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The origins of research and patterns of authorship in the *International Journal of Production Research*

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This paper evaluates the origins of the research that has been published in the *International Journal of Production Research* (*IJPR*) for the time period 1985–2010, which includes approximately 77% of all articles that have been published in *IJPR* since its inception. We assess the productivity of individual authors, the author's affiliation at the time each article was published, the country the author's affiliation is located, and the institution where the author was granted a Ph.D. degree. By analysing the countries in which author affiliations are located, we can determine which countries are having the greatest impact on defining the research published in *IJPR*. For international journals, it is important to publish research from an international constituency, thus maintaining one of its purposes. By analysing the affiliations of the authors as well as where the authors received their Ph.D. training, we can determine which institutions are having the greatest contributions to the research published in *IJPR*. We believe it is useful to consider both the affiliations of the authors and where the authors received their academic training since both are indicative of an institution's true influence on a journal. To date, no published study has examined the individuals, institutions, and countries that have contributed to *IJPR* and, in particular, where the contributing researchers received their Ph.D. degrees.

Keywords: operational research; operations management

1. Introduction

The body of knowledge for any academic discipline is generally represented in the journals in which its research is published. Journals represent the primary depository for the knowledge generated and are the major vehicle for knowledge dissemination and future research efforts. As suggested by Reynolds and Clark (1984), the status of any discipline is largely determined by the articles published in its journals. While books, conference proceedings, etc. are important sources of discipline knowledge, the reputation of academic researchers is determined largely by the number of articles they publish in a set of academic journals. Likewise, each journal represents a portion of this body of knowledge as there are typically many journals in which authors can choose to publish their work. Each journal, given its preferred methodology, scope, editorial board and whether it is an international or US-based journal, will develop its own area of expertise. Thus, over time, the authors that publish in a journal ultimately define the scope of topical coverage, the direction of research published in a journal as well as affecting the perceived quality of each journal. As such, it is interesting to analyse the origins of a journal's published research to discover which authors, institutions and countries are having the greatest influence on shaping the status and direction of that journal.

In addition to the origins of research in a journal, other factors help explain the research direction a journal is following. For example, the volume of research a journal publishes is indicative of the volume of knowledge being presented by that journal. Various measures of the collaboration between authors is indicative of the cross-pollination of ideas and sharing of resources between authors, institutions and countries. Research collaboration is a means of sharing expertise and skills of authors, a means to train and develop junior faculty and Ph.D. students, and, as in any maturing discipline, a means to make significant contributions. Therefore, an analysis of the degree of collaboration of its authors serves as a measure of the innovativeness of research topics being published in a journal.

With this in mind, this paper evaluates the origins of the authors that have published in the *International Journal of Production Research* (*IJPR*) for the time period 1985–2010. We are interested in the individual authors who have published in *IJPR*, the author's affiliation at the time a paper was published, the country the author's affiliation is located

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and the institution where the author was granted a Ph.D. Given that research is generated by individual researchers, it is important to recognise those *individuals* who have had the greatest impact on defining the knowledge represented in *IJPR*. By limiting our analysis to the research over this 26-year period, we may not capture the total impact of those authors that are near the end of their academic careers as much of their research might have been published prior to 1985. Thus, since *IJPR* began publication in 1961, we cannot capture any impacts made on the early development of the journal. However, an assessment of the research between 1985 and 2010 will provide a good view of the journal and how authorship patterns have evolved over time. And, since the number of articles published in *IJPR* has increased dramatically since its early years, our study includes the majority of the research articles that have been published. In fact, prior to 1985, there were 118 issues of *IJPR* published while between 1985 and 2010, there were 400 issues. So, our time period represents 77% of all issues that have been published and, assuming the number of articles in each issue has not decreased, our study considers approximately 77% of all research that has been published in the journal.

By analysing the countries in which author affiliations are located, we can determine which *countries* are having the greatest impact on defining the research published in *IJPR*. For an international journal such as *IJPR*, it is important to publish research from an international constituency, thus maintaining one of its purposes. By analysing the affiliation of the authors as well as where the authors received their Ph.D. training, we can determine which *institutions* are having the greatest contribution on the research published in *IJPR*. We feel that it is not sufficient to simply consider the affiliation of an author to determine the impact of an institution. Indeed, the institutions where authors received their academic training may be more indicative of an institution's true influence on a journal. Further, this paper will analyse various bibliometrics that measure the degree and patterns of research collaboration between authors. To date, no published study has examined the individuals, institutions and countries that have contributed to *IJPR* and, in particular, where the contributing researchers received their Ph.D. degrees. Likewise, no study has examined the degree of collaboration between the authors that have published in *IJPR*.

2. Related literature

There have been many studies that ranked institutions and/or individuals based on their research productivity. The most common approach is to first identify a set of discipline-specific journals. Once these journals have been identified, the total number of articles published in this set of journals is used to rank individual researchers. Institutional rankings are determined by the number of articles published by authors affiliated with the institution. For example, institutions have been ranked using this approach in a variety of academic disciplines such as Supply Chain Management (Maloni, Carter, and Kaufmann 2012), Transportation and Logistics (Carter et al. 2005), Accounting (Chan, Chen, and Cheng 2005; Mathieu and McConomy 2003), Economics (Conroy et al. 1995; Coupe 2003; Jin and Hong 2008; Scott and Mitias 1996), Finance (Heck, Cooley, and Hubbard 1986; Heck 2007; Lasser and Rydqvist 2006; Sousa and Vieira 2011), Information Systems (Clark and Warren 2006; Clark et al. 2011), Behaviour Analysis (Shabani et al. 2004), Biology (Grant et al. 2007), Criminal Justice (Fabianic 2002; Sorensen and Pilgrim 2002; Steiner and Schwartz 2006), Psychology (Feingold 1989; Mahoney et al. 2010), Real Estate (Chan et al. 2008; Dombrow and Turnbull 2000, 2002; Jin and Yu 2011; Urbancic 2007), Rehabilitation Counselling (West, Armstrong, and Ryan 2005), Science Education (Barrow, Settlage, and Germann 2008), and Special Education (Miller and Maddux 1991). Additionally, in the area of Finance, Heck (2007) and Heck, Cooley and Hubbard (1986) considered the ranking of institutions based on the affiliation of authors as well as where the researchers received their Ph.D. training. In the area of Real Estate, Sa-Aadu and Shilling (1988) ranked institutions based on the number of articles their Ph.D. graduates published as well as where those graduates were subsequently employed.

In the Production and Operations Management area, Young, Baird and Pullman (1996) evaluated the productivity of individual researchers in a set of 21 journals. Their study provided a ranking of the top 100 researchers based on the quality and quantity of their research programme for the five-year period (1989–1993). Researchers have also been ranked based on the number of dissertations they or their students had directed (Meredith and Amoako-Gyampah 1990). The authors noted that, since 1960, 10 individuals had accounted for nearly 63% of all research in the field. Using author affiliations, the research productivity of the US institutions was studied by Malhotra and Kher (1996). Five journals (*Decision Sciences (DS), Institute of Industrial Engineers Transactions (IIE), IJPR, Journal of Operations Management (JOM)* and *Management Science (MS)*) were selected as being the most influential in the discipline. A ranking of the top 50 schools based on author-affiliated research for a 15-year period (1980–1994) in these five journals was then provided. Agrawal (2002) identified the top five most productive institutions that had published in the following three journals between 2000 and 2002: *JOM, Manufacturing & Operations Management (M&SOM)* and *Production and Operations Management (POM)*. The author found that none of the top five in *JOM*, three of the top

five in *M&SOM* and each of the top five in *POM* were considered a top 10 ranked Production and Operations Management programme in the US according to *US News and World Report*. In the Production and Operations Management area, we are aware of no published study that investigates the research productivity of an institution based on the number of articles published by its Ph.D. graduates.

3. Methodology

Our unit of measure in this study is the individual articles published in *IJPR*. We exclude any book reviews, comments to the editor, etc. since articles represent the primary form of research dissemination among academic scholars. As such, we consider all journal articles published in *IJPR* from 1985 through 2010, which represents 26 years of academic research. For each article, we collect author name(s), their affiliation(s) at the time the article was published and the country of origin for their affiliation. In total, there were 5372 articles published by 7103 unique authors in *IJPR* during this time span. When we consider that some authors have multiple articles published in the journal, there are 12,703 individuals listed as an author for the 5372 articles. For each of the 7103 authors, we then try to identify the institution where they received their Ph.D. training. This was accomplished through a rigorous Internet search including such sources as: university websites, research institution web-sites, journal articles that included an author biography, individual websites and popular press releases. In cases where the Ph.D. school could not be found on the Internet, the last known email address of an author was used to send a polite inquiry as to where the researcher received their training. As a last resort, co-authors were contacted by email to identify where the individual received their Ph.D. All told, we were able to identify the institution where 95.6% of all authors received their training. To the best of our knowledge, no assessment of authorship has considered the Ph.D. granting institution where each researcher received their formal training. This is understandable considering the fact that it took almost 20 months of effort from the authors as well as six graduate students at two universities to identify these institutions.

In research studies such as this present one, the question remains as to whether each author should receive full credit for an article or whether the credit should be distributed among all co-authors. In Young et al. (1996), the productivity of researchers was measured both ways. In their 'distributed' measure, each author received one unit of credit for each article they authored. We refer to this measure as *author articles* since it represents the number of published articles that a researcher would use toward their promotion and tenure. In the 'shared' measure used by Young et al. (1996), each author received $1/n$ units of credit for each article they authored (n represents the number of authors on an individual article). We refer to this measure as *full articles* since it represents the total number of articles that a researcher is responsible for after weighting for number of authors. In a sense, it represents the number of sole authored articles that the author would have published if they had worked alone. Ideally, we would like to measure the exact nature of each author's contribution to any article. However, trying to gather the information needed to do so would likely prove impossible. Another possible approach, assigning an unequal weighting to article authors based on their authorship ordering, would be somewhat arbitrary. Why should the first author receive more weight than the second author when the actual contributions to the article are unknown? In the present study, we follow the approach by Young et al. (1996) and measure research output of an individual researcher using a 'distributed' measure (*author articles*) and a 'shared' measure (*full articles*). This approach has also been used in other research studies (Chan, Chen and Steiner 2004; Chan, Fung, and Leung 2006; Kumar and Kundu 2004). In addition, this paper will assess the patterns of authorship and the degree of collaboration between authors, institutions and countries that have published in *IJPR*.

4. Results

We present the results related to the origins of the published research in three parts: Authors, Institutions and Countries. We follow those results with discussions of various bibliometric data to capture patterns of authorship related to the degree of research collaboration within the journal.

4.1 *The origins of IJPR research by individual authors*

In this section, we discuss the top 100 individual researchers that have had the greatest overall contribution to *IJPR* during the time period 1985–2010. The panel on the left side of Table 1 presents the top researchers based on the number of *author articles,* which is basically a count of the articles on which the researcher is an author and represents the measure typically used for most promotion and tenure decisions. The panel on the right side of Table 1 presents the top researchers based on the number of *full articles* attributed to each researcher. This is a weighted measure whereby each author receives $1/n$ article credits (n is the number of authors on the article).

Table 1. The top 100 authors by author articles and full articles (1985–2010).

Rank	Author	Author articles	Rank	Author	Full articles
1	Tiwari, Manoj Kumar	43	1	Malmborg, Charles J.	17.250
2	Chan, Felix T.S.	34	2	Tanchoco, J.M.A.	16.000
3	Tanchoco, J.M.A.	33	3	Tiwari, Manoj Kumar	14.717
4	Nee, A.Y.C.	27	4	Egbelu, Pius J.	14.333
5	Egbelu, Pius J.	25	5	Kusiak, Andrew	12.250
6	Malmborg, Charles J.	24	6	Chan, Felix T.S.	12.117
7	Kusiak, Andrew	22	7	Yih, Yuehwern	10.333
7	Yih, Yuehwern	22	8	Rajendran, Chandrasekharan	9.000
9	Elsayed, E.A.	19	9	Dowlatshahi, Shad	9.000
10	Kim, Yeong-Dae	17	10	Elsayed, E.A.	8.833
10	Rajendran, Chandrasekharan	17	10	Miltenburg, John	8.833
10	Sarker, Bhaba R.	17	12	Nee, A.Y.C.	8.733
13	Fry, Timothy D.	16	13	Sarker, Bhaba R.	8.667
13	Mukhopadhyay, Samar K.	16	14	Kim, Yeong-Dae	8.450
13	Ngoi, Bryan Kok Ann	16	15	Ho, Chrwan-Jyh	8.333
13	Shtub, Avraham	16	16	Jeang, Angus	8.333
13	Wysk, Richard A.	16	17	Sawik, Tadeusz J.	8.250
18	Chandra, M. Jeya	15	18	Silver, Edward A.	8.167
18	Joshi, Sanjay B.	15	19	Shtub, Avraham	8.083
18	Lehtihet, E. Amine	15	20	Tseng, Yuan-Jye	8.000
18	Montgomery, Douglas C.	15	21	Barad, Miryam	7.750
18	Uzsoy, Reha	15	22	Co, Henry C.	7.500
18	Wang, Hsu-Pin (Ben)	15	23	Inman, Robert R.	7.417
24	Cochran, Jeffery K.	14	24	Ngoi, Bryan Kok Ann	7.367
24	Cox, James F.	14	25	Wilhelm, Wilbert E.	7.333
24	Inman, Robert R.	14	25	Koulamas, Christos P.	7.333
24	Jung, Mooyoung	14	27	Malakooti, Behnam	7.167
24	Ong, S.K.	14	28	Boctor, Fayez Fouad	7.167
24	Pearn, W.L.	14	29	Fry, Timothy D.	7.000
24	Tseng, Yuan-Jye	14	30	Uzsoy, Reha	6.833
24	Wadhwa, Subhash	14	30	Baykasoğlu, Adil	6.833
32	Cavalier, Tom M.	13	32	Wang, Hsu-Pin (Ben)	6.667
32	Chang, Tien-Chien	13	32	Suresh, Nallan C.	6.667
32	Co, Henry C.	13	34	Gindy, Nabil N.Z.	6.667
32	Hwang, Hark-Chin	13	35	Cochran, Jeffery K.	6.500
32	Jiang, Bernard C.	13	36	Narendran, T.T.	6.333
32	Mahmoodi, Farzad	13	36	Ronen, Boaz	6.333
32	Mak, K.L.	13	38	Cox, James F.	6.333
32	Melnyk, Steven A.	13	39	Wysk, Richard A.	6.250
32	Miltenburg, John	13	39	Chandra, M. Jeya	6.250
32	Narendran, T. T.	13	41	Sabuncuoglu, Ihsan	6.167
32	Ohta, Hiroshi	13	42	Joshi, Sanjay B.	6.067
32	Ronen, Boaz	13	43	Gupta, Surendra M.	6.000
32	Runger, George C.	13	43	de Koster, Rene B.M.	6.000
32	Sabuncuoglu, Ihsan	13	43	Al-Hakim, Latif A.	6.000
32	Shankar, Ravi	13	46	Azizoğlu, Meral	5.833
32	Shanker, Kripa	13	47	Mukhopadhyay, Samar K.	5.817
32	Silver, Edward A.	13	48	Chang, Tien-Chien	5.700
32	Weston, Richard	13	49	Spencer, Michael S.	5.667
32	Wilhelm, Wilbert E.	13	49	Hwang, Hark-Chin	5.667
32	Wu, Zhang	13	51	Ohta, Hiroshi	5.583
52	Azizoğlu, Meral	12	51	Wu, Zhang	5.583
52	Fung, Richard Y.K.	12	53	Weston, Richard	5.567
52	Gupta, Surendra M.	12	54	van der Zee, Durk-Jouke	5.500
52	Moodie, Colin L.	12	54	Tapiero, Charles S.	5.500
52	Philipoom, Patrick R.	12	54	Benton, W.C.	5.500
52	Slomp, Jannes	12	57	Shanker, Kripa	5.417
52	Suresh, Nallan C.	12	58	Jung, Mooyoung	5.333
59	Akturk, M. Selim	11	59	Mahmoodi, Farzad	5.250

(*Continued*)

Table 1. (*Continued*).

Rank	Author	Author articles	Rank	Author	Full articles
59	Askin, Ronald G.	11	59	Hwarng, H. Brian	5.250
59	Barad, Miryam	11	61	Logendran, Rasaratnam	5.167
59	Chan, P.L.Y.	11	62	Sarkis, Joseph	5.167
59	de Koster, Rene B.M.	11	62	Chen, Mingyuan	5.167
59	Fowler, John W.	11	62	Hitomi, Katsundo P.	5.167
59	Gindy, Nabil N.Z.	11	65	Lehtihet, E. Amine	5.117
59	Gunasekaran, Angappa	11	66	Ong, S.K.	5.083
59	Irani, Shahrukh A.	11	66	Pearn, W.L.	5.083
59	Malakooti, Behnam	11	68	Sinriech, David	5.033
59	Nagi, Rakesh	11	69	Nof, Shimon Y.	5.000
59	Newman, S.T.	11	69	Chakravarty, Amiya K.	5.000
59	Nof, Shimon Y.	11	69	Martin, G.E.	5.000
59	O'Grady, Peter J.	11	69	Enns, S.T.	5.000
59	Peters, Brett A.	11	69	Son, Young K.	5.000
59	Salvendy, Gavriel	11	69	Berkley, Blair J.	5.000
59	Sarkis, Joseph	11	75	Askin, Ronald G.	4.917
59	Sinriech, David	11	75	Salvendy, Gavriel	4.917
77	Baykasoğlu, Adil	10	77	Jiang, Bernard C.	4.867
77	Ben-Arieh, David	10	78	Ben-Arieh, David	4.867
77	Boctor, Fayez Fouad	10	79	Kaspi, Moshe	4.833
77	Chen, Mingyuan	10	79	Rosenblatt, Meir J.	4.833
77	Dowlatshahi, Shad	10	79	Wemmerlv, Urban	4.833
77	Graves, Robert J.	10	82	Akturk, M. Selim	4.833
77	Heragu, Sunderesh S.	10	82	O'Grady, Peter J.	4.833
77	Hitomi, Katsundo P.	10	82	Pande, Sarang S.	4.833
77	Ho, Chrwan-Jyh	10	85	Gunasekaran, Angappa	4.783
77	Hodgson, Thom J.	10	86	Runger, George C.	4.750
77	Huang, Samuel H.	10	86	Slomp, Jannes	4.750
77	Jeang, Angus	10	88	Wadhwa, Subhash	4.667
77	Jiang, Zhibin	10	89	Mak, K.L.	4.667
77	Kaspi, Moshe	10	89	Gupta, Mahesh C.	4.667
77	Khoo, Li-Pheng	10	91	Peters, Brett A.	4.667
77	Liang, Ming	10	91	Gupta, Jatinder N.D.	4.667
77	Pande, Sarang S.	10	91	Viswanathan, Shivakumar	4.667
77	Takahashi, Katsuhiko	10	94	Philipoom, Patrick R.	4.583
77	Tu, Y.L.	10	94	Khoo, Li-Pheng	4.583
77	Wong, Yoke San	10	94	Liang, Ming	4.583
77	Yoshimura, Masataka	10	97	Melnyk, Steven A.	4.533
77	Zhang, Y.F.	10	98	**4 Authors Tied**	4.500
99	**31 Authors Tied**	9			

The most prolific authors measured by the number of *author articles* are Dr Manoj Tiwari who has authored or co-authored 43 articles, Dr Felix Chan with 34 articles and Dr J.M.A. Tanchoco with 33 articles. When we consider the number of *full articles*, Dr Charles Malmborg is the most productive researcher with Drs Tanchoco and Tiwari finishing 2nd and 3rd, respectively. An interesting way to view these results is that the average number of authors per article published for any researcher can be determined by dividing the number of *author articles* by the number of *full articles*. Consider Dr Malmborg who published 24 *author articles* and accumulated 17.25 *full articles*. Following the above logic, the average number of authors for an article on which Dr Malmborg is a co-author is 1.39 (24/17.25) while for Dr Tiwari, the average number of authors per article is 2.92 (43/14.72). Essentially, these averages are a measure of the degree of collaboration for each author and can easily be determined for any of the authors listed on both the left and right panels of Table 1. Such data are useful to individual researchers in that it provides a benchmark that they can use to compare to their own research records to see how they stack up with the most prolific researchers in *IJPR*. Further, it provides deserved recognition to those authors who have greatly contributed to *IJPR*.

To provide a more granular view of the most productive researchers' careers, we show in Tables 2 and 3 the top 30 authors (and ties) for five time periods (1986–1990, 1991–1995, 1996–2000, 2001–2005 and 2006–2010) rather than over the entire 26-year period. Results are shown for *author articles* in Table 2 and for *full articles* in Table 3. Similar calculations as discussed above can be made for these authors to determine their degree of collaboration during each

Table 2. Top 30 authors (and ties) over five-year periods based on author articles.

	1986–1990		1991–1995		1996–2000		2001–2005		2006–2010	
Count	Author	#	Author	#	Author	#	Author	#	Author	#
1	Tanchoco, J.M.A.	9	Tanchoco, J.M.A.	15	Rajendran, Chandrasekharan	9	Tiwari, Manoj Kumar	17	Chan, Felix T.S.	25
2	Chandra, M. Jeya	7	Ngoi, Bryan Kok Ann	10	Malmborg, Charles J.	8	Chan, Felix T.S.	9	Tiwari, Manoj Kumar	24
3	Egbelu, Pius J.	7	Egbelu, Pius J.	7	Tseng, Yuan-Jye	8	Nee, A.Y.C.	9	Wadhwa, Subhash	11
4	Ohta, Hiroshi	7	Irani, Shahrukh A.	7	Nee, A.Y.C.	7	Lehtihet, E. Amine	8	Azizoğlu, Meral	9
5	Wysk, Richard A.	7	Narendran, T.T.	7	Egbelu, Pius J.	6	Mak, K.L.	8	Chan, P.L.Y.	9
6	Dar-El, Ezey M.	6	Yih, Yuehwern	7	Kim, Yeong-Dae	6	Baykasoğlu, Adil	7	Nee, A.Y.C.	9
7	Muramatsu, Rintaro	6	Cox, James F.	6	Kusiak, Andrew	6	Cavalier, Tom M.	7	Pearn, W.L.	8
8	Wang, Hsu-Pin (Ben)	6	Elsayed, E.A.	6	Ngoi, Bryan Kok Ann	6	Jung, Mooyoung	7	Shankar, Ravi	8
9	Chandrasekharan, M.P.	5	Fry, Timothy D.	6	Peters, Brett A.	6	Labib, Ashraf W.	7	Tu, Y.L.	8
10	Chang, Tien-Chien	5	Koulamas, Christos P.	6	Shanker, Kripa	6	Montgomery, Douglas C.	7	Zandieh, M.	8
11	Elsayed, E.A.	5	Li, Rong-Kwei	6	Tanchoco, J.M.A.	6	Ong, S.K.	7	Gunasekaran, Angappa	7
12	Knott, Kenneth	5	Ronen, Boaz	6	Yih, Yuehwern	6	Silver, Edward A.	7	Jiang, Zhibin	7
13	Kusiak, Andrew	5	Sinriech, David	6	Cochran, Jeffery K.	5	Yih, Yuehwern	7	Dolgui, Alexandre	6
14	Malakooti, Behnam	5	Uzsoy, Reha	6	Guide, V. Daniel R.	5	del Castillo, Enrique	6	Haq, A. Noorul	6
15	Moodie, Colin L.	5	Wang, Hsu-Pin (Ben)	6	Jeang, Angus	5	Fowler, John W.	6	Katayama, Hiroshi	6
16	Rosenblatt, Meir J.	5	Armarego, E.J.A.	5	Kogan, Konstantin	5	Fung, Richard Y.K.	6	Li, Lin	6
17	Sarin, Subhash C.	5	Benton, W.C.	5	Mahmoodi, Farzad	5	Graves, Robert J.	6	Lin, Shih-Wei	6
18	Shtub, Avraham	5	Co, Henry C.	5	Maimon, Oded Z.	5	Kim, Yeong-Dae	6	Pastor, Rafael	6
19	Tapiero, Charles S.	5	Hitomi, Katsundo P.	5	Mukhopadhyay, Samar K.	5	Lau, Jason S.K.	6	van der Zee, Durk-Jouke	6
20	Co, Henry C.	4	Inman, Robert R.	5	Ramesh, R.	5	Malmborg, Charles J.	6	Wu, Zhang	6
21	Weston, Richard	4	Kusiak, Andrew	5	Seifoddini, Hamid	5	Pearn, W.L.	6	Ying, Kuo-Ching	6
22	Wilhelm, Wilbert E.	4	Mukhopadhyay, Samar K.	5	Veeramani, Dharmaraj	5	Sabuncuoglu, Ihsan	6	Malmborg, Charles J.	5
23	Barad, Miryam	4	Pham, D.T.	5	Sarker, Bhaba R.	4	Wang, Fu-Kwun	6	Jung, Mooyoung	5
24	Gindy, Nabil N.Z.	4	Raman, Shivakumar	5	Joshi, Sanjay B.	4	Wu, Zhang	6	Ong, S.K.	5
25	Salvendy, Gavriel	4	Shtub, Avraham	5	Lehtihet, E. Amine	4	Egbelu, Pius J.	5	Jiang, Bernard C.	5
26	Singh, N.	4	Son, Young K.	5	Runger, George C.	4	Sarker, Bhaba R.	5	Sarkis, Joseph	5
27	Wemmerlv, Urban	4	Spencer, Michael S.	5	Wilhelm, Wilbert E.	4	Newman, S.T.	5	Elmaraghy, Hoda A.	5
28	Chakravarty, Amiya K.	4	Suresh, Nallan C.	5	Gupta, Surendra M.	4	Hodgson, Thom J.	5	Tan, Keah-Choon	5
29	Taylor, Bernard W.	4	Joshi, Sanjay B.	4	Akturk, M. Selim	4	Harding, Jennifer A.	5	Zhang, Jie	5
30	Chang, Yih-Long	4	Miltenburg, John	4	Gindy, Nabil N.Z.	4	He, David W.	5	Gharbi, Ali	5
	Leonard, R.	4	Ohta, Hiroshi	4	Nagi, Rakesh	4	Xie, S.Q.	5	Rezg, N.	5
	Ishii, Kazuyoshi	4	Weston, Richard	4	Newman, S.T.	4	Allada, Venkat	5	Allahverdi, Ali	5
	Rajagopalan, R.	4	Gupta, Surendra M.	4	Boctor, Fayez Fouad	4	Huang, George Q.	5	Ding, Han	5
			Moodie, Colin L.	4	Khoo, Li-Pheng	4	Xirouchakis, Paul	5	Jiao, Jianxin (Roger)	5
			Philipoom, Patrick R.	4	Zhang, Y.F.	4	King, Russell E.	5	Li, Der-Chiang	5
			Askin, Ronald G.	4	Popplewell, K.	4	Lam, Yee Cheong	5	Wang, Lihui	5
			Malakooti, Behnam	4	Spencer, Michael S.	4	Qiu, R.G.	5	Camarinha-Matos, Luis M.	5
			Salvendy, Gavriel	4	Yang, Min-Yang	4			Defersha, Fantahun M.	5
			Ben-Arieh, David	4	Meller, Russell D.	4			Kumar, Vikas	5
			Kaspi, Moshe	4	Batra, J.L.	4			Vinodh, S.	5
			Singh, N.	4	Lee, Chung-Yee	4			Zhang, Lianfeng (Linda)	5
			Yang, Min-Yang	4	Meeran, S.	4				

(*Continued*)

Table 2. (*Continued*).

	1986–1990		1991–1995		1996–2000		2001–2005		2006–2010	
Count	Author	#	Author	#	Author	#	Author	#	Author	#
			Gupta, Yash P.	4	Srivastava, Rajesh	4				
			Lin, Li	4	Li, R.-K.	4				
			Logendran, Rasaratnam	4	Özdamar, Linet	4				
			Shafer, Scott M.	4	Khmelnitsky, Eugene	4				
			Talavage, Joseph J.	4						
			Sanders, Jerry L.	4						
			Bard, Jonathan F.	4						
			Dooley, Kevin J.	4						
			Berkley, Blair J.	4						
			Kaparthi, Shashidhar	4						
			Enkawa, Takao	4						
			Golhar, Damodar Y.	4						
			Lim, L.E.N.	4						
			Menq, C.H.	4						
			Rakshit, Atanu	4						
			Raoot, Arun D.	4						
			Rembold, Bernhard	4						

represents the number of author articles by the author.

Table 3. Top 30 authors (and ties) over five-year periods based on full articles.

	1986–1990		1991–1995		1996–2000		2001–2005		2006–2010	
Order	Author	#	Author	#	Author	#	Author	#	Author	#
1	Tanchoco, J.M.A.	4.33	Tanchoco, J.M.A.	7.5	Malmborg, Charles J.	6.83	Tiwari, Manoj Kumar	5.87	Chan, Felix T.S.	8.45
2	Egbelu, Pius J.	4.33	Koulamas, Christos P.	5.5	Tseng, Yuan-Jye	5.5	Baykasoğlu, Adil	4.83	Tiwari, Manoj Kumar	7.85
3	Gindy, Nabil N.Z.	4	Egbelu, Pius J.	4.5	Rajendran, Chandrasekharan	4.83	Malmborg, Charles J.	4	Azizoğlu, Meral	4.33
4	Kusiak, Andrew	4	Son, Young K.	4.5	Jeang, Angus	4.5	Chan, Felix T.S.	3.67	Sawik, Tadeusz J.	4
5	Barad, Miryam	3.5	Ngoi, Bryan Kok Ann	4.2	Ngoi, Bryan Kok Ann	3.17	Labib, Ashraf W.	3.5	Wadhwa, Subhash	3.67
6	Wysk, Richard A.	3.33	Benton, W.C.	4	Egbelu, Pius J.	3	Jung, Mooyoung	3.25	van der Zee, Durk-Jouke	3.25
7	Ohta, Hiroshi	3.33	Berkley, Blair J.	4	Kim, Yeong-Dae	3	Yih, Yuehwern	3.17	Dolgui, Alexandre	3.17
8	Chandra, M. Jeya	3	Yih, Yuehwern	3.83	Boctor, Fayez Fouad	2.83	Silver, Edward A.	3.17	Zandieh, M.	3.08
9	Cheng, T.C.E.	3	Uzsoy, Reha	3.58	Tanchoco, J.M.A.	2.83	Al-Hakim, Latif A.	3	Miltenburg, John	3
10	Johri, Pravin K.	3	Malakooti, Behnam	3.5	Kusiak, Andrew	2.75	Dowlatshahi, Shad	3	Pearn, W.L.	3
11	Pourbabai, Behnam	3	Narendran, T.T.	3.5	Kogan, Konstantin	2.67	van Hop, Nguyen	3	Rao, R. Venkata	3
12	Shtub, Avraham	3	Spencer, Michael S.	3.5	Gupta, Jatinder N.D.	2.5	Nee, A.Y.C.	2.92	Li, Lin	2.92
13	Tapiero, Charles S.	3	Ronen, Boaz	3.33	Meller, Russell D.	2.5	Gupta, Mahesh C.	2.67	Katayama, Hiroshi	2.83
14	Wilhelm, Wilbert E.	3	Cox, James F.	3	Miltenburg, John	2.5	Sabuncuoglu, Ihsan	2.67	Nee, A.Y.C.	2.78
15	Malakooti, Behnam	2.83	Enns, S.T.	3	Sarker, Bhaba R.	2.5	Wang, Fu-Kwun	2.67	Jiang, Zhibin	2.75
16	Dar-El, Ezey M.	2.67	Fry, Timothy D.	3	Seifoddini, Hamid	2.5	Lehtihet, E. Amine	2.58	Chan, P.L.Y.	2.58
17	Wang, Hsu-Pin (Ben)	2.67	Inman, Robert R.	3	Shewchuk, John P.	2.5	Egbelu, Pius J.	2.5	Pastor, Rafael	2.58
18	Abdel-Malek, Layek L.	2.5	Malmborg, Charles J.	3	Wang, J.	2.5	Karsak, E. Ertugrul	2.5	Zhang, Lianfeng (Linda)	2.58
19	Chakravarty, Amiya K.	2.5	Sinriech, David	3	Yih, Yuehwern	2.5	Martin, Rodney L.	2.5	Gunasekaran, Angappa	2.53
20	Chandrasekharan, M.P.	2.5	Co, Henry C.	2.83	Nee, A.Y.C.	2.37	Onwubolu, Godfrey C.	2.5	Che, Z.H.	2.5
21	de Koster, Rene B.M.	2.5	Hitomi, Katsundo P.	2.83	Veeramani, Dharmaraj	2.33	Sarker, Bhaba R.	2.5	Dowlatshahi, Shad	2.5
22	Elsayed, E.A.	2.5	Logendran, Rasaratnam	2.83	Guide, V. Daniel R.	2.33	Mak, K.L.	2.42	Elmaraghy, Hoda A.	2.5
23	Knott, Kenneth	2.5	Suresh, Nallan C.	2.83	Lee, Chung-Yee	2.33	Wu, Zhang	2.42	Kwak, Choonjong	2.5
24	Silver, Edward A.	2.5	Wang, Hsu-Pin (Ben)	2.83	Özdamar, Linet	2.33	Ong, S.K.	2.42	Martinez-Olvera, Cesar	2.5
25	So, Kut C.	2.5	Irani, Shahrukh A.	2.75	Peters, Brett A.	2.33	Talluri, Srinivas	2.33	McMullen, Patrick R.	2.5
26	Wemmerlv, Urban	2.5	Ben-Arieh, David	2.5	Shanker, Kripa	2.33	He, David W.	2.33	Park, Byung Chun	2.5
27	Rosenblatt, Meir J.	2.33	Fawcett, S.E.	2.5	Ramesh, R.	2.17	Hwarng, H. Brian	2.25	Shankar, Ravi	2.4
28	Sarin, Subhash C.	2.33	Hassan, Mohsen M.D.	2.5	Spencer, Michael S.	2.17	Sawik, Tadeusz J.	2.25	Tu, Y.L.	2.4
29	Salvendy, Gavriel	2.17	Martin, G.E.	2.5	Cochran, Jeffery K.	2.08	van der Zee, Durk-Jouke	2.25	Lin, Shih-Wei	2.33
30	Martin, G.E.	2	Elsayed, E.A.	2.42	Khoo, Li-Pheng	2.08	Khouja, Moutaz	2.17	Ying, Kuo-Ching	2.33
	Meredith, Jack R.	2					Yeh, Chi-Hao	2.17	González-Benito, Javier	2.33
	Shunmugam, M.S.	2							Yavuz, Mesut	2.33
	Wilson, James M.	2								
	Azadivarj, Farhad	2								
	Madu, Christian N.	2								
	Rajagopalan, R.	2								
	Browne, Jim	2								
	Lau, Hon-Shiang	2								
	Seidmann, Abraham	2								
	Funk, Jeffrey L.	2								
	Hall, Randolph W.	2								
	Shaw, Michael J.	2								
	Steudel, M.	2								

represents the number of full articles by the author.

time period. An analysis of this data illustrates the up-and-comers such as Dr P.L.Y. Chan who published nine articles in 2006–2010 but has only 11 articles overall which places him in 65th position in the top 100 authors. Yet, his nine articles placed him 4th for 2006–2010 indicating that he may just be starting his research career. The research of Drs Tiwari and Felix Chan is very recent as they ranked 1st or 2nd during the periods 2000–2005 and 2006–2010. Dr Tanchoco on the other hand was most active prior to 1995 as he ranked at the top of the list for 1986–1990 and 1991–1995 but has fallen out of the top 30 after 2000. This breakdown of results helps to identify those authors who had a significant impact on shaping *IJPR* in the past as well as identifying those authors who can be expected to shape *IJPR* into the future.

4.2 *The origins of IJPR research by academic institutions*

There are several measures of the impact of an institution on *IJPR*. As discussed earlier, the true impact of an institution may not be limited to just the research of authors who were affiliated with that institution at the time an article was published. Indeed, the institution where a researcher received their research training also has an impact. While the current affiliation of authors impacts their research efforts through faculty collaboration, tenure and promotion requirements, and research resources such as grants and/or reduced teaching loads, the institutions where researchers earn their Ph.D. degrees provide the methodological skills through course work as well as the skills required to put a research paper together through collaboration with the faculty. Further, the research productivity of an institution's Ph.D. graduates is one measure of the quality of that institution's Ph.D. programme. While by no means is the research productivity of Ph.D. graduates the only measure (other factors such as number of graduated students and their placements should be considered), it is indicative of how well the institutions prepared their graduates for research.

Table 4 shows the top 50 academic institutions that have contributed the most research to *IJPR* for 1985–2010. For the sake of brevity, only abbreviated names of academic institutions are shown in the table. The full names are shown in Table A1 of the Appendix. In Table 4, we present the number of *author articles* and *full articles* for each institution based on researcher affiliation, the institution where the author received Ph.D. training and a combination measure, which is based on the average of the author's affiliation and Ph.D. institution. This combined measure may, for reasons discussed above, capture the impact of an institution more completely than either of its component measures in isolation.

In total, there were 1202 different academic institutions that contributed one or more articles to *IJPR* during this 26-year time period. The top 50 institutions represent 4.2% of all institutions that contributed to the journal yet accounted for 35.2% of all *author articles* based on author affiliation, 41.8% of all *author articles* based on researcher Ph.D. training, 34% of *full articles* based on author affiliation and 42.5% of *full articles* based on Ph.D. training. Considering researcher affiliation, only 18 institutions out of the top 50 are US institutions while 29 institutions out of the top 50 are located in the USA when we consider where the researcher received their Ph.D. training. Clearly, US institutions account for the majority of the Ph.D. training for researchers that publish in *IJPR* while researcher affiliation is much more widespread.

We see in Table 4 that Purdue University and Pennsylvania State University are ranked 1st and 2nd in *author articles* and in *full articles* based on the affiliation of the researcher and based on where the researcher received their Ph.D. training. In fact, Purdue and Penn State account for 3.94% of *author papers* based on researcher affiliation and 5.45% based on Ph.D. training. It is interesting that, of the top 10 institutions based on author affiliation, three are in the USA, two are European and five are from Asia, illustrating the international constituency and appeal of *IJPR*. Nine of the top 10 institutions based on the research productivity of its Ph.D. graduates are from the USA. When we consider the combination measure, Purdue and Penn State are solidly ranked 1st and 2nd in *author articles* and *full articles*. Seven of the top 10 institutions are located in the USA, one is located in Europe and two are located in Asia when we consider *author articles*. For *full articles*, six institutions are in the USA, one is in Europe while three are in Asia. If, as we have suggested, the combination measure may best capture the impact of an institution on *IJPR*, it is safe to say that US institutions have had the greatest impact in shaping the journal over the 26-year time period considered.

While the contribution of each institution to *IJPR* over the 26 year time period is indicative of its total impact on the journal, a more granular view is warranted to illustrate any changes in the research productivity of each institution over time. Researchers change their affiliation or their preferred research outlets, which can affect the productivity of an institution in any journal. Or an institution can evolve into a top-tier research institution through its hires, incentives for research offered to its existing faculty, etc. Only by looking at smaller time periods can these changes be illustrated. As such, we present and discuss the research contributions of institutions in three parts across the five time periods discussed above. First, we discuss the research of each institution based on author affiliation. Second, we discuss the research of each institution based on their Ph.D. graduates. And lastly, we discuss an overall impact of each institution

based on the combined measure of research productivity. In each of the three sections, we present results for both the number of *full articles* and *author articles.*

4.2.1 *Institutional research contributions by author affiliations*

Table 5 presents the top 50 institutions contributing to *IJPR* in terms of author affiliations. Despite being the most prolific institution over the 26-year time period, we see that the research by authors affiliated with Purdue University has decreased over the last 10 years. Such a drop-off could have occurred if some active researchers retired or changed affiliation, changed their preferred research outlets from *IJPR* to other journals, or the volume of research by faculty at Purdue decreased. However, given its dominance from 1985–2000, Purdue is still ranked as the most productive research institution over the entire time period as far as author affiliation is concerned. Penn State, ranked 2nd overall, has maintained a fairly steady level of research over the entire time period as has Loughborough University, ranked 4th overall. Of particular note is the recent increase in research output by several Asian institutions. Shanghai Jiao Tong University (SJTU) had no research published in *IJPR* prior to 1995, yet ranked 1st during the period 2006–2010 with 89 *author articles* and 32.0 *full articles*. Despite the lack of research early on, its recent productivity was sufficient to rank 8th overall in *author articles* and 10th in *full articles*. Similarly, National University of Singapore (NUS), University of Hong Kong (Hong Kong), Yuan Ze University (Yuan Ze), National Chiao Tung University (NCTU), Hong Kong Polytechnical University (Poly UHK) and Nanyang Technological University (NTU) have recently demonstrated dramatic increases in both the number of *author articles* and the number of *full articles* published by researchers affiliated with these institutions. This recent productivity was sufficient for them to rank 3rd, 6th, 15th, 10th, 24th and 5th, respectively, for *author articles* over the entire time period considered. And, during the most recent period, 2006–2010, these six institutions ranked 1st, 2nd, 3rd, 5th, 8th and 7th, respectively. One US institution and one European institution, Arizona State University and University of Groningen, have demonstrated a slightly less dramatic increase in research in the most recent time period. If these trends continue, we should expect a growing presence of many Asian institutions in *IJPR*. Based on these observations, it is clear that the origins of the research being published in *IJPR* are changing. Since it is not the intent of this paper to delve into the possible explanations for these changes, we leave this for future research efforts.

4.2.2 *Institutional research contributions by Ph.D. granting institutions*

As discussed above, the institution where a researcher received their Ph.D. training has an impact on their research productivity. Indeed, this institution is where they learned their research methodologies, developed their research networks and learned how to package research articles. Further, the research productivity of its graduates is one measure of the quality of that institutions' Ph.D. programme. As such, it is important to recognise those institutions that are providing the research training and skills needed by authors. With this in mind, Table 6 presents the top 50 Ph.D.-granting institutions based on the research productivity of its graduates. As we stated before, we know of no studies in Production and Operations Management that have looked at the research productivity of an institution's Ph.D. graduates.

Based on *author articles* over the entire time period considered, Table 6 indicates that 9 of the top 10 institutions ranked by Ph.D. graduate research productivity are US universities. The sole non-US institution in the top 10 is Loughborough University, which is ranked 6th according to number of *author articles* and eighth according to *full articles*. Based on the number of articles published by Ph.D. graduates, Purdue and Penn State are solidly ranked 1st and 2nd overall for *author articles* and *full articles*. It seems clear that, given the productivity of researchers affiliated with Purdue and Penn State, Ph.D. students have been encouraged by the faculty to publish in *IJPR*. Contrary to this pattern, Ph.D. graduates from the University of Michigan and Georgia Institute of Technology are increasing their research presence in *IJPR* despite the fact that the productivity of researchers affiliated with Michigan was only ranked 34th while the productivity of researchers affiliated with Ga. Tech was ranked 40th (see Table 5). And, similar to the growing presence of Asian institutions based on researcher affiliation, research from Ph.D. graduates from NCTU, SJTU and NUS has dramatically increased over the last decade. In fact, for 2006–2010, the research from Ph.D. graduates of these three institutions was ranked 4th, 6th and 10th, respectively, based on *author articles* and 2nd, 6th and 12th based on *full articles*.

4.2.3 *Institutional research contributions using a combination measure*

Above, we presented the results pertaining to an institution's research productivity based on the productivity of researchers affiliated with an institution followed by the results related to the productivity of an institution's Ph.D. graduates.

Table 4. Top 50 institutions based on *IJPR* authors' affiliations, Ph.D. granting institutions, and a combination of the two (1985–2010).

	Author's affiliation				Author's Ph.D. granting institution				Combination of affiliation and Ph.D. institution			
Order	Academic institution	Author articles	Academic institution	Full articles	Academic institution	Author articles	Academic institution	Full articles	Academic institution	Author articles	Academic institution	Full articles
1	Purdue	255	Purdue	115.52	Purdue	430	Purdue	197.75	Purdue	342.5	Purdue	156.63
2	Penn State	246	Penn State	99.62	Penn State	262	Penn State	109.28	Penn State	254	Penn State	104.45
3	NUS	201	NUS	74	Michigan	203	Virginia Tech	88.48	Loughborough	183	Loughborough	67.89
4	Loughborough	193	Loughborough	73.67	Virginia Tech	193	Michigan	87.35	NUS	152	Virginia Tech	61.75
5	NTU	193	NTU	71.76	Ga. Tech	184	Ga. Tech	84.28	NTU	140.5	Michigan	57.59
6	Hong Kong	131	IIT Madras	51.17	Loughborough	173	Texas A&M	70.03	Virginia Tech	139	NUS	55.2
7	Arizona State	122	Tel Aviv	47.58	Wisconsin	164	Wisconsin	69.8	Arizona State	133	Texas A&M	54.24
8	SJTU	122	KAIST	46.55	Texas A&M	153	Loughborough	62.11	Michigan	133	Ga. Tech	53.93
9	KAIST	109	Hong Kong	46.15	Arizona State	144	Arizona State	58.57	Texas A&M	123.5	NTU	51.43
10	NCTU	105	SJTU	45.82	Ohio State	135	Ohio State	55.72	Ga. Tech	119.5	IIT Madras	49.54
11	IIT Madras	104	NCTU	42.17	Manchester	126	Iowa	52.55	NCTU	111.5	Arizona State	49.06
12	Texas A&M	94	Arizona State	39.55	NCTU	118	Manchester	50.95	Wisconsin	105.5	Wisconsin	47.69
13	Tel Aviv	87	Texas A&M	38.45	MIT	112	NCTU	50.65	Ohio State	104	NCTU	46.41
14	Yuan Ze	87	RPI	37.58	Iowa	109	Florida	49.02	SJTU	102.5	Ohio State	44.69
15	Virginia Tech	85	Yuan Ze	37.02	Florida	104	IIT Madras	47.92	IIT Madras	101	Manchester	41.23
16	NTHU	83	Calgary	36.6	NUS	103	Nottingham	45.21	Manchester	96.5	Iowa	41.15
17	SUNY Buffalo	80	SUNY Buffalo	36.17	IIT Madras	98	MIT	45.12	Hong Kong	93.5	KAIST	39.23
18	Calgary	78	Virginia Tech	35.02	NCSU	97	Georgia	44.42	KAIST	91.5	SJTU	38.94
19	IIT Delhi	76	NTHU	34.57	Georgia	95	Indiana Bloom.	44.25	Iowa	87	Tel Aviv	35.96
20	Michigan State	74	Ohio State	33.67	Minnesota	95	Cal Berkeley	44.1	NCSU	84.5	Michigan State	34.82
21	RPI	74	Manchester	31.51	Texas Austin	94	Stanford	43.57	SUNY Buffalo	79	SUNY Buffalo	34.6
22	Ohio State	73	Michigan State	30.85	Nottingham	92	Minnesota	41.45	Michigan State	78	Nottingham	34.44
23	Poly UHK	72	Windsor	30.5	Cal Berkeley	91	Texas Tech	40.68	MIT	77.5	NCSU	34.18
24	NCSU	72	Groningen	30.08	Stanford	90	NCSU	40.58	Florida	72.5	Florida	33.05
25	PUST	72	Iowa	29.75	NTU	88	Michigan State	38.78	IIT Delhi	71.5	Hong Kong	32.49
26	Groningen	70	Michigan	27.83	Texas Tech	87	Texas Austin	37.42	Clemson	70	Georgia	30.89
27	Windsor	70	NCSU	27.77	Indiana Bloom.	86	Birmingham	36.73	Nottingham	69	Windsor	30.71
28	NIFFT	67	PUST	26.67	Birmingham	86	NUS	36.4	Windsor	69	Minnesota	30.52
29	Manchester	67	IIT Delhi	26.57	SJTU	83	SUNY Buffalo	33.03	Minnesota	68.5	MIT	30.48
30	City UHK	65	Technion	26.45	Michigan State	82	Illinois Urbana	32.59	Tel Aviv	67.5	RPI	29.38
31	Iowa	65	Poly UHK	26.33	SUNY Buffalo	78	SJTU	32.07	Georgia	66	Clemson	28.83
32	Clemson	64	South Carolina	26.25	Clemson	76	KAIST	31.92	RPI	64	Cal Berkeley	27.63
33	Polytechnico	63	Clemson	26.05	KAIST	74	Clemson	31.62	NTHU	63	Texas Tech	27
34	Michigan	63	Bilkent	25.67	Illinois Urbana	70	Case Western	31.5	Polytechnico	62.5	IIT Delhi	26.18
35		63	Wisconsin	25.58	Lehigh	68	NTU	31.11	Yuan Ze	61.5	NTHU	26.15

(*Continued*)

Table 4. (*Continued*).

	Author's affiliation				Author's Ph.D. granting institution				Combination of affiliation and Ph.D. institution			
Order	Academic institution	Author articles	Academic institution	Full articles	Academic institution	Author articles	Academic institution	Full articles	Academic institution	Author articles	Academic institution	Full articles
36	South Carolina Technion	60	Auburn	24.92	Windsor	68	Windsor	30.92	Texas Tech	60.5	Yuan Ze	25.43
37	NCKU	58	Iowa State	24.87	IIT Delhi	67	Lehigh	29.78	Texas Austin	60.5	Stanford	25.16
38	Bilkent	57	Polytechnico	24.78	K.U. Leuven	65	Cranfield	28.51	K.U. Leuven	59.5	Texas Austin	25.04
39	Tsinghua	57	City UHK	24.75	Kyoto	65	Missouri	27.03	PUST	58.5	Polytechnico	24.95
41	Ga. Tech	55	Rutgers	24.58	Polytechnico	62	Northwestern	26	Poly UHK	57.5	Cranfield	24.84
42	OPU	55	Nottingham	23.67	Waseda	62	IIT Delhi	25.8	Kyoto	57.5	Case Western	24.75
43	K.U. Leuven	54	Ga. Tech	23.58	Case Western	61	Cincinnati	25.23	Cal Berkeley	56.5	Iowa State	24.52
44	Rutgers	54	LSU	23.58	Cranfield	61	Polytechnico	25.12	Birmingham	56	Birmingham	23.59
45	Auburn	53	Cardiff	22.95	Cincinnati	59	McMaster	25	Cranfield	54.5	Technion	23.48
40	Cardiff	53	Concordia	22.5	Missouri	59	Carnegie Mellon	24.35	City UHK	53.5	Indiana Bloom.	23.29
46	HUST	53	NCKU	22.05	McMaster	57	Tel Aviv	24.33	OPU	53	McMaster	23.17
47	Iowa State	52	McMaster	21.33	London	57	Iowa State	24.17	Cardiff	52.5	Auburn	22.73
48	Concordia	51	Cranfield	21.18	Twente	57	Waterloo	24.12	Stanford	52.5	Cincinnati	22.3
49	Kyoto	50	NIFFT	21	Hong Kong	56	Middle East TU	23.83	Iowa State	52	Calgary	22.13
50	LSU	49	Northeastern	20.67	RPI	54	Oklahoma SU	23.81	Groningen	51.5	PUST	22

Table 5. Top 50 institutions based on faculty research productivity (1985–2010).

		Number of author articles								Number of full articles					
Overall rank	School	Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	Overall rank	School	Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
1	Purdue	255	58	76	58	42	18	1	Purdue	115.5	23.1	36.3	27.8	17.8	9.2
2	Penn State	246	51	44	38	59	50	2	Penn State	99.6	23.1	20.6	16.3	20.9	16.9
3	NUS	201	7	18	29	77	69	3	NUS	74.0	3.7	9.8	11.0	26.5	22.2
4	Loughborough	193	31	27	42	54	39	4	Loughborough	73.7	14.3	11.8	20.3	17.6	9.5
4	NTU	193	2	45	40	69	37	5	NTU	71.8	0.7	18.2	18.2	22.4	12.3
6	Hong Kong	131	0	4	11	48	66	6	IIT Madras	51.2	8.0	15.0	19.8	5.3	3.0
7	Arizona State	122	5	10	20	46	41	7	Tel Aviv	47.6	9.2	11.7	15.0	5.1	5.5
7	SJTU	122	0	0	6	27	89	8	KAIST	46.6	4.2	12.2	15.8	11.3	3.1
9	KAIST	109	8	27	35	30	9	9	Hong Kong	46.2	0.0	1.7	4.8	16.3	21.4
10	NCTU	105	5	15	17	31	37	10	SJTU	45.8	0.0	0.0	2.4	11.4	32.0
11	IIT Madras	104	17	31	38	11	7	11	NCTU	42.2	2.5	5.7	8.7	11.8	13.5
12	Texas A&M	94	13	32	18	15	13	12	Arizona State	39.6	3.0	3.6	7.3	14.3	11.4
13	Tel Aviv	87	15	18	30	10	11	13	Texas A&M	38.5	6.0	11.8	7.3	6.7	5.5
13	Yuan Ze	87	1	2	14	21	49	14	RPI	37.6	1.8	8.3	13.0	9.2	5.3
15	Virginia Tech	85	22	9	15	20	12	15	Yuan Ze	37.0	0.2	0.6	9.5	8.8	18.0
16	NTHU	83	2	14	14	28	25	16	Calgary	36.6	2.5	6.8	7.0	12.1	8.2
17	SUNY Buffalo	80	19	19	23	11	8	17	SUNY Buffalo	36.2	8.4	8.8	10.1	5.3	3.6
18	Calgary	78	3	10	12	28	25	18	Virginia Tech	35.0	8.8	3.1	8.8	7.5	4.3
19	IIT Delhi	76	7	7	7	18	37	19	NTHU	34.6	1.0	6.0	6.5	11.4	9.7
20	Michigan State	74	6	13	13	18	23	20	Ohio State	33.7	7.9	12.5	3.9	1.5	4.8
20	RPI	74	4	15	21	22	12	21	Manchester	31.5	11.0	4.0	5.2	9.3	2.0
22	Ohio State	73	13	27	12	4	12	22	Michigan State	30.9	2.8	6.8	5.3	7.2	8.4
23	NCSU	72	12	13	14	23	7	23	Windsor	30.5	6.8	7.2	7.3	3.0	6.2
23	Poly UHK	72	0	1	10	22	39	24	Groningen	30.1	0.3	1.0	4.0	8.7	16.1
23	PUST	72	1	5	7	30	29	25	Iowa	29.8	5.5	14.0	5.8	2.3	2.2
26	Windsor	70	16	17	16	8	13	26	Michigan	27.8	2.8	7.0	3.3	4.3	8.9
26	Groningen	70	1	3	10	19	37	27	NCSU	27.8	6.3	5.0	5.1	6.9	3.0
28	Manchester	67	22	9	11	19	6	28	PUST	26.7	0.3	2.0	3.2	12.2	9.0
28	NIFFT	67	0	0	2	29	36	29	IIT Delhi	26.6	3.2	2.7	2.6	6.4	11.7
30	City UHK	65	0	6	17	25	17	30	Technion	26.5	7.2	7.0	1.5	4.3	5.0
30	Iowa	65	10	33	12	5	5	31	Poly UHK	26.3	0.0	1.0	4.0	8.3	13.0
32	Clemson	64	10	5	16	20	13	32	South Carolina	26.3	3.0	7.3	7.2	4.6	4.2
33	Michigan	63	8	13	5	12	23	33	Clemson	26.1	5.0	1.9	6.8	7.5	4.9
33	Polytechnico	63	5	5	27	16	10	34	Bilkent	25.7	1.0	3.5	5.0	8.3	7.8
33	South Carolina	63	9	17	17	11	9	35	Auburn	24.9	4.0	7.5	3.1	4.6	4.3
36	Technion	60	16	15	4	13	10	36	Iowa State	24.9	3.5	8.0	2.3	5.2	5.0

(*Continued*)

Table 5. (*Continued*).

Overall rank	School	Number of author articles: Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	Overall rank	School	Number of full articles: Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
37	NCKU	58	0	5	7	19	27	37	Polytechnico	24.8	2.2	2.5	11.6	6.0	2.5
38	Bilkent	57	2	5	9	21	20	38	City UHK	24.8	0.0	2.3	8.1	8.8	5.6
38	Tsinghua	57	0	1	10	19	27	39	Rutgers	24.6	6.3	7.2	3.4	2.7	3.0
40	Ga. Tech	55	8	8	13	7	19	40	Ga. Tech	23.6	3.7	3.9	6.8	2.9	6.3
40	OPU	55	14	21	2	6	8	40	LSU	23.6	5.3	3.8	6.0	5.8	2.7
42	K.U. Leuven	54	2	7	7	8	24	42	Cardiff	23.0	1.3	4.3	4.0	4.8	8.5
42	Rutgers	54	11	20	7	7	6	43	Concordia	22.5	2.0	4.7	3.7	3.5	8.0
44	Auburn	53	8	13	7	13	9	44	NCKU	22.1	0.0	1.1	2.8	7.6	10.6
44	Cardiff	53	4	10	8	10	21	45	NIFFT	21.0	0.0	0.0	1.0	9.4	10.6
44	HUST	53	0	0	3	22	28	46	OPU	19.8	6.5	6.8	1.0	2.0	2.1
47	Iowa State	52	7	17	5	9	13	47	Tsinghua	18.7	0.0	0.3	2.9	6.0	9.4
48	Concordia	51	4	11	8	7	19	48	K.U. Leuven	18.2	1.0	2.5	2.0	3.0	7.4
49	Kyoto	50	15	8	5	7	14	49	Kyoto	18.0	6.0	4.2	2.0	2.8	2.7
50	LSU	49	12	7	11	12	7	50	HUS	16.1	0.0	0.0	1.2	6.3	8.7
50	NTU	49	0	2	5	7	35								
50	NTUST	49	0	0	8	19	22								

Table 6. Top 50 institutions based on Ph.D. graduate research productivity (1985–2010).

		Number of author articles								Number of full articles					
Overall rank	School	Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	Overall rank	School	Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
1	Purdue	430	83	105	98	79	60	1	Purdue	197.8	38.4	50.4	49.2	29.9	27.4
2	Penn State	262	40	55	48	52	58	2	Penn State	109.3	17.7	24.6	22.7	19.0	20.8
3	Michigan	203	19	29	30	54	65	3	Virginia Tech	88.5	15.4	22.7	18.7	18.1	12.6
4	Virginia Tech	193	28	45	42	44	32	4	Michigan	87.4	7.8	14.3	15.3	21.6	24.6
5	Ga. Tech	184	14	25	39	42	63	5	Ga. Tech	84.3	6.9	12.0	22.2	20.0	22.9
6	Loughborough	173	15	19	34	50	55	6	Texas A&M	70.0	6.0	17.9	15.3	17.7	12.8
7	Wisconsin	164	15	31	32	38	46	7	Wisconsin	69.8	7.5	15.7	14.9	15.4	15.5
8	Texas A&M	153	14	33	31	40	34	8	Loughborough	62.1	4.4	8.0	16.0	17.5	16.2
9	Arizona State	144	6	25	15	49	47	9	Arizona State	58.6	3.0	12.6	6.6	19.1	16.7
10	Ohio State	135	16	27	32	20	37	10	Ohio State	55.7	6.9	10.8	13.3	8.5	14.9
11	Manchester	126	21	18	22	28	36	11	Iowa State	52.6	3.0	10.8	13.4	12.0	13.0
12	NCTU	118	4	9	12	34	59	12	Manchester	51.0	10.2	7.6	8.7	9.5	14.7
13	MIT	112	13	15	31	27	25	13	NCTU	50.7	1.4	3.5	6.7	13.7	25.5
14	Iowa State	109	6	22	25	23	32	14	Florida	49.0	7.5	12.1	11.2	8.7	9.0
15	Florida	104	15	23	23	23	19	15	IIT Madras	47.9	7.3	11.6	19.3	5.5	4.2
16	NUS	103	2	7	12	39	42	16	Nottingham	45.2	8.8	3.9	11.3	12.9	6.9
17	IIT Madras	98	15	24	36	12	11	17	MIT	45.1	6.8	6.8	13.0	9.6	8.6
18	NCSU	97	23	16	13	26	15	18	Georgia	44.4	6.1	12.3	11.8	6.7	6.8
19	Georgia	95	5	21	27	20	22	19	Indiana Bloom.	44.3	12.3	9.7	7.3	5.8	6.5
19	Texas Austin	95	15	22	24	16	16	20	Cal Berkeley	44.1	8.2	9.2	9.3	6.5	9.0
21	Minnesota	94	12	20	17	23	20	21	Stanford	43.6	9.4	12.3	7.6	6.1	5.6
22	Nottingham	92	13	10	26	25	15	22	Minnesota	41.5	2.0	11.3	11.8	8.0	8.5
23	Cal Berkeley	91	12	17	20	16	23	23	Texas Tech	40.7	10.7	12.9	6.0	4.9	5.5
24	Stanford	90	16	25	15	17	13	24	NCSU	40.6	12.0	6.1	4.9	9.0	5.6
25	NTU	88	2	20	20	28	18	25	Michigan State	38.8	3.5	6.8	5.6	11.0	11.9
26	Texas Tech	87	21	24	13	12	15	26	Texas Austin	37.4	4.8	8.6	8.0	8.7	6.7
27	Birmingham	86	19	17	11	23	15	27	Birmingham	36.7	9.5	7.0	5.0	8.7	6.0
27	Indiana Bloom.	86	18	18	18	15	13	28	NUS	36.4	1.3	2.6	5.5	12.4	13.6
29	SJTU	83	0	0	4	24	55	29	SUNY Buffalo	33.0	4.8	6.0	8.5	7.2	6.5
30	Michigan State	82	6	12	13	23	28	30	Illinois Urbana	32.6	1.3	6.1	12.6	5.0	7.6
31	SUNY Buffalo	78	13	14	20	17	14	31	SJTU	32.1	0.0	0.0	1.8	10.1	20.1
32	Clemson	76	13	15	16	18	13	32	KAIST	31.9	1.7	7.3	7.3	8.7	6.9
33	KAIST	74	4	15	16	22	17	33	Clemson	31.6	5.9	6.7	7.2	6.8	4.6
34	Illinois Urbana	70	3	14	23	14	16	34	Case Western	31.5	7.2	8.5	8.3	5.3	1.3

(*Continued*)

Table 6. (*Continued*).

Overall rank	School	Number of author articles: Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	Overall rank	School	Number of full articles: Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
35	Windsor	68	10	15	17	11	15	35	NTU	31.1	0.7	7.4	7.2	9.2	6.7
35	Legigh	68	3	13	13	21	18	36	Windsor	30.9	4.7	6.4	8.4	4.8	6.7
37	IIT Delhi	67	6	5	4	18	34	37	Lehigh	29.8	1.3	6.7	6.5	7.9	7.4
38	K.U. Leuven	65	3	7	7	12	30	38	Cranfield	28.5	4.2	2.0	8.4	4.3	9.3
38	Kyoto	65	16	10	8	13	17	39	Missouri	27.0	1.8	8.5	4.6	6.9	5.2
40	Polytechnico	62	4	4	29	12	13	40	Northwestern	26.0	5.0	7.8	3.0	5.0	5.2
40	Waseda	62	21	12	5	4	15	41	IIT Delhi	25.8	2.4	2.5	1.4	6.6	12.9
42	Cranfield	61	8	4	15	10	23	42	Cincinnati	25.2	3.3	6.6	3.4	6.4	3.7
42	Case Western	61	14	16	15	10	4	43	Polytechnico	25.1	1.7	2.3	12.5	4.4	4.3
44	Cincinnati	59	6	14	9	16	10	44	McMaster	25.0	2.2	2.9	8.0	6.1	5.8
44	Missouri	59	4	16	10	18	11	45	CMU	24.4	6.3	5.8	2.7	6.6	2.7
46	McMaster	57	5	7	15	16	14	46	Tel Aviv	24.3	1.5	6.0	8.0	2.7	6.2
46	Twente	57	9	4	13	16	15	47	Iowa State	24.2	2.8	7.2	6.0	4.6	3.7
46	London	57	1	2	2	20	32	48	Waterloo	24.1	2.5	6.0	4.2	4.1	7.3
49	Hong Kong	56	0	1	2	17	35	49	METU	23.8	0.0	3.0	1.5	6.0	13.3
50	RPI	54	2	6	10	15	21	50	Oklahoma SU	23.8	7.6	7.2	5.2	1.8	2.1
50	Maryland	54	4	10	13	13	14								

In this section, we average these two productivity measures into a combined measure and have suggested, for reasons discussed earlier, that the true impact of an institution on any journal may be better measured using this metric. Table 7 presents the top 50 Institutions ranked by this combination measure for both *author articles* and *full articles*. Given the productivity of their affiliated researchers and Ph.D. graduates, Purdue and Penn State are ranked 1st and 2nd for the combined measure over the entire time period considered. However, Purdue, while ranked 1st for each time period prior to 2006–2010, slipped to 4th in *full articles* and moved out of the top 10 for *author articles*. Using the combined measure over the entire period of time considered, 7 of the top 10 institutions are in the USA, two are in Asia and one is located in Europe. In the most recent time period, four Asian institutions are ranked in the top 10 illustrating their growing impact on the journal. In fact, SJTU and NCTU are ranked 1st and 2nd in the most recent time period. This is indicative of the growing Ph.D. programmes and research focus at these two institutions and may be indicative of a change that places more emphasis on research in many academic institutions throughout Asia.

4.3 *The origins of IJPR research by countries*

In this section, we focus on the volume of research that is being published in *IJPR* by the country of the researcher's affiliation (for both academic and non-academic affiliations). The volume of research generated by the institutions located in a particular country is influenced by the number of institutions in that country as well as by the research focus and support at those institutions. It would be logical to expect an institution located in close proximity to an active research institution to produce and publish more research articles of its own since there are greater opportunities for collaboration between researchers who are located close together. In addition, the competitive nature of institutions might encourage better research productivity of neighbouring institutions. As such, it is important to identify those countries that are producing the most research published in *IJPR*.

Table 8 presents the number of articles and the percentage of total articles that were generated by researchers in the top 50 countries over the entire time period considered in this paper. In total, there were 1994 different institutions from 95 different countries that had an author who published in *IJPR*. It is no surprise that the vast majority of research published in the journal originated in the USA. The UK ranks second. In fact, these two countries accounted for 42.38% of the *author articles* and 43.73% of the *full articles* based on author affiliation. Their Ph.D. graduates accounted for 56.32% of the *author articles* and 57.98% of the *full articles.* It is interesting to note that authors affiliated with US and UK institutions published fewer articles in *IJPR* than their Ph.D. graduates. For example, Ph.D. graduates from US institutions published 5451 *author articles* while authors affiliated with US institutions published only 4058 *author articles* and Ph.D. graduates from UK institutions published 1388 *author articles* while authors affiliated with UK institutions published 933 *author articles*. Similar results are evident for *full articles*. On the other hand, authors affiliated with institutions in Taiwan, India or Canada published more research than their Ph.D. graduates. Overall, the top 10 countries accounted for 76.95% of the total *author articles* and 76.83% of the *full articles* published over the 26 year time period considered. The top 10 countries based on the research by their Ph.D. graduates accounted for just over 81% of *author* and *full articles*.

Next, we present a more detailed look at the research being published by researchers in the various countries over time. Table 9 presents the number of *author articles* and *full articles* for the top 15 research-producing countries for each of the five-year periods considered. The research contribution to *IJPR* for any country is the total of the research contributed by all institutions located in that country. The results are based on the country of the institutional affiliation (not Ph.D. institution) of each researcher.

Perhaps the most obvious trend is that in 1986–1990, the top two countries, USA and UK, accounted for about 67% of *author articles* as well as *full articles.* Yet, in the time period 2006–2010, these two countries accounted for only about 27% of the total research articles published in *IJPR*. The top five countries accounted for about 80% of the research in 1986–1990, yet in 2006–2010, the top five countries accounted for only 52.3% of the *author articles* and 46.5% of the *full articles*. This clearly illustrates that the origins of the research being published in *IJPR* has changed over the last 20 years. Countries such as Korea and Singapore have increased their research contributions by more than 300% while Taiwan and China have increased theirs by more than 1000%. Based on these results, we can say that while the USA and the UK dominated the research published in *IJPR* in decades past, the research being published now is truly international in its origin.

In Table 10, we present the results for the research contributions to *IJPR* by Ph.D. graduates from the institutions located in each country. In 1986–1990, Ph.D. graduates from institutions located in the USA and UK accounted for about 73% of all research published in the journal. In the most recent time period, 2006–2010, these countries accounted for only 42% of the *author articles* and 36.5% of the *full articles*. The top five countries accounted for about

Table 7. Top 50 institutions based on a combination of faculty and Ph.D. graduate research productivity (1985–2010).

		Number of author articles								Number of author articles					
Overall rank	School	Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	Overall Rank	School	Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
1	Purdue	342.5	70.5	90.5	78.0	60.5	39.0	1	Purdue	156.6	30.8	43.3	38.5	23.9	18.3
2	Penn State	254.0	45.5	49.5	43.0	55.5	54.0	2	Penn State	104.4	20.4	22.6	19.5	20.0	18.8
3	Loughborough	183.0	23.0	23.0	38.0	52.0	47.0	3	Loughborough	67.9	9.4	9.9	18.2	17.6	12.9
4	NUS	152.0	4.5	12.5	20.5	58.0	55.5	4	Virginia Tech	61.7	12.1	12.9	13.8	12.8	8.5
5	NTU	140.5	2.0	32.5	30.0	48.5	27.5	5	Michigan	57.6	5.3	10.7	9.3	12.9	16.8
6	Virginia Tech	139.0	25.0	27.0	28.5	32.0	22.0	6	NUS	55.2	2.5	6.2	8.2	19.4	17.9
7	Arizona State	133.0	5.5	17.5	17.5	47.5	44.0	7	Texas A&M	54.2	6.0	14.9	11.3	12.2	9.1
8	Michigan	133.0	13.5	21.0	17.5	33.0	44.0	8	Ga. Tech	53.9	5.3	8.0	14.5	11.4	14.6
9	Texas A&M	123.5	13.5	32.5	24.5	27.5	23.5	9	NTU	51.4	0.7	12.8	12.7	15.8	9.5
10	Ga. Tech	119.5	11.0	16.5	26.0	24.5	41.0	10	IIT Madras	49.5	7.7	13.3	19.6	5.4	3.6
11	NCTU	111.5	4.5	12.0	14.5	32.5	48.0	11	Arizona State	49.1	3.0	8.1	7.0	16.7	14.0
12	Wisconsin	105.5	12.5	24.0	23.0	19.5	24.5	12	Wisconsin	47.7	6.7	13.0	11.1	7.9	8.1
13	Ohio State	104.0	14.5	27.0	22.0	12.0	24.5	13	NCTU	46.4	1.9	4.6	7.7	12.8	19.5
14	SJTU	102.5	0.0	0.0	5.0	25.5	72.0	14	Ohio State	44.7	7.4	11.7	8.6	5.0	9.8
15	IIT Madras	101.0	16.0	27.5	37.0	11.5	9.0	15	Manchester	41.2	10.6	5.8	7.0	9.4	8.3
16	Manchester	96.5	21.5	13.5	16.5	23.5	21.0	16	Iowa	41.2	4.3	12.4	9.6	7.2	7.6
17	Hong Kong	93.5	0.0	2.5	6.5	32.5	50.5	17	KAIST	39.2	2.9	9.8	11.6	10.0	5.0
18	KAIST	91.5	6.0	21.0	25.5	26.0	13.0	18	SJTU	38.9	0.0	0.0	2.1	10.7	26.1
19	Iowa	87.0	8.0	27.5	18.5	14.0	18.5	19	Tel Aviv	36.0	5.3	8.8	11.5	3.9	5.8
20	NCSU	84.5	17.5	14.5	13.5	24.5	11.0	20	Michigan State	34.8	3.1	6.8	5.4	9.1	10.2
21	SUNY Buffalo	79.0	16.0	16.5	21.5	14.0	11.0	21	SUNY Buffalo	34.6	6.6	7.4	9.3	6.3	5.1
22	Michigan State	78.0	6.0	12.5	13.0	20.5	25.5	22	Nottingham	34.4	5.1	5.3	9.6	7.9	5.3
23	MIT	77.5	8.5	11.0	20.0	18.0	19.0	23	NCSU	34.2	9.2	5.5	5.0	7.9	4.3
24	Florida	72.5	9.5	16.5	17.5	13.0	15.0	24	Florida	33.1	4.7	8.0	8.1	4.8	7.0
25	IIT Delhi	71.5	6.5	6.0	5.5	18.0	35.5	25	Hong Kong	32.5	0.0	1.0	2.8	10.8	16.6
26	Clemson	70.0	11.5	10.0	16.0	19.0	13.0	26	Georgia	30.9	5.3	9.2	6.6	5.3	3.9
27	Windsor	69.0	13.0	16.0	16.5	9.5	14.0	27	Windsor	30.7	5.8	6.8	7.9	3.9	6.4
28	Nottingham	69.0	7.5	11.0	21.5	14.5	12.0	28	Minnesota	30.5	3.0	10.6	7.4	4.2	4.9
29	Minnesota	68.5	6.0	20.5	17.5	10.5	13.0	29	MIT	30.5	4.1	5.0	8.3	6.0	6.7
30	Tel Aviv	67.5	8.5	14.5	22.5	8.0	12.5	30	RPI	29.4	1.1	5.3	8.8	7.0	7.1
31	Georgia	66.0	12.0	17.5	14.0	11.5	9.5	31	Clemson	28.8	5.5	4.3	7.0	7.1	4.8
32	RPI	64.0	3.0	10.5	15.5	18.5	16.5	32	Cal Berkeley	27.6	6.3	7.3	5.3	3.3	4.5
33	NTHU	63.0	1.5	10.0	9.0	20.0	22.5	33	Texas Tech	27.0	6.8	9.6	4.7	2.7	2.9
34	Polytechnico	62.5	4.5	4.5	28.0	14.0	11.5	34	IIT Delhi	26.2	2.8	2.6	2.0	6.5	12.3
35	Yuan Ze	61.5	0.5	1.0	8.0	13.5	38.5	35	NTHU	26.2	0.8	4.3	4.1	8.5	8.4
36	Texas Tech	60.5	14.5	19.0	11.0	7.0	8.0	36	Yuan Ze	25.4	0.1	0.3	5.3	5.4	14.4
37	Texas Austin	60.5	10.5	14.5	10.5	12.0	12.0	37	Stanford	25.2	5.5	6.9	4.4	3.7	3.2
38	K.U. Leuven	59.5	2.5	7.0	7.0	10.0	27.0	38	Texas Austin	25.0	4.6	6.1	5.1	4.6	4.3

(*Continued*)

Table 7. (*Continued*).

Overall rank	School	Number of author articles: Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	Overall Rank	School	Number of author articles: Overall 1985–2010	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
39	PUST	58.5	0.5	4.5	5.0	23.0	25.5	39	Polytechnico	25.0	1.9	2.4	12.0	5.2	3.4
41	Poly UHK	57.5	0.0	2.0	7.5	18.0	30.0	41	Cranfield	24.8	3.5	1.8	5.8	3.8	8.8
42	Kyoto	57.5	15.5	9.0	6.5	10.0	15.5	42	Case Western	24.8	8.9	6.8	4.6	3.1	0.8
43	Cal Berkeley	56.5	9.5	14.5	11.5	8.0	11.5	43	Iowa State	24.5	3.1	7.6	4.1	4.9	4.3
44	Birmingham	56.0	11.0	13.0	8.5	13.0	10.0	44	Birmingham	23.6	5.3	5.3	4.2	4.8	3.9
45	Cranfield	54.5	6.5	3.5	11.0	9.0	23.0	45	Technion	23.5	4.3	6.8	3.0	4.6	3.8
40	City UHK	53.5	0.0	3.5	12.0	19.5	18.5	40	Indiana Bloom.	23.3	6.4	5.5	3.6	3.1	3.3
46	OPU	53.0	15.0	20.5	2.0	6.0	6.0	46	McMaster	23.2	2.8	4.8	6.2	3.8	5.0
47	Cardiff	52.5	4.0	8.5	6.5	10.5	23.0	47	Auburn	22.7	3.2	7.1	2.2	4.7	3.9
48	Stanford	52.5	9.5	14.0	9.0	10.0	7.5	48	Cincinnati	22.3	3.7	4.5	3.5	5.7	2.6
49	Iowa State	52.0	6.0	16.0	9.0	9.5	11.0	49	Calgary	22.1	1.3	3.9	4.7	7.5	4.8
50	Groningen	51.5	0.5	2.0	7.5	14.5	27.0	50	PUST	22.0	0.2	1.8	2.1	9.4	8.5
50	South Carolina	51.5	8.5	12.5	12.5	9.5	8.5								

Table 8. Top 50 countries based on author affiliation and Ph.D. granting institution (1985–2010).

Author affiliation						Ph.D. granting institution					
Country	Author articles	%	Country	Author articles	%	Country	Full articles	%	Country	Full articles	%
USA	4058	34.46	USA	1796.2	35.94	USA	5451	44.89	USA	2410.5	46.74
UK	933	7.92	UK	389.3	7.79	UK	1388	11.43	UK	579.8	11.24
Taiwan	880	7.47	Taiwan	371.3	7.43	India	547	4.50	India	227.4	4.41
India	594	5.04	Canada	257.2	5.15	Canada	488	4.02	Canada	208.0	4.03
Canada	579	4.92	India	239.2	4.79	Taiwan	446	3.67	Taiwan	180.3	3.50
China	529	4.49	Korea	190.1	3.80	China	380	3.13	China	140.2	2.72
Korea	441	3.74	China	183.5	3.67	Japan	351	2.89	Japan	130.3	2.53
Singapore	403	3.42	Singapore	149.6	2.99	France	325	2.68	France	126.6	2.45
Hong Kong	337	2.86	Turkey	133.7	2.68	Italy	255	2.10	Germany	100.8	1.95
Japan	308	2.62	Hong Kong	129.2	2.59	Korea	231	1.90	Italy	100.4	1.95
Turkey	282	2.39	Japan	116.3	2.33	Germany	229	1.89	Turkey	96.7	1.88
France	269	2.28	France	107.9	2.16	Turkey	210	1.73	Korea	96.2	1.87
Italy	252	2.14	Israel	107.9	2.16	Netherlands	209	1.72	Netherlands	88.2	1.71
Israel	212	1.80	Italy	99.0	1.98	Spain	204	1.68	Spain	74.0	1.44
Spain	200	1.70	Germany	86.0	1.72	Singapore	193	1.59	Hong Kong	70.0	1.36
Germany	196	1.66	Netherlands	83.8	1.68	Hong Kong	188	1.55	Singapore	68.2	1.32
Netherlands	196	1.66	Spain	73.2	1.46	Israel	132	1.09	Israel	67.9	1.32
Australia	131	1.11	Australia	62.4	1.25	Australia	123	1.01	Australia	54.1	1.05
Iran	108	0.92	Iran	41.7	0.83	Belgium	95	0.78	Sweden	35.6	0.69
Belgium	79	0.67	Sweden	35.0	0.70	Sweden	77	0.63	Belgium	35.2	0.68
Greece	78	0.66	Greece	32.1	0.64	Iran	69	0.57	Iran	27.8	0.54
Sweden	72	0.61	Saudi Arabia	31.9	0.64	New Zealand	58	0.48	Poland	27.8	0.54
Saudi Arabia	60	0.51	Belgium	28.2	0.56	Greece	57	0.47	New Zealand	22.7	0.44
Portugal	55	0.47	Brazil	25.4	0.51	Poland	48	0.40	Greece	22.1	0.43
Brazil	54	0.46	Thailand	24.0	0.48	Brazil	45	0.37	Brazil	20.1	0.39
New Zealand	52	0.44	Portugal	21.8	0.44	Portugal	39	0.32	Portugal	15.8	0.31
Thailand	50	0.42	New Zealand	20.4	0.41	Denmark	34	0.28	Thailand	13.2	0.26
Switzerland	36	0.31	Poland	15.0	0.30	Finland	29	0.24	Denmark	12.6	0.24
Finland	35	0.30	Switzerland	12.8	0.26	Thailand	27	0.22	Russia	11.8	0.23
Mexico	26	0.22	Mexico	10.6	0.21	Russia	21	0.17	Finland	9.4	0.18
Poland	24	0.20	Finland	10.6	0.21	Switzerland	21	0.17	Austria	9.2	0.18
Egypt	19	0.16	Austria	8.4	0.17	Serbia	19	0.16	Saudi Arabia	8.5	0.16
Kuwait	18	0.15	Egypt	7.9	0.16	Austria	18	0.15	Belarus	8.2	0.16
Serbia	16	0.14	Kuwait	7.8	0.16	Belarus	18	0.15	Serbia	7.9	0.15
Austria	15	0.13	Denmark	6.7	0.13	Saudi Arabia	17	0.14	Switzerland	7.9	0.15
Slovenia	15	0.13	Norway	6.5	0.13	Slovenia	12	0.10	Egypt	4.8	0.09
Denmark	13	0.11	Serbia	6.5	0.13	Egypt	11	0.09	Slovenia	4.2	0.08
Malaysia	13	0.11	Slovenia	5.7	0.11	Hungary	7	0.06	Norway	3.9	0.08
Norway	12	0.10	Tunisia	4.8	0.10	Norway	7	0.06	Hungary	3.3	0.06
Tunisia	12	0.10	Malaysia	4.7	0.09	Romania	7	0.06	Croatia	3.0	0.06
Romania	9	0.08	Fiji	4.0	0.08	Croatia	6	0.05	Romania	3.0	0.06
Bahrain	6	0.05	Romania	4.0	0.08	Czech Repub.	5	0.04	South Africa	2.5	0.05

(*Continued*)

Table 8. (*Continued*).

Author affiliation						Ph.D. granting institution					
Country	Author articles	%	Country	Author articles	%	Country	Full articles	%	Country	Full articles	%
Croatia	6	0.05	Jordan	3.2	0.06	Mexico	5	0.04	Tunisia	1.8	0.04
Fiji	6	0.05	Croatia	3.0	0.06	South Africa	5	0.04	Mexico	1.8	0.03
Indonesia	6	0.05	Indonesia	3.0	0.06	Tunisia	5	0.04	Africa	1.5	0.03
Jordan	6	0.05	Bahrain	2.8	0.06	Africa	3	0.02	Bulgaria	1.5	0.03
Belarus	5	0.04	Cyprus	2.7	0.05	Argentina	3	0.02	Argentina	1.3	0.03
Cyprus	5	0.04	Peru	2.2	0.04	Kuwait	3	0.02	Kuwait	1.3	0.03
Peru	5	0.04	Nigeria	2.0	0.04	Malaysia	3	0.02	Algeria	1.0	0.02
Colombia	4	0.03	South Africa	2.0	0.04	Algeria	2	0.02	Czech Repub.	1.0	0.02
Czech Repub.	4	0.03	Chile	1.8	0.04	Bulgaria	2	0.02	Ukraine	0.8	0.02

Table 9. Top 15 countries based on authors' affiliations by percentage of author articles and full articles (1986–2010).

1986–1990				1991–1995				1996–2000			
Country	% of author articles	Country	% of full articles	Country	% of author articles	Country	% of full articles	Country	% of author articles	Country	% of full articles
USA	57.07	USA	56.23	USA	55.17	USA	55.91	USA	40.46	USA	39.41
UK	10.49	UK	10.24	UK	7.92	UK	7.99	UK	8.71	UK	8.59
Canada	5.24	Canada	6.35	Canada	5.51	Canada	5.31	Taiwan	6.39	Taiwan	7.63
Japan	5.24	India	3.95	India	4.94	India	4.64	Canada	6.10	India	4.41
India	4.09	Japan	3.94	Singapore	3.54	Singapore	3.35	India	4.60	Korea	4.08
Israel	3.56	Israel	3.86	Japan	3.43	Israel	2.90	Korea	3.92	Hong Kong	3.12
Netherlands	1.69	Germany	1.40	Taiwan	3.26	Taiwan	2.86	Singapore	3.44	Singapore	3.08
France	1.33	Korea	1.40	Israel	2.42	Japan	2.64	Hong Kong	3.05	Italy	2.62
Korea	1.33	Taiwan	1.04	Korea	2.42	Australia	1.98	Italy	2.71	Israel	2.37
Germany	1.07	China	0.88	Australia	1.63	France	1.19	Israel	2.13	France	1.91
Taiwan	0.98	Singapore	0.79	Italy	1.29	Italy	1.11	Japan	1.98	Germany	1.90
China	0.89	Turkey	0.64	France	1.07	Hong Kong	1.10	France	1.89	Turkey	1.89
Singapore	0.80	Sweden	0.55	Hong Kong	1.01	Turkey	1.02	Germany	1.74	Netherlands	1.51
Italy	0.71	Poland	0.36	Netherlands	0.79	Saudi Arabia	0.72	Netherlands	1.69	China	1.40
Serbia	0.71	Egypt	0.36	Turkey	0.79	Germany	0.63	China	1.65	Saudi Arabia	1.03

2001–2005				2006–2010			
USA	28.21	USA	28.20	USA	18.91	USA	23.08
Taiwan	8.79	Taiwan	9.19	Taiwan	11.26	Korea	7.68
UK	7.57	UK	7.35	China	8.95	India	5.86
Singapore	5.29	Korea	5.25	UK	6.89	UK	5.27
Korea	5.21	Canada	4.41	India	6.27	Germany	4.60
China	4.82	Singapore	4.41	Canada	4.47	France	3.76
Hong Kong	4.29	Hong Kong	3.79	Korea	4.06	Taiwan	3.36
India	4.14	Turkey	3.55	Turkey	3.93	Spain	2.17
Canada	4.11	France	2.88	Hong Kong	3.46	Jordan	1.70
France	3.07	Italy	2.29	Spain	3.10	Canada	1.61
Turkey	2.82	Germany	1.78	Singapore	2.89	Turkey	1.53
Italy	2.39	Netherlands	1.72	France	2.78	Portugal	1.51
Japan	2.32	Israel	1.68	Italy	2.55	Italy	1.40
Spain	1.79	Australia	1.56	Germany	2.42	Israel	1.26
Germany	1.61	Sweden	0.95	Iran	2.34	Brazil	1.21

Table 10. Top 15 countries based on authors' Ph.D. institutions by percentage of author articles and full articles (1986–2010).

1986–1990				1991–1995				1996–2000			
Country	% of author articles	Country	% of full articles	Country	% of author articles	Country	% of full articles	Country	% of author articles	Country	% of full articles
USA	60.15	USA	60.27	USA	59.67	USA	61.52	USA	51.52	USA	51.76
UK	12.68	UK	12.82	UK	10.14	UK	10.02	UK	11.57	UK	11.52
Japan	5.22	India	3.86	India	5.01	India	4.89	Canada	4.53	Canada	4.56
India	4.14	Japan	3.77	Canada	3.87	Canada	3.57	India	4.06	India	4.12
Canada	3.48	Canada	3.55	Japan	3.60	Japan	2.74	Italy	2.80	Italy	2.71
Germany	2.24	Germany	2.85	France	1.58	Israel	1.88	France	2.47	France	2.49
Netherlands	1.82	Netherlands	2.22	Israel	1.58	France	1.74	Taiwan	2.15	Taiwan	2.35
France	1.66	France	1.43	Singapore	1.47	Korea	1.39	Germany	2.05	Germany	2.16
Israel	0.83	Israel	1.18	Taiwan	1.42	Australia	1.30	Japan	2.05	Japan	1.87
Australia	0.66	Poland	1.01	Korea	1.36	Taiwan	1.28	Netherlands	1.77	Israel	1.65
Egypt	0.66	Australia	0.59	Italy	1.31	Singapore	1.16	Singapore	1.59	Korea	1.60
Italy	0.66	Egypt	0.59	Australia	1.25	Italy	1.13	China	1.45	Netherlands	1.60
Poland	0.58	Italy	0.56	Netherlands	0.98	Turkey	0.86	Korea	1.45	China	1.37
Serbia	0.58	China	0.51	New Zealand	0.82	Netherlands	0.81	Hong Kong	1.35	Singapore	1.33
China	0.50	Sweden	0.51	Turkey	0.76	New Zealand	0.76	Israel	1.31	Hong Kong	1.23

2001–2005				2006–2010			
USA	42.05	USA	42.05	USA	31.04	USA	29.72
UK	12.30	UK	12.00	UK	10.93	UK	6.82
Taiwan	4.08	Taiwan	4.22	Taiwan	6.40	India	5.21
Canada	3.56	Canada	3.69	China	6.33	Korea	4.68
France	3.56	India	3.61	India	5.33	Germany	4.54
India	3.56	France	3.15	Canada	4.33	Japan	4.07
China	3.08	China	2.95	Turkey	3.12	China	3.89
Japan	2.73	Korea	2.67	France	3.00	Taiwan	3.16
Korea	2.59	Japan	2.64	Spain	2.89	France	2.60
Singapore	2.32	Turkey	2.21	Italy	2.59	Russia	2.41
Italy	2.14	Germany	2.02	Germany	2.46	Poland	2.13
Hong Kong	2.04	Italy	2.01	Korea	2.43	Israel	2.06
Spain	1.90	Hong Kong	1.92	Hong Kong	2.33	Jordan	1.90
Germany	1.80	Singapore	1.86	Japan	2.13	Sweden	1.71
Netherlands	1.73	Netherlands	1.86	Netherlands	2.07	Thailand	1.71

85% of the research in 1986–1990, yet only 60% of the *author articles* and 51% of the *full articles* in 2006–2010. Asian countries, such as Taiwan and China, have demonstrated a dramatic increase in the published research of their Ph.D. graduates and European countries such as Italy and France have also demonstrated noticeable increases. Of course, we do not know if these increases are due to an increased volume of Ph.D. graduates or that Ph.D. graduates are better trained for research. This is another question left to future researcher efforts. The same issue should be investigated to discover why the graduates from the US and the UK institutions are publishing fewer papers in the journal. Are these two countries graduating fewer Ph.D. students? Are they graduating students that are less trained? Or have the journals of choice for these Ph.D. graduates changed? All of these questions are interesting and warrant further study.

4.4 *The patterns of authorship*

Above, we discussed the origins of the research that has been published in *IJPR* from 1985–2010. Results were presented for the most prolific individual researchers, institutions and countries. In this section, we discuss the patterns of authorship and the degrees of research collaboration of the articles that have been published. In Table 11, we provide a frequency distribution that shows the number of authors that have authored various numbers of articles since 1985. As stated earlier, there are 12,703 article authors (7103 unique authors) of the 5372 research articles published in IJPR between 1985 and 2010. Some of the 7103 authors had numerous articles while many had just a single article. We see in Table 11 that 70% (4963/7103) of the authors published only one article and 85% (6021/7103) published two or fewer articles. In fact, the average number of *author articles* per author is 1.79 and the average number of *full articles* per author is 0.76. Clearly, there is a small set of prolific researchers that have contributed a disproportionate amount of research to the journal. For example, the top 100 authors for the entire time period accounted for 1364 *author articles* for an average of 13.6 articles per author. And, there were 438 researchers (approximately 6.2%) that authored five or more articles.

While it is well known that research collaboration, as measured by some ratio of the number authors compared to the number of published articles, is increasing across many various disciplines (Gazni, Sugimoto, and Didegah 2012), the degree of research collaboration between authors and institutions in *IJPR* has not been studied. Research collaboration allows for the sharing of competences, resources and ideas as well as connecting researchers to a larger research network. However, determining the exact relationship of this collaboration is difficult to measure. For example, assigning author weightage to data analysis efforts, idea origination or writing skills is difficult at best. Yet, collaboration measures have been developed and used in previous research in order to quantify the degree of collaboration between authors (Gupta, Kumar, and Karisiddappa 1997; Savanur and Srinkanth 2010; Sutter and Kocher 2004). The first of these measures is the Collaboration Index (CI), which is basically the average number of authors per article. The Degree of Collaboration (DC) is the percentage of multiple authored articles published in a journal and the Collaboration Coefficient by Ajiferuke, Burrel and Tague (1988) combines the CI and DC into a single measure.

Table A2 in the Appendix presents various measures of research collaboration for each year over the time period considered in this paper. For sake of clarity and discussion, we present Figures 1(a–c) to graphically illustrate the data presented in Table A2. Figure 1(a) presents basic descriptive statistics, Figure 1(b) presents collaboration metrics and Figure 1(c) presents some additional measures of author collaboration.

Table 11. Frequency of authors publishing articles in *IJPR* (1985–2010).

Number of articles	Frequency of authors	Number of articles	Frequency of authors
43	1	12	7
34	1	11	18
33	1	10	22
27	1	9	31
25	1	8	35
24	1	7	48
22	2	6	93
19	1	5	133
17	3	4	230
16	5	3	414
15	6	2	1058
14	8	1	4963
13	20		

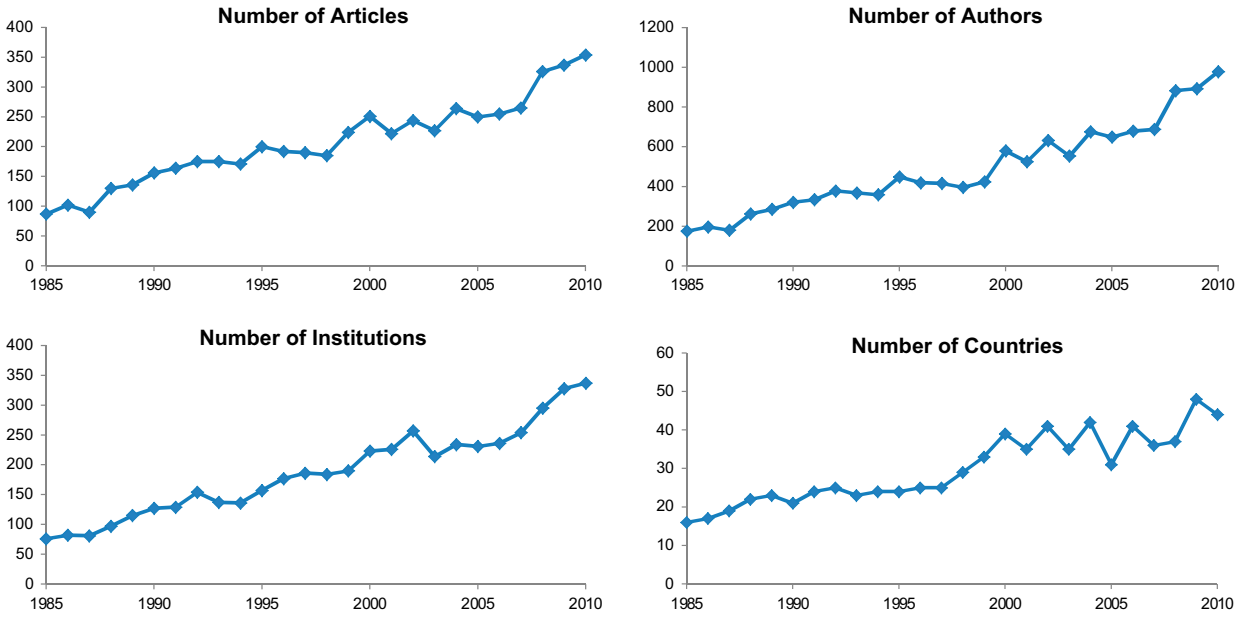

Figure 1.(a) Number of articles, authors, institutions and countries (1985–2010).

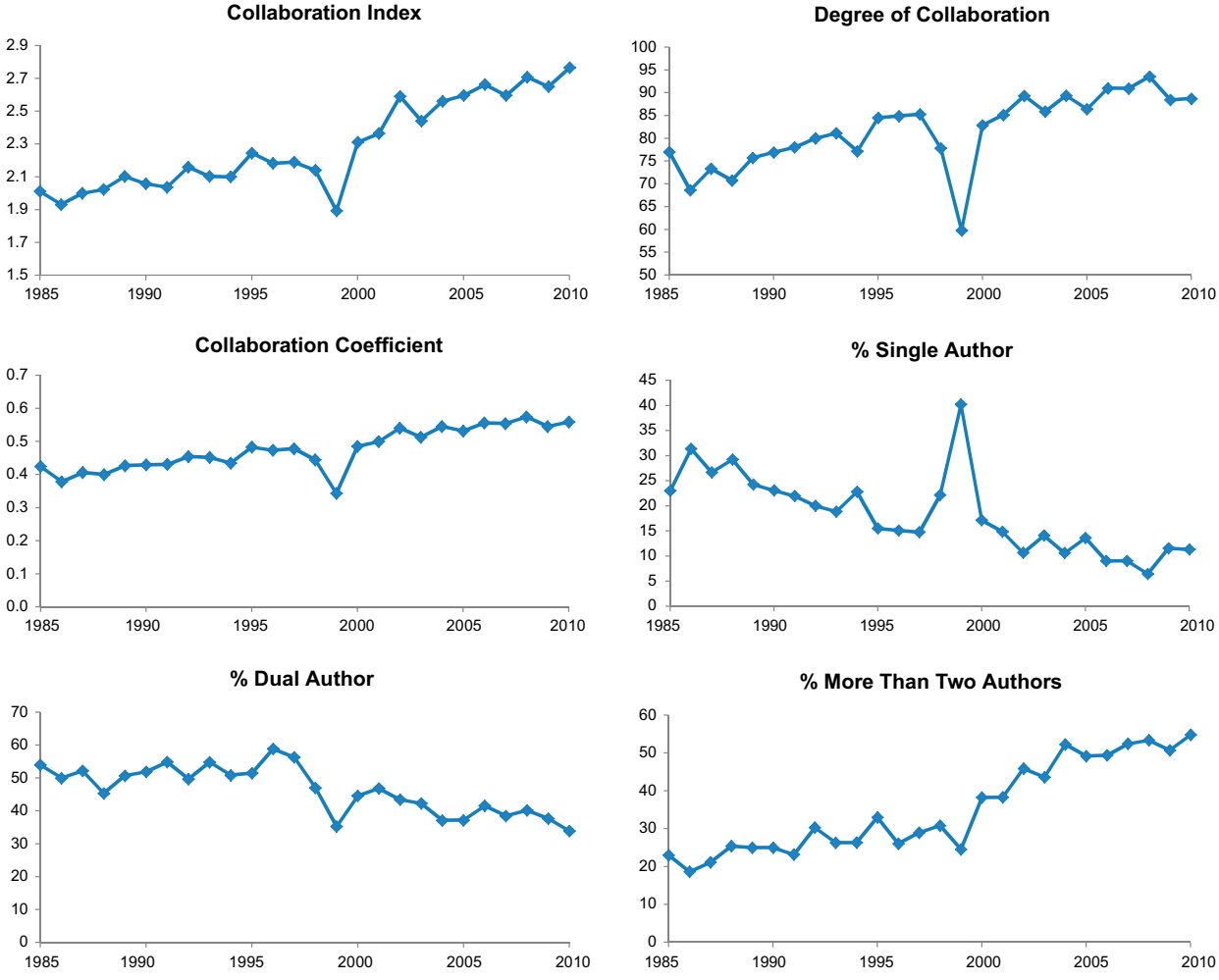

Figure 1.(b) Collaboration measures and percentage single, dual and more than two authors (1985–2010).

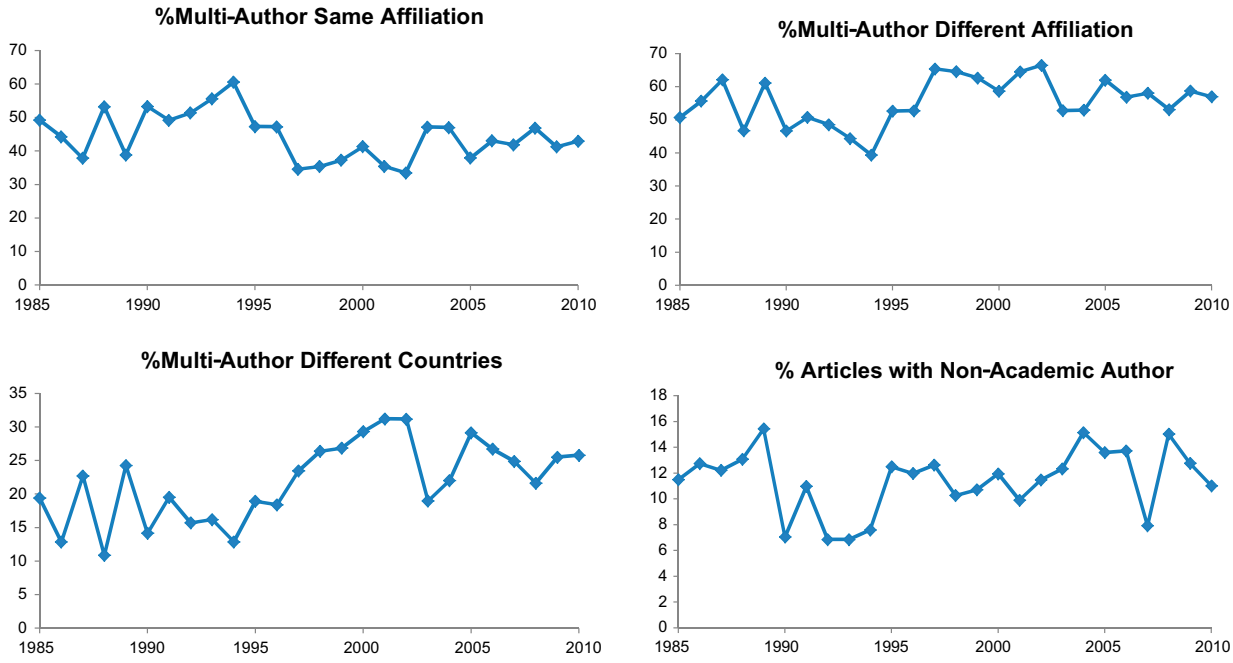

Figure 1.(c) Percentage multi-author same affiliation, different affiliations, different countries and with non-academic author (1985–2010).

It is clear in Figure 1(a) that the number of articles published each year in *IJPR* has increased steadily since 1985. Along with the increase in articles, the number of researchers that authored an article and the number of institutions represented by these authors increased as well. As the number of institutions increased, so too did the number of countries represented by these institutions. Based on these descriptive statistics, it is clear that the body of research being published in *IJPR* is becoming much more inclusive with respect to a worldwide set of academic researchers, their affiliated institutions and the countries where their institutions are located.

Figure 1(b) provides several metrics that measure the research collaboration between authors. The Collaboration Index is simply the average number of authors per published article. As evident, the number of authors per article has demonstrated a steady increase since 1985 where it has grown from 2.01 authors per article to 2.77 authors per article in 2010. It is interesting to note that in 1999, an unusually large number of sole authored articles were published, which was not consistent with the growing collaboration trend. Either researchers that submitted papers during this time mostly worked by themselves or the Editorship of the journal aggregated single authored articles to be published in the same issue. The other collaboration metrics, Degree of Collaboration and Collaboration Coefficient also show increasing trends over time. Lastly, the percentage of single authored and dual authored articles is decreasing over time while the percentage of articles with three or more authors is increasing. These latter trends are consistent with the three collaboration metrics.

Finally, Figure 1(c) provides four additional metrics of collaboration. We present the percentage of multi-authored articles having all authors from the same affiliation, the percentage of multi-authored articles having authors from different affiliations, the percentage of articles having authors from institutions located in different countries and lastly, the percentage of all articles having an author from a non-academic institution, such as a company or an independent research lab. Despite the metrics that show an increase in the volume of research collaboration, the pattern of that collaboration does not appear to be changing. The collaboration of authors from the same institution and the collaboration of authors from different institutions in the same country do not show increasing or decreasing trends over time. Only the collaboration between authors affiliated with institutions in other countries seems to have increased, particularly between 1994 and 2002. Thus, it appears that the increase in research collaboration between authors that published in *IJPR* is due to more multiple authorship and fewer single and dual authored articles. The nature of the affiliation, other than a slight increase for the collaboration between countries, has not changed noticeably.

5. Conclusion

This paper looked at the research published in *IJPR* between 1985 and 2010. We found that over this 26-year time period, there were 7103 unique authors that published 5372 articles from 1202 different institutions located in 95 different countries. These articles represent approximately 77% of all articles that have been published in *IJPR* since its inception in 1961. We were interested in where this research originated, as related to the authors, the institutions and the countries. We presented our discussion by focusing on the most prolific individual researchers, the most productive institutions and the most productive countries. We use two metrics that have been used in previous studies to measure research contribution. The first metric is the number of *author articles,* which is the number of articles on which an individual is an author. This is the most common measure used for tenure and promotion decisions. Our second metric is the number of *full articles* for each researcher, which is the number of articles weighted by the number of authors on each article. One can think of this as the number of sole authored articles that the author would have published if they had worked alone.

For the individual, it is important for the most prolific researchers to receive the recognition they have earned due to their research efforts. Further, it is important for aspiring researchers to see how they 'stack up' with the most productive researchers in the field. To be ranked in the top 10% of the most productive researchers in *IJPR*, an author would have had to publish three *author articles* since 1985. We found that a relatively small number of authors have a large number of published articles. For example, the average number of *author articles* for an individual researcher is 1.79, yet the top 100 researchers averaged 13.6 *author articles*, and 438 individuals had five or more *author articles*.

For each institution, we looked at the number of articles published in *IJPR* by authors affiliated with the institution, by authors with Ph.D. degrees from the institution and the average of the two, referred to as the combination measure. While author affiliation information was easily obtained, determining the institution where each researcher received their Ph.D. training was much more difficult. Through an intensive search on the Internet, we were able to identify the institution where 95.6% of the individuals received their Ph.D. training. We believe that the impact of an institution on any journal is not limited to the authors affiliated with that institution. Indeed, the research generated by its Ph.D. graduates is due to the training and skills that were learned while a student. As such, the institution where a researcher received their training should receive some credit and recognition. While we make no assertions regarding this point, many would view the research productivity of an institution's Ph.D. graduates as a measure of the quality of its Ph.D. programme. However, we do suggest that our combination measure may better represent the overall impact of an institution on any journal in any discipline. Therefore, it is important to identify those institutions that are generating the majority of the research being published and to identify those institutions that are training the most prolific Ph.D. graduates. To the best of our knowledge, no study has investigated the Production and Operations Management research of an institution by considering the research of its Ph.D. graduates as well as the research productivity of its faculty.

Results related to institutional research productivity showed that based on author affiliation, Purdue and Penn State were the most productive institutions. Likewise, the research productivity of its Ph.D. graduates was sufficient to rank Purdue and Penn State 1st and 2nd for the entire time period considered. As far as author affiliation is concerned, National University of Singapore, Loughborough University and Nanyang Technical University rounded out the top five. When we looked at the research of Ph.D. graduates, we saw that University of Michigan, Virginia Polytechnic and State University, and Georgia Institute of Technology were ranked in the top five after Purdue University and Pennsylvania State University. During the most recent time period, 2006–2010, the number of articles from researchers at Shanghai Jiao Tong University, Nanyang Technical University and University of Hong Kong showed a dramatic increase and, in terms of research from Ph.D. graduates, Georgia Institute of Technology and National Chiao Tung University increased dramatically. Based on the overall data (1985–2010), Purdue University and Pennsylvania State University have had the most influence in shaping *IJPR*. However, a review of the five-year time periods show that the set of institutions that shaped *IJPR* in the past may not be the same institutions that will do so in the future.

When we considered the country of origin for the articles published, we saw that, based on author affiliation, almost 35% of all research published in *IJPR* journal since 1985 originated in the USA. The other countries in the top five were the UK, Taiwan, India and Canada. Further, about 45% of the articles published in *IJPR* since 1985 were written by researchers who received their Ph.D. from institutions in the USA and about 11% received their Ph.D. in the UK. When we take a more granular view over time, we see that prior to 1995, approximately 57% and 10% of the research originated in the USA and UK, respectively. During the most recent time period, 2006–2010, the percentage of articles originating in the USA and UK declined to about 20% and 6%, respectively. On the other hand, research from Taiwan and China increased by over 1000% from the earliest to the most recent time period such that they now rank in 2nd and 3rd place behind the USA, with the UK now in 4th place. The research by Ph.D. graduates shows similar patterns. Contributions by researchers trained in the USA decreased from 60% in 1986–1990 to 31% in 2006–2010.

Research from Ph.D. graduates trained in the UK has remained steady at about 11%. Research productivity from Ph.D. graduates trained in Taiwan and China has steadily increased over the entire time period such that they now rank 3rd and 4th, respectively. This may be indicative of the improving quality of Ph.D. education in these countries.

In addition to an analysis of the origins of the published research, we also calculated various bibliometric indicators to see how the patterns of authorship have changed in the journal since 1985. As in many disciplines, the average number of authors per article, the Collaboration Index, has increased over time. Likewise, other indicators of collaboration between authors have increased. For example, the number of single authored and dual authored articles as a percentage has decreased while the number of articles with three or more authors has increased. There are many reasons for research collaboration such as desire to build research networks, share research resources, share research skills and/or share research ideas. We leave the discovery of the exact reasons for the increased collaboration to future researchers.

As in any descriptive study such as this, many questions remain unanswered. For example, what does the research network of the most prolific researchers look like? Is their productivity a result of individual talent, high levels of research support in the form of release time or financial compensation, a plethora of Ph.D. students or a strong research faculty at their institution? These same questions could be studied for different institutions as well. In this way, individuals and institutions could address any deficiencies that limit their research productivity. Further, it would be interesting to discover why the research productivity in *IJPR* from certain institutions is increasing or decreasing over time. Is it because of the level of resources at the institution has changed? Or, is it because the journal preference for tenure and promotion at these institutions has changed? Lastly, it would be interesting to discover the amount and strength of research collaboration between individuals and institutions. And, once these research relationships have been identified, it would be interesting to discover the reasons why certain individuals and institutions collaborate and others do not.

References

Agrawal, V. K. 2002. "Constituencies of Journals in Production and Operations Management: Implications on Reach and Quality." *Production and Operations Management* 11 (2): 101–108.

Ajiferuke, I., Q. Burrel, and J. Tague. 1988. "Collaborative Coefficient: A Single Measure of the Degree of Collaboration in Research." *Scientometrics* 14: 421–433.

Barrow, L. H., J. Settlage, and P. J. Germann. 2008. "Institutional Research Productivity in Science Education for the 1990's: Top Rankings." *Journal of Science Education and Technology* 17: 357–365.

Carter, C. R., D. B. Vallenga, J. J. Gentry, and B. J. Allen. 2005. "Affiliation of Authors in Transportation and Logistics Academic Journals: A Reassessment." *Transportation Journal* 44: 54–64.

Chan, K. C., C. Chen, and T. L. Steiner. 2004. "Research Productivity of the Finance Profession in Europe." *Journal of Business Finance and Accounting* 31: 177–213.

Chan, K. C., C. R. Chen, and L. T. W. Cheng. 2005. "Ranking Research Productivity in Accounting for Asia-pacific Universities." *Review of Quantitative Finance and Accounting* 24: 47–64.

Chan, K. C., H.-G. Fung, and W. K. Leung. 2006. "International Business Research: Trends and School Rankings." *International Business Review* 15: 317–338.

Chan, K. C., W. G. Hardin, K. Liano, and Z. Yu. 2008. "The Internationalization of Real Estate Research." *Journal of Real Estate Research* 30 (1): 91–124.

Clark, J. G., and J. Warren. 2006. "In Search of the Primary Suppliers of IS Research: Who are they and Where Did They Come From?" *Communications of the Association for Information Systems* 18: 296–328.

Clark, J. G., Y. A. Au, D. B. Walz, and J. Warren. 2011. "Assessing Researcher Publication Productivity in the Leading Information Systems Journals: A 2005–2009 Update." *Communications of the Association for Information Systems* 29: 459–504.

Conroy, M. E., R. Dusansky, D. Drukker, and A. Kildegaard. 1995. "The Productivity of Economics Departments in the US: Publications in the Core Journals." *Journal of Economic Literature* 33 (4): 1966–1971.

Coupe, T. 2003. "Revealed Performances: Worldwide Rankings of Economists and Economics Departments, 1990–2000." *Journal of the European Economic Association* 1: 1309–1345.

Dombrow, J., and G. K. Turnbull. 2000. "Individual and Institutional Contributors to the Journal of Real Estate Finance and Economics: 1988–1999." *Journal of Real Estate Finance and Economics* 21 (2): 203–214.

Dombrow, J., and G. K. Turnbull. 2002. "Individuals and Institutions Publishing Research in Real Estate, 1989–1998." *Journal of Real Estate Literature* 10 (1): 45–92.

Fabianic, D. A. 2002. "Publication Productivity of Criminal Justice Faculty in Criminal Justice Journals." *Journal of Criminal Justice* 30: 549–558.

Feingold, A. 1989. "Assessment of Journals in Social Science Psychology." *American Psychologist* 44: 961–964.

Gazni, A., C. R. Sugimoto, and F. Didegah. 2012. "Mapping World Scientific Collaboration: Authors, Institutions and Countries." *Journal of the American Society for Information Science and Technology* 63: 323–335.

Grant, J. B., J. D. Olden, J. J. Lawler, C. R. Nelson, and B. R. Silliman. 2007. "Academic Institutions in the United States and Canada Ranked According to Research Productivity in the Field of Conservation Biology." *Conservation Biology* 21: 1139–1144.

Gupta, B. M., S. Kumar, and C. R. Karisidddappa. 1997. "Collaboration Profile of Theoretical Population Genetics Speciality." *Scientometrics* 39: 293–314.

Heck, J. L. 2007. "Establishing a Pecking Order for Finance Academics: Ranking of US Finance Doctoral Programs." *Review of Pacific Basin Financial Markets and Policies* 10 (4): 479–490.

Heck, J. L., P. L. Cooley, and C. M. Hubbard. 1986. "Contributing Authors and Institutions to the Journal of Finance: 1946–1985." *Journal of Finance* 41: 1129–1140.

Jin, J. C., and J. H. Hong. 2008. "East Asian Rankings of Economics Departments." *Journal of Asian Economics* 19 (1): 74–82.

Jin, J. C., and E. S. H. Yu. 2011. "World Ranking of Real Estate Research: Recent Changes in School Competitiveness and Research Institutions." *Journal of Real Estate Finance and Economics* 42: 229–246.

Kumar, V., and S. K. Kundu. 2004. "Ranking the International Business Schools: Faculty Publication as the Measure." *Management International Review* 44: 213–218.

Lasser, D., and K. Rydqvist. 2006. "Ranking Journals by Concentration of Author Affiliation: Thirty-five Years of Finance Research". Centre for Economic Policy Research Discussion Paper No. 5731, London, UK.

Mahoney, K. T., W. C. Buboltz, B. Calvert, and R. Hoffman. 2010. "Research Productivity in Select Psychology Journals, 1986–2008." *Journal of Psychology* 144 (6): 361–411.

Malhotra, M. K., and H. V. Kher. 1996. "Institutional Research Productivity in Production and Operations Management." *Journal of Operations Management* 14: 55–77.

Maloni, M., C. R. Carter, and L. Kaufmann. 2012. "Author Affiliation in Supply Chain Management and Logistics Journals: 2008–2010." *International Journal of Physical Distribution and Logistics Management* 42 (1): 83–101.

Mathieu, R., and B. J. McConomy. 2003. "Productivity in 'Top-ten' Academic Accounting Journals by Researchers at Canadian Universities." *Canadian Accounting Perspectives* 2 (1): 43–76.

Meredith, J. R., and K. Amoaka-Gyampah. 1990. "The Genealogy of Operations Management." *Journal of Operations Management* 9 (2): 146–167.

Miller, S. A., and C. D. Maddux. 1991. "A Study of Institutional Affiliations of Authors of Articles in Selected Special Education Assessment Journals." *Assessment for Effective Intervention* 16 (2–3): 180–183.

Reynolds, C. R., and J. H. Clark. 1984. "Trends in School Psychology Research: 1974–1980." *Journal of School Psychology* 22 (1): 43–52.

Sa-Aadu, J., and J. D. Shilling. 1988. "Rankings of Contributing Authors to the AREUEA Journal by Doctoral Origin and Employer: 1973–1987." *American Real Estate and Urban Economics Journal* 16 (3): 257–270.

Savanur, K., and R. Srinkanth. 2010. "Modified Collaborative Coefficient: A New Measure for Quantifying the Degree of Research Collaboration." *Scientometrics* 84: 365–371.

Scott, L. C., and P. M. Mitias. 1996. "Trends in Rankings of Economics Departments in the US: An Update." *Economic Inquiry* 34 (2): 378–400.

Shabani, D. B., J. E. Carr, A. I. Petursdottir, B. E. Esch, and J. N. Gillett. 2004. "Scholarly Productivity in Behavior Analysis: The most Prolific Authors and Institutions from 1992 to 2001." *The Behavior Analyst Today* 5: 235–243.

Sorensen, J., and R. Pilgrim. 2002. "The Institutional Affiliations of Authors in Leading Criminology and Criminal Justice Journals." *Journal of Criminal Justice* 30: 11–18.

Sousa, P. S. A., and P. C. C. Vieira. 2011. "Universities and Authors: A Ranking for International Finance." *Economics Bulletin* 31 (1): 507–518.

Steiner, B., and J. Schwartz. 2006. "The Scholarly Productivity of Institutions and Their Faculty in Leading Criminology and Criminal Justice Journals." *Journal of Criminal Justice* 34: 293–400.

Sutter, M., and M. Kocher. 2004. "Patterns of Co-authorship Among Economics Departments in the USA." *Applied Economics* 36: 327–333.

Urbancic, F. B. 2007. "Contributors to the *Journal of Real Estate Research*: The First Twenty Years." *Journal of Real Estate Practice and Education* 10 (1): 81–106.

West, S. L., A. J. Armstrong, and K. A. Ryan. 2005. "An Assessment of Institutional Publication Productivity in Rehabilitation Counseling." *Rehabilitation Counseling Bulletin* 49: 51–54.

Young, S. T., B. C. Baird, and M. E. Pullman. 1996. "POM Research Productivity in US Business Schools." *Journal of Operations Management* 14: 41–53.

Appendix 1

Table A1. Abbreviations for academic institutions.

Abbreviation	Full name of academic institution	Abbreviation	Full name of academic institution
Arizona State	Arizona State University	Missouri	University of Missouri at Columbia
Auburn	Auburn University	MIT	Massachusetts Institute of Technology
Bilkent	Bilkent University	NCKU	National Cheng Kung University
Birmingham	University of Birmingham	NCSU	North Carolina State University
Brunel	Brunel University	NCTU	National Chiao Tung University
Cal Berkeley	University of California at Berkeley	NIFFT	National Institute of Foundry and Forge Technology
Calgary	University of Calgary	Northeastern	Northeastern University
Cardiff	Cardiff University	Northwestern	Northwestern University
Carnegie Mellon	Carnegie Mellon University	Nottingham	University of Nottingham
Case Western	Case Western Reserve University	NTHU	National Tsing Hua University
Cincinnati	University of Cincinnati	NTU	Nanyang Technological University
City UHK	City University of Hong Kong	NTUST	National Taiwan University of Science and Technology
Clemson	Clemson University	NUS	National University of Singapore
Concordia	Concordia University	Ohio State	Ohio State University
Cranfield	Cranfield University	Oklahoma SU	Oklahoma State University
Florida	University of Florida	OPU	Osaka Prefecture University
Ga. Tech	Georgia Institute of Technology	Penn State	Pennsylvania State University at State College
Georgia	University of Georgia	Poly UHK	Hong Kong Polytechnic University
Groningen	University of Groningen	Polytechnico	Polytechnic University of Milan
Hong Kong	University of Hong Kong	Purdue	Purdue University
HUST	Huazhong University of Science and Technology	PUST	Pohang University of Science and Technology
IIT Delhi	Indian Institute of Technology at Delhi	RPI	Rensselaer Polytechnic Institute
IIT Madras	Indian Institute of Technology at Madras	Rutgers	Rutgers University
Illinois Urbana	University of Illinois at Urbana Champaign	SJTU	Shanghai Jiao Tong University
Indiana Bloom.	Indiana University at Bloomington	South Carolina	University of South Carolina at Columbia
Iowa	University of Iowa	Stanford	Stanford University
Iowa State	Iowa State University	SUNY Buffalo	State University of New York at Buffalo
K.U. Leuven	Catholic University of Leuven (K.U. Leuven)	Technion	Technion – Israel Institute of Technology
KAIST	Korea Advanced Institute of Science and Technology	Tel Aviv	Tel Aviv University
Kyoto	Kyoto University	Texas A&M	Texas A&M University
Lehigh	Lehigh University	Texas Austin	University of Texas at Austin
London	University of London	Texas Tech	Texas Tech University
Loughborough	Loughborough University	Tsinghua	Tsinghua University
LSU	Louisiana State University	Twente	University of Twente
Manchester	University of Manchester	Virginia Tech	Virginia Tech
Maryland	University of Maryland at College Park	Waseda	Waseda University
McMaster	McMaster University	Waterloo	University of Waterloo
Michigan	University of Michigan at Ann Arbor	Windsor	University of Windsor
Michigan State	Michigan State University	Wisconsin	University of Wisconsin at Madison
Middle East TU	Middle East Technical University	Yuan Ze	Yuan Ze University
Minnesota	University of Minnesota at Twin Cities		

Appendix 2

Table A2. Patterns of authorship and research collaboration in *IJPR* (1985–2010).

Year	Number of articles	Number of authors	Number of institutions	Number of countries	Collaboration index	Degree of collaboration	Collaboration coefficient	% Single author	% Dual author	% More than two authors	% Multi-author same affiliation	% Multi-author different affiliation	% Multi-author different countries	% Articles with non-academic author
1985	87	175	76	16	2.01	77.0	0.424	23.0	54.0	23.0	49.3	50.7	19.4	11.5
1986	102	197	82	17	1.93	68.6	0.378	31.4	50.0	18.6	44.3	55.7	12.9	12.7
1987	90	180	81	19	2.00	73.3	0.406	26.7	52.2	21.1	37.9	62.1	22.7	12.2
1988	130	263	97	22	2.02	70.8	0.400	29.2	45.4	25.4	53.3	46.7	10.9	13.1
1989	136	286	115	23	2.10	75.7	0.427	24.3	50.7	25.0	38.8	61.2	24.3	15.4
1990	156	321	127	21	2.06	76.9	0.429	23.1	51.9	25.0	53.3	46.7	14.2	7.1
1991	164	334	129	24	2.04	78.0	0.431	22.0	54.9	23.2	49.2	50.8	19.5	11.0
1992	175	378	154	25	2.16	80.0	0.454	20.0	49.7	30.3	51.4	48.6	15.7	6.9
1993	175	368	137	23	2.10	81.1	0.452	18.9	54.9	26.3	55.6	44.4	16.2	6.9
1994	171	359	136	24	2.10	77.2	0.435	22.8	50.9	26.3	60.6	39.4	12.9	7.6
1995	200	449	157	24	2.25	84.5	0.483	15.5	51.5	33.0	47.3	52.7	18.9	12.5
1996	192	419	177	25	2.18	84.9	0.474	15.1	58.9	26.0	47.2	52.8	18.4	12.0
1997	190	416	186	25	2.19	85.3	0.478	14.7	56.3	28.9	34.6	65.4	23.5	12.6
1998	185	396	184	29	2.14	77.8	0.445	22.2	47.0	30.8	35.4	64.6	26.4	10.3
1999	224	424	190	33	1.89	59.8	0.343	40.2	35.3	24.6	37.3	62.7	26.9	10.7
2000	251	580	223	39	2.31	82.9	0.485	17.1	44.6	38.2	41.3	58.7	29.3	12.0
2001	222	525	226	35	2.36	85.1	0.500	14.9	46.8	38.3	35.4	64.6	31.2	9.9
2002	244	632	257	41	2.59	89.3	0.541	10.7	43.4	45.9	33.5	67.0	31.2	11.5
2003	227	554	214	35	2.44	85.9	0.513	14.1	42.3	43.6	47.2	52.8	19.0	12.3
2004	264	676	234	42	2.56	89.4	0.546	10.6	37.1	52.3	47.0	53.0	22.0	15.2
2005	250	649	231	31	2.60	86.4	0.532	13.6	37.2	49.2	38.0	62.0	29.2	13.6
2006	255	679	236	41	2.66	91.0	0.556	9.0	41.6	49.4	43.1	56.9	26.7	13.7
2007	265	688	254	36	2.60	90.9	0.554	9.1	38.5	52.5	41.9	58.1	24.9	7.9
2008	326	883	295	37	2.71	93.6	0.575	6.4	40.2	53.4	46.9	53.1	21.6	15.0
2009	337	893	328	48	2.65	88.4	0.546	11.6	37.7	50.7	41.3	58.7	25.5	12.8
2010	354	979	337	44	2.77	88.7	0.559	11.3	33.9	54.8	43.0	57.0	25.8	11.0