

Research in production and operations management: A university analysis

Abstract

Many universities around the World have made important contributions in the field of production and operations management. This article presents the most productive and influential universities between 1990 and 2014. For doing so, we use the Web of Science database in order to search for the information which is usually regarded as the most relevant for scientific research. The results show a wide dispersion between the country of origin of the leading universities being some of them in North America, Europe and Asia. These results are quite different from many other management areas where English speaking countries, and especially the USA, tend to be the dominant ones. The Hong Kong Polytechnic University is the most productive university while the Michigan State University is the most influential one. The temporal evolution shows that before the USA had a more dominant position while now there is more dispersion around the World. The analysis of selected journals indicates that many journals tend to be more influenced by their country of origin. However, some other ones show a more general profile publishing papers from most of the countries around the World.

Keywords: Production and operations management; bibliometrics; Web of Science; university analysis.

Introduction

The universities and other related institutions are the most common places for developing research. During the last century, the number of universities has increased a lot especially motivated by the growth of the population and the development of the economies. Especially, this increase has been very significant during the last decades. Today, there are many thousands of universities around the World. In the literature, there are many techniques for measuring their scientific production of the universities. Among others, it is worth noting bibliometrics. It is defined as the science that studies the bibliographic material quantitatively (Broadus, 1987). Bibliometrics has been studied in a wide range of fields (Merigó et al. 2015a; Podsakoff et al. 2008).

There are many bibliometric studies in production and operations management. Some of them focused on the most significant journals in the field including Goh et al. (1997) and Barman et al. (2001). They extended the analysis developed previously by other studies (Barman et al. 1991). More recently, Holsapple and Lee-Post (2010) developed a behavior-based analysis of journals in this discipline and Stonebraker et al. (2012) focused on the impact factor as a tool for measuring the quality of the journals.

Some other authors focus on other issues including the work of Pilkington and Meredith (2009) that developed a citation analysis in order to study the evolution of operations management between 1980 and 2006. Hsieh and Chang (2009) presented a general overview of production and operations management by studying the publications of twenty leading journals in this field. This work developed a university ranking between 1973 and 2008 and found the Massachusetts Institute of Technology and the Georgia Institute of Technology in the first positions. Only three institutions in the Top 20 were from outside the USA. Although this study represents an important contribution to the field, it needs improvements because the twenty journals considered, may not strictly represent the

discipline. The main reason for this is because many journals have a broader perspective publishing papers outside the core of production and operations management. Therefore, the results may be conditioned by this issue. From a general perspective, the results were clearly over estimating the results of the USA because old journals such as Management Science and Operations Research are totally dominated by this country. However, the problem is that these journals do not only publish papers in production and operations management, so the results are deviated by this issue. An example of this can be seen in the authors ranking where many authors that are more oriented to the general field of operations research rather than production and operations management do appear in the list.

In order to solve this issue, the aim of this paper is to present a more general approach that can clearly represent the field of production and operations management in a more complete way. Particularly, this study aims to provide a general overview of the leading universities in this field between 1990 and 2014. For doing so, we present a ranking with the thirty most productive universities. We also consider a temporal evolution in order to see how their influence and productivity has changed throughout time. The article also considers the most productive institutions in four selected journals. Finally, the paper ends developing a bibliographic coupling of the leading universities in the five thousand most cited papers.

Methods

This study uses the Web of Science (WoS) database in order to collect the information for the bibliometric analysis. The data was collected between April and May 2015. In order to search for the material, we used a double search process between keywords and journals. The keywords selected are: operations management; production management; supply chain management; total quality management; TQM; logistics; MRP and JIT. The journals selected for the analysis were complimentary to the keywords by using the Boolean “OR” so all the

material found with the keywords or the journals were considered. The search considered all the publications of twenty-seven journals that have a strong focus on this field. These journals appear in Table 2 of Muller and Merigó (2015) with 100% in the %POM column. Additionally, the results are filtered by considering the Research Areas and WoS categories mentioned in Muller and Merigó (2015). The search process finds 51015 articles in this field.

The study considers a time period of twenty-five years between 1990 and 2014. It also considers a wide range of bibliometric indicators in order to provide a complete representation of the bibliographic information including the total number of papers, citations, citations per paper, the *h*-index (Hirsch, 2005), and some other related indicators regarding the number of articles that overcome a citation threshold (Merigó et al. 2015b).

Results

This Section presents the results of the paper. First, we consider the global ranking between 1990 and 2014. Next, the article considers the temporal evolution of the most productive and influential universities. Third, the leading universities in some selected journals. Finally, the study presents the bibliographic coupling of the most significant institutions in production and operations management.

Leading universities in production and operations management

A lot of universities around the World are strongly involved in production and operations management research. In order to identify the leading ones, let us look into the results obtained between 1990 and 2014 according to some well-known bibliometric indicators. Table 1 presents the thirty most productive institutions in this field. Additionally, some other indicators are presented in order to obtain a more general perspective of each of the thirty universities.

Table 1: Most influential countries in innovation research

R	University	Cou	TP	TC	H	C/P	≥100	≥50
1	Hong Kong Polytechnic University	CHN	738	9941	43	13,47	9	33
2	Penn State University	USA	509	6394	35	12,56	10	17
3	Arizona State University	USA	509	11865	53	23,31	21	55
4	National University of Singapore	SGP	475	6773	37	14,26	2	16
5	Indian Institute of Technology	IND	471	6121	36	13,00	6	25
6	Michigan State University	USA	421	12471	57	29,62	26	64
7	City University of Hong Kong	CHN	394	4954	33	12,57	4	15
8	Purdue University	USA	369	7159	41	19,40	11	33
9	University of Michigan	USA	361	6318	38	17,50	10	27
10	University of Manchester	UK	349	5853	39	16,77	6	29
11	Georgia Institute of Technology	USA	331	7534	44	22,76	18	36
12	University of Minnesota Twin Cities	USA	319	10395	55	32,59	26	60
13	Cardiff University	UK	317	5712	37	18,02	7	27
14	Massachusetts Institute of Technology	USA	315	9931	49	31,53	20	47
15	Cranfield University	UK	313	4670	30	14,92	7	14
16	Erasmus University Rotterdam	NET	310	6733	41	21,72	12	31
17	Eindhoven University of Technology	NET	310	5020	37	16,19	5	24
18	University of Hong Kong	CHN	307	4674	33	15,22	5	14
19	Loughborough University	UK	307	3091	26	10,07	0	8
20	Texas A M University College Station	USA	305	5551	38	18,20	7	29
21	National Cheng Kung University	TWN	299	3039	29	10,16	0	4
22	University of Nottingham	UK	296	4388	32	14,82	4	16
23	Shanghai Jiao Tong University	CHN	294	2177	21	7,40	2	5
24	Nanyang Technological University	SGP	292	4303	32	14,74	7	20
25	University of Montreal	CAN	288	4168	32	14,47	5	18
26	National Chiao Tung University	TWN	288	3918	29	13,60	6	14
27	Ohio State University	USA	277	8228	43	29,70	18	33
28	University of Maryland College Park	USA	273	5921	39	21,69	11	28
29	University of Warwick	UK	257	3601	30	14,01	3	15
30	Polytechnic University of Milan	ITA	249	3135	28	12,59	0	13

R = Rank; Cou = Country; TP, TC, H, C/P = H-index, cites, papers and cites per paper; ≥100, ≥50 = Articles with more than 100 and 50 cites.

The Hong Kong Polytechnic University is the most productive university in production and operations management. However, it is still less influential than some American universities such as the Arizona State University, Michigan State University and University of Minnesota Twin Cities. An interesting result seen in this list is that the USA is not as dominant as in other management fields (Podsakoff et al. 2008). In this case, only eleven universities appear in the Top 30 which is quite low compared to other management fields. The main reason is because production and operations management lies at the intersection of management and operations research. Therefore, from the operations side, the results are closer to the results seen in engineering and computer science (Merigó et al. 2015a). It is worth noting that Asia and Europe get nine universities each in the ranking.

Temporal analysis of the most productive universities

Next, let us look into the evolution throughout time of the leading universities. For doing so, we consider periods of five years between 1990 and 2014 in order to see the leaders in the nineties and during the last years. Tables 2, 3, 4, 5 and 6 present the Top 10 universities in production and operations management between 1990-1994, 1995-1999, 2000-2004, 2005-2009 and 2010-2014, respectively.

As we can see, in the nineties, the USA was more influential than now. This is in accordance with the general evolution of research worldwide where before, the majority of international research was carried out by English speaking countries. But now more and more institutions all over the World are starting to develop research with an international impact. Particularly, Purdue University and the University of North Carolina show the most remarkable results in the nineties. North Carolina still holds his influence during the rest of the periods although Hong Kong Polytechnic University becomes more relevant achieving the first position in the ranking.

Table 2: Leading universities in production and operations management between 1990–1994

R	University	TP	TC	H	C/P
1	Purdue University	56	1670	23	29,82
2	University of North Carolina	55	1244	18	22,62
3	Penn State University	54	1054	16	19,52
4	Indian Institute of Technology	43	1172	19	27,26
5	Ohio State University	40	1283	14	32,08
6	Texas A M University College Station	36	733	14	20,36
7	University of Michigan	32	952	15	29,75
8	National University of Singapore	32	390	12	12,19
9	Massachusetts Institute of Technology	32	1957	15	61,16
10	Korea Advanced Institute of Science Technology	32	459	13	14,34

Table 3: Leading universities in production and operations management between 1995–1999

R	University	TP	TC	H	C/P
1	University of North Carolina	97	3395	28	35,00
2	Purdue University	88	2308	27	26,23
3	Penn State University	81	1168	18	14,42
4	University of Manchester	78	1335	19	17,12
5	Indian Institute of Technology	74	1098	19	14,84
6	Arizona State University	67	1851	25	27,63
7	City University of Hong Kong	54	886	16	16,41
8	University of Nottingham	52	1313	19	25,25
9	University of Michigan	50	1682	20	33,64
10	University of Warwick	48	938	17	19,54

Table 4: Leading universities in production and operations management between 2000–2004

R	University	TP	TC	H	C/P
1	University of North Carolina	128	4849	33	37,88
2	Arizona State University	104	4145	34	39,86
3	Penn State University	100	1254	19	12,54
4	Hong Kong Polytechnic University	97	2297	29	23,68
5	Michigan State University	93	5129	37	55,15
6	National University of Singapore	92	2577	26	28,01
7	City University of Hong Kong	85	1365	22	16,06
8	University of Manchester	78	2110	27	27,05
9	Eindhoven University of Technology	76	2070	25	27,24
10	Purdue University	72	2122	21	29,47

Table 5: Leading universities in production and operations management between 2005–2009

R	University	TP	TC	H	C/P
1	Hong Kong Polytechnic University	203	4781	36	23,55
2	University of North Carolina	161	4249	32	26,39
3	Arizona State University	161	3045	29	18,91
4	National University of Singapore	126	2003	25	15,90
5	Indian Institute of Technology	125	2021	22	16,17
6	Michigan State University	122	4089	38	33,52
7	Penn State University	113	2287	26	20,24
8	University of Hong Kong	106	1936	24	18,26
9	Georgia Institute of Technology	105	2991	31	28,49
10	City University of Hong Kong	103	1617	22	15,70

Table 6: Leading universities in production and operations management between 2010–2014

R	University	TP	TC	H	C/P
1	Hong Kong Polytechnic University	401	2617	24	6,53
2	Shanghai Jiao Tong University	193	781	13	4,05
3	University of North Carolina	186	955	15	5,13
4	National University of Singapore	178	1087	17	6,11
5	Penn State University	161	653	12	4,06
6	Indian Institute of Technology	157	523	10	3,33
7	Michigan State University	151	1173	19	7,77
8	Arizona State University	149	1045	14	7,01
9	City University of Hong Kong	144	1006	17	6,99
10	National Cheng Kung University	131	641	13	4,89

Analysis of the most productive universities in some selected journals

In order to deepen in the analysis, let us look into the universities that publish mostly in four representative journals in production and operations management. In this study, we consider the International Journal of Production Research, the International Journal of Production Economics, the Journal of Operations Management and the International Journal of Operations and Production Management. Table 7 presents the ten most productive universities in the International Journal of Production Research. Note that some additional bibliometric indicators are presented including the total cites, the *h*-index and the citations per paper.

Table 7: Leading universities in the International Journal of Production Research

R	University	TP	TC	H	C/P
1	Indian Institute of Technology	192	2632	27	13,70
2	Purdue University	118	2545	28	21,56
3	Shanghai Jiao Tong University	112	593	12	5,29
4	Penn State University	112	1142	18	10,19
5	Hong Kong Polytechnic University	106	866	16	8,16
6	Nanyang Technological University	105	1366	20	13,01
7	National University of Singapore	100	1561	24	15,61
8	Loughborough University	95	1089	18	11,46
9	University of Hong Kong	86	1380	21	16,04
10	University of North Carolina	80	1156	19	14,45

The Indian Institute of Technology is the most productive and influential institution in this journal between 1990 and 2014. Purdue University also presents remarkable results. Three Chinese universities and two from Singapore appear in the list. Only three universities are from the USA and one from the UK.

Next, let us look into the International Journal of Production Economics. The results are shown in Table 8.

The Hong Kong Polytechnic University leads this ranking far away from the second position which is obtained by the Eindhoven University of Technology. This journal is mainly led by European institutions that have six in the Top 10. Two Chinese universities appear in the list and only one from the USA.

Table 9 presents the results for the Journal of Operations Management. Note that this journal and the next one have a closer orientation to the management field while the previous two are closer to engineering and operations research.

Table 8: Leading universities in the International Journal of Production Economics

R	University	TP	TC	H	C/P
1	Hong Kong Polytechnic University	170	2647	29	15,57
2	Eindhoven University of Technology	90	1076	19	11,95
3	Linköping University	87	1537	24	17,66
4	University of Nottingham	76	1735	20	22,82
5	Lappeenranta University of Technology	66	1009	19	15,28
6	University of Groningen	64	909	16	14,20
7	University of North Carolina	55	784	16	14,25
8	Cardiff University	55	1650	21	30
9	City University of Hong Kong	48	607	14	12,64
10	Indian Institute of Technology	45	888	16	19,73

Table 9: Leading universities in the Journal of Operations Management

R	University	TP	TC	H	C/P
1	Michigan State University	69	3951	37	57,26
2	University of Minnesota Twin Cities	52	2823	28	54,28
3	Arizona State University	48	2355	25	49,06
4	Ohio State University	37	2102	18	56,81
5	University of North Carolina	34	1864	22	54,82
6	University of South Carolina	23	1327	16	57,69
7	Indiana University	22	1063	17	48,31
8	Emory University	20	728	13	36,4
9	Clemson University	19	787	14	41,42
10	University of Western Ontario	18	1430	16	79,44

Michigan State University is the leading university in this journal. It is worth noting that the first nine universities are from the USA while the tenth one is from Canada. These

results clearly prove the dominant position the North American universities have in the field of management.

Finally, let us look into the International Journal of Operations and Production Management. The results appear in Table 10. Note that this journal is from Europe.

Table 10: Leading universities in the Int. Journal of Operations and Production Management

R	University	TP	TC	H	C/P
1	Cranfield University	67	1731	20	25,83
2	University of Manchester	50	795	18	15,9
3	University of Warwick	48	731	16	15,22
4	University of Cambridge	43	1917	21	44,58
5	University of Bath	33	828	15	25,09
6	Polytechnic University of Milan	32	678	15	21,18
7	Monash University	32	373	13	11,65
8	University of Padua	28	671	14	23,96
9	University of North Carolina	24	473	14	19,70
10	University of Groningen	24	146	9	6,08

Cranfield University is the most productive university in this journal between 1990 and 2014 although the University of Cambridge is more influential. The Top 5 is constituted only by British universities while the Top 10 has eight European universities and only one from the USA.

Bibliographic coupling of the leading universities

Another important issue to consider is the bibliographic influence that each university has and the bibliographic network formed around its publications and citations. A tool for doing so is bibliographic coupling. It is defined as a measure that considers the number of

times two different studies reference a common third work in their bibliographies (Martyn, 1964). If applying this concept to universities, we are considering the number of times two documents from different institutions cite a common third article. This approach allows us to identify the bibliographic references that different institutions have in common and at the same time see how relevant they are in this field. Figure 1 presents the bibliographic coupling of the leading universities in the five thousand most cited papers in production and operations management between 1990 and 2014.

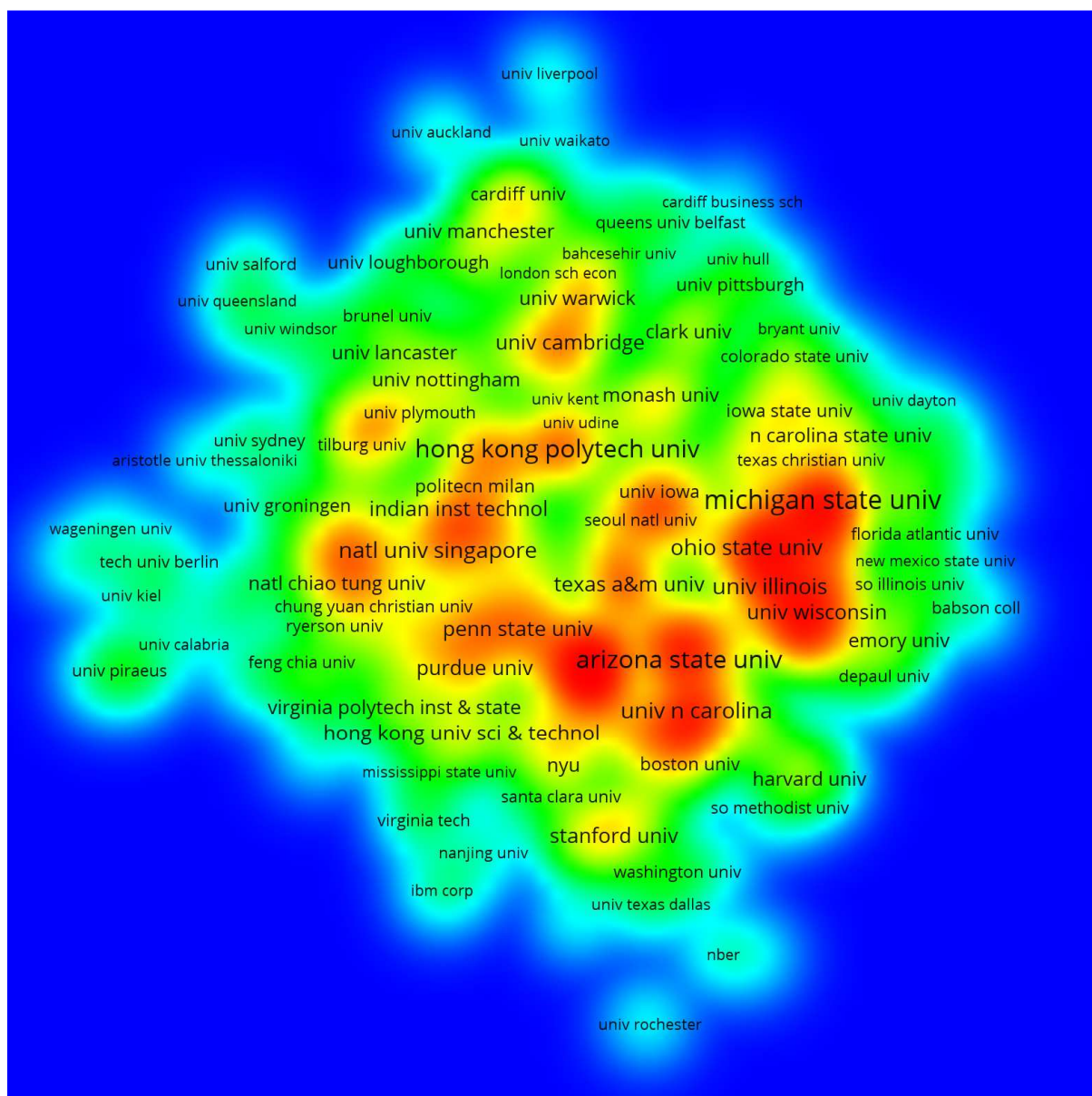


Figure 1: Bibliographic coupling of the leading universities in production and operations management

As we can see, the American universities form the core of the field. Most of these universities appear in Table 1. However, Asian institutions also have an important presence in the field. The Hong Kong Polytechnic University and the National University of Singapore also form an important core in this area. British universities are less significant although they also form some important cores around the University of Cambridge, the University of Warwick and the University of Manchester. Note that Figure 1 is presented using a density visualization of the results.

Conclusions

This study has presented a general overview of the most productive and influential universities between 1990 and 2014 in production and operations management. The results are extracted from the WoS database which is usually regarded as the most influential for scientific research. The findings of the article indicate that production and operations management has more dispersion than other management fields because universities from all over the World are leading the discipline. In management and social sciences this is quite uncommon and usually English speaking countries hold a dominant position. The main explanation for this is that production and operations management is close to more technical fields such as engineering and operations research where the current research is led by institutions from a wide range of countries and not only by English speaking countries.

Focusing on the results, the Hong Kong Polytechnic University is the most productive university although Michigan State University is the most influential one according to the total number of citations. Currently, North America, Europe and East Asia have a similar level of significant research in this area as seen from the number of institutions that appear in the ranking. Another interesting result is that the universities tend to publish more in their local top journals being the USA a dominant leader in the Journal of Operations Management,

Europe in the International Journal of Operations and Production Management, and a wider dispersion is seen in the International Journal of Production Research and in the International Journal of Production Economics.

The trends for the future indicate that the dispersion will continue in the future with the appearance of more universities from developing countries. A first indication of this is the Indian Institute of Technology that already entered the list. Note that this institute has several locations in different Indian cities. But it is remarkable that an Indian institution entered the ranking. In future research, we will deepen in the analysis expanding the rankings to a bigger list of universities and including more journals in the analysis. Some other bibliometric techniques will be also considered such as co-authorship and the citation networks.

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