provided by Lotka's law. The theoretical condition of Lotka's law (to have 60% of authors with one contribution) is not met either in our datasets but, however, the differences between observations and predictions are smaller in this case. More research is necessary to confirm our findings for other publication venues.

The phenomena above may be explained theoretically. First, the distribution of author count frequencies depends on the nature of the scientific discipline. It is likely that management fields differ from sciences, for which the original laws were proposed. Second, the distribution is probably dependent on the age of the field (Kretschmer and Rousseau 2001). It is possible that in future the Lotka's coefficient n will become closer to 2 as academics start contributing to these conferences more regularly.

The scientometric literature presents numerous attempts to apply both laws to various scholarly domains. In most cases, some deviation from the theoretical values was observed. However, with respect to MIS conferences, it is more important to understand the implications resulting from the findings, rather than trying to fit the observed productivity distribution into a specific theoretical pattern. A major advantage of using these laws is that when applied to a conference, both Lotka's and Yule-Simon's laws reflect the degree of retention of conference delegates. The lower the fraction of researchers who publish only a single work in the proceedings, the higher is the conference delegate retention rate. The conference stakeholders may trace this rate longitudinally, or compare it with those at other conferences to understand how competitive their event is in terms of retaining productive contributors.

Several limitations of this project are noted. First, the three selected conferences are not exactly comparable:

- While PACIS and ICIS are dedicated exclusively to MIS, ASAC is a multi-division conference;
- The number of articles from ASAC proceedings is much lower compared to those of the other two conferences, although the period of time examined is longer;
- Although ASAC and PACIS have a geographical framework (Canada and Pacific and Asia, respectively) they still have international components, whereas ICIS is international by definition.

There are also other MIS conferences attracting hundreds of academics, students and practitioners, and publishing rigorous, innovative and thought-provoking papers, for example, the Americas Conference on Information Systems and the Annual Global Information Technology Management Association World Conference.

Second, in rare cases, there were inconsistencies in author names in different proceedings volumes (e.g., with or without middle name or initial). Despite our attempts to identify all names correctly, some omissions were possible. Third, caution should be exerted in generalizing the 'optimal' indices found in this research. The procedures are still debated in the scientometric literature, and it can be hardly argued that these coefficients are applicable to MIS in general. More research on these laws' suitability for MIS in general is recommended.

Future research should examine more MIS conferences to identify whether theoretical bibliometric distributions can be fitted to observed distributions. An interesting comparison would be between the proceedings of MIS-only conferences and general conferences with MIS tracks. It is necessary to compare MIS conference proceedings with publications in leading MIS journals; this line of research has been somewhat missing. It is also suggested that researchers who apply Lotka's and Yule-Simon's laws concentrate on the practical implications of these laws, such as the degree of conference delegate loyalty, rather than on obtaining the prescribed theoretical indices.

It is also useful to explore possible cultural aspects influencing co-authorship trends; e.g., do papers from some continents (i.e., academic environments) tend to have more authors compared to papers coming from other continents? Do leading contributors from specific countries prefer individualist or collectivist style of work?

This study broadened our understanding of the state and evolution of the MIS field by moving from the traditional journal exploration to the analysis of three representative conferences: ICIS, PACIS and ASAC. The findings suggest that the discipline has been progressing towards academic maturity, and that the collaboration among researchers has been growing. This is a positive sign of the future development of the field. We, therefore, encourage other researchers to periodically examine the discipline to obtain a more nuanced understanding of where the discipline currently is, and where it is headed to.

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