

The role of academic collaboration in the impact of Latin-American research on management

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Abstract The aim of this paper is to determine the role that academic collaboration plays on the impact of Latin-American and the Caribbean research on management as an academic research discipline. The results show that the impact of Latin American articles on management, which were published between 1990 and 2010 in JCR journals is positively associated to collaboration $r_s = .133$, $p = .001$. Collaborated articles have on average 1.22 times more impact than single authored ones. The level of collaboration is positively correlated to impact $r_s = .337$, $p = .001$. Articles published through international collaboration have 1.59 times more impact than those published through domestic collaboration.

Keywords Academic collaboration · Citation base impact · Citation-based performance · Management research · Self-citation

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Introduction

The aim of this paper is to determine the role that academic collaboration plays in the impact of Latin-American and the Caribbean (LA–C) research on management as an academic research discipline. The research is on Braun and Glanzel's (2001) ideas on the ever growing significance of scientific collaboration on the individual as well as on institutional or national levels of cooperation and (Rousseau 2000; Van Raan 1998) ongoing conversation on the influence of international collaboration on the impact of articles. To study the role of collaboration in the impact of articles at the country level in developing regions is important because for developing countries collaboration is an effective way of closing the gap with respect to more developed nations (Vogel 1997, p. 253).

The increasingly interdisciplinary, complex, and costly characteristics of modern science encourages scholars to get involved in collaborative research (Beaver and Rosen 1979). The collaboration among scholars in research activity has become the norm (de Bellis 2009). As a consequence at present, articles produced by one author are scarce in the scientific arena. This trend has led the scientific community to determine if the impact of articles, measured as the number of citations an article receives is associated with academic collaboration.

As a consequence of this trend, there has been increasing academic interest in the association between collaboration and impact (Avkiran 2012; Bridgstock 1991; Glänzel 2002; Hanna-Mari et al. 2014; Hart 2007; Jiann-wien and Ding-wei 2010; Levitt and Thelwall 2009, 2010; Liemu and Koricheva 2005; Smart and Bayer 1986; Suárez-Balseiro et al. 2009; Van Raan 1998; Vogel 1997). These studies presented important findings and supporting evidence about the existence or absence of a relationship between collaboration and the impact of articles in several scientific fields. However, results about the relationship between academic collaboration and the impact of articles on management at the level of countries and regions of emergent economies are particularly scarce.

Previous studies on collaboration patterns in the management discipline have been conducted by (Smart and Bayer 1986) who studied a 10 years time span (1972–1981) of four top-tier journals of the discipline, as well as (Rodríguez-Pereira et al. 2000) who studied 66 articles on management science in Brazil published from 1981 to 1995. More recently Acedo et al. (2006) studied the scientific production of a 22 years time frame in eleven top tier journals of the discipline from USA and Europe. Thus, the results presented in previous studies contributed information, essentially in the context of micro and meso levels of collaboration (authors and institutions) and mainly coming from the most developed economies. Thus, the analysis of the relationship between collaboration and impact of scientific production on management in regions and countries of emergent economies would add additional evidence to contrast the behavior of the publications under other conditions. Thus, our research questions are:

1. Are there any differences in the citation patterns of LA–C articles on management published through collaboration in contrast with articles published without collaboration?
2. Are there any differences in the citation patterns of LA–C articles on management published through international collaboration in contrast with articles published through domestic collaboration?

To answer the research questions we analyzed 1,079 articles of LA–C authors published from January 1, 1990 to December 31, 2010 in 119 journals of *Social Science Citation Index* database in the category “management”. The results of the present study are useful

for determining publication strategy for researchers and academic institutions that finance and promote research.

Theory and hypothesis

Academic collaboration and its association with the impact of articles

Although an implicit agreement among the scientific community is perceived on the benefits of academic collaboration for the development of scientific research, the findings reported in previous research about the association between collaboration and the impact of articles show different results. For example, a positive association between collaboration and impact have been reported by Lindsey (1980) for Sociology of Science. Similar results were reported by Bridgstock (1991) for Astronomy, Glänzel (2002) for Biomedical Research, Chemistry and Mathematics, Moya-Anegón et al. (2006) for Agriculture, Hart (2007) for Academic Librarianship, Levitt and Thelwall (2009) for Library and Information Science, Jiann-wien and Ding-wei (2010, p. 322) for basic Sciences, Avkiran (2012) for Finance and recently Yu et al. (2014) for Cardiology and Cardiovasology and lastly (Hanna-Mari et al. 2014) for Natural sciences, Engineering, Medicine and health sciences, Agriculture and forestry, Social sciences and Humanities.

Conversely other studies reported no association between collaboration and impact e.g., Smart and Bayer (1986) for Education Measure and Clinical Psychology, Rousseau (2000) for Mathematics and Liemu and Koricheva (2005) for Ecology. Furthermore, findings of similar citation patterns between articles single authored rather than those multi-authored were presented by Levitt and Thelwall (2010) for the field of Economics.

The studies on the relationship between collaboration and impact in the management discipline also show different results. While Smart and Bayer (1986) reported a positive association for Management Science in general and (Rodríguez-Pereira et al. 2000) for Brazilian Management Science, Acedo et al. (2006) found no significant differences in the citation patterns between articles single authored to multi-authored ones.

Just as Rousseau (2000) concluded: “It is certainly not true that always multi-authored articles receive more citations than single-authored ones, nor is the saying ‘the more co-authors, the more citations’ always correct” Smart and Bayer (1986) also concluded multi-authored articles usually have higher citation frequencies than single-authored ones, but this relation is not so strong as to hold under all circumstances and for all domains of science.

Although the findings reported in previous research show no agreement on the influence of collaboration on the impact of articles, the scholars still believe that co-authoring improves the quality of work and the probability of acceptance. Thus, we posit as first hypothesis:

Hypothesis 1 LA–C articles on management published through collaboration show a higher impact than articles published without collaboration.

The level of collaboration and its association with an articles’ impact

Most governments have been keen to increase the level of international collaboration engaged in by the researchers whom they support in the belief that this will bring about cost savings and other benefits (Katz and Martin 1997, p. 1). At present there is an ongoing

conversation on the influence of international collaboration on the impact of articles (Van Raan 1998). Katz and Martin (1997) reported that articles by authors from two countries on average received about 50 % more citations than articles by authors from a single country. Narin and Witlow (1990) reported that for science in general, articles published in international collaboration are cited twice as much as those published by means of the collaboration among authors coming from one country. Van Raan (1998) presented strong evidences to demonstrate that the internationally co-authored publications have higher impact than domestic ones.

The relationship among the level of collaboration and the impact of articles has been studied for several scientific disciplines. For example, Moya-Anegón et al. (2006) found that the impact factor of articles in the field of Agronomy is larger in the international collaboration level than in the national one. Similar results were found by Liemu and Koricheva (2005) for Ecology, Vogel (1997) for Chilean Physics, Rodríguez-Pereira et al. (2000) for Brazilian Management and, recently Yu et al. (2014) reported a positive relationship between research performance and international research collaboration in the field of cardiology and cardiovascular. Nevertheless, Levitt and Thelwall (2010, p. 182) reported for the field of economics that the results, in a general way, are similar to the previous study. However individual patterns are observed for each country where the average of citations of the articles published in collaboration is similar to the articles published without it.

Gómez et al. (1999) reported a positive association for the impact of LA–C research and its collaboration with Europe and USA covering all sciences. Adams (2013, p. 558), through the analysis of the global scientific production, found that the annual increase of the impact of the publications from countries with more economic development is conditioned by international collaboration.

Rousseau (2000) reported that in ‘mathematics’ more collaboration occurs with scientists from within the same country, but conversely collaboration with scientists from abroad yields more citations. He also reported that for theoretical physics there is a clear preference for collaborations with scientists from abroad. These collaborations also yield more than double the number of citations than collaborations within the country. Also, for theoretical chemistry collaborations with scientists from abroad yields more citations per article than collaborations within the same country.

According to the above mentioned results it would be expected that international collaboration would foster the impact on LA–C articles on management. Thus, articles published through international collaboration would attract a larger impact than articles published through domestic collaboration. Thus, we defined as a second hypothesis:

Hypothesis 2 LA–C international co-authored articles on management have a higher impact than domestic authored ones.

Methods

Unit of analysis

For the study of the impact of articles in the field of management as an academic discipline Morrison and Inkpen (1991); Podsakoff et al. (2008) and Shane (1997) analyzed the authors as a unit of analysis, while Kirkpatrick and Locke (1992) and Acedo et al. (2006) use the institutions. Contrary to the previous studies, we have selected collaboration at the

level of countries. This way, the Latin American countries represented in the articles on management published in co-authorship constitute the study unit of analysis.

Study time frame

The decision about which time span to use was related to the time periods in previous studies. Morrison and Inkpen (1991) analyzed the scientific production on international business in five journals within the years 1980–1989. Kirkpatrick and Locke (1992) analyzed the scientific production published in 36 journals on management from 1983 to 1987. On the other hand Shane (1997) analyzed the articles on Entrepreneurship that appear in the 15 most outstanding journals in the period 1987–1994. A fourth study, Trieschmann et al. (2000) analyzed the five most outstanding journals in the period 1981–2004, while Podsakoff et al. (2008) studied 25 years between 1981 and 2004 in a more recent and complete research. In other studies Cardoza and Fornés (2011) studied the period 1966–2007 and focused on the 40 most important journals. All these studies differ in the sources analyzed, the time periods analyzed, and the methods used.

We observe that there is no algorithm generally accepted by the researchers to select time frames. In the present research we analyze 21 years of scientific production of Latin American authors' on the management discipline (management category according to the Web of Science classification), in the Social Sciences Citation Index, from January 1, 1990 to December 31, 2010. The data retrieval was carried out on June 17–20, 2014. The entries found were categorized and saved for each country individually. This way, the present research differs from previous ones in two essential characteristics: (1) the unit of analysis (countries of a specific region), and, (2) the variables used for the study.

Authors like Podsakoff et al. (2008) carried out a dynamic study splitting the time periods in several stages. Although we analyze a 21-years time span we did not make this dynamic study. The reason is the objective of the research is not to evaluate the changes over time, but rather, to study the influence of academic collaboration on the impact of Latin American articles on management.

Collecting data and creating matrices for quantitative analysis

For the present study we use the bibliometric data from Latin American articles on management published with the participation of authors from Latin American countries with or without the collaboration of authors from countries of other regions represented in the subfield (CU) of the field of address of each article. For this, we developed a search strategy in the database ISI web of knowledge, ISI digital version (WOS) as follows: advanced search CU = (Country) and WC = (Management), time span: from January 1st, 1990 to December 31 2010, language: all, citation database: SSCI, document type: article.

Criteria for selecting the information for the study

To guarantee the reliability of the data we apply the following inclusion/exclusion criteria. First, we select all the documents of the document type “articles” of the category “Management” of the classification (WC) of the WOS of each Latin American country published in the time period selected in the database ISI. Although ISI data integrity has been questioned e.g., see (de Bellis 2009, p. 189), van Raan (2005, p. 6) the decision to use the ISI database as the source for the study was based on the following reasons: (1) it is the

world leading database in publications and reports of citations Adams and King (2009, p. 2). Over 20 million researchers from over 3,800 institutions in 98 countries use ISI; (2) this database provides access to information from approximately 8,500 of the most prestigious, influential research journals in the world; (3) the annual production of indicators that allow measuring the performance of the countries under acknowledged and generally accepted worldwide indicators by the scientific community, and (4) it includes the necessary fields for obtaining information, and for creating matrixes of data for the quantitative analyses.

We selected the documents of the type “articles” since it is considered the primary route to disseminate new knowledge in most of the scientific disciplines (Adams and Gurney 2013). We carried out a manual selection of the entries to eliminate duplicates and we verified that all the entries belong in the category “management” using the field of thematic category (subject category) assigned by ISI with the table of equivalence of Le Rapport, OST (2004).

Variables, operationalization and coding

Dependent variable

The impact of LA–C articles on management In 1955 Dr. Eugene Gardfield revolutionized research with his concept of citation index and searching, giving birth to the Science Citation Index in 1961 (Garfield 1972). Today, the citation count that articles receive has become an indicator of great relevance in the evaluation of performance in the field of science.

According to Podsakoff et al. (2008, p. 664) citation counts are a better measure of scholarly influence than the number of articles published. Other authors agree upon this criterion Mingers and Fang (2010). Gómez-Mejía and Balkin (1992, p. 925) point out that citations count should be seen as an indicator of how useful the result of the research of an author is for the rest of the researchers from the scientific community which he/she belongs to, while Laband (1985, p. 641) outlines that the more citations a researcher receives, the more valued their contribution is in the market of ideas. The importance of the impact of publications has also been reflected in terms of the salary that researchers receive. For example, Gómez-Mejía and Balkin (1992, p. 940) found that in the management field there is a positive correlation among the number of citations that a researcher receives and his/her salary $r = .24, p < .05$.

Maybe due to the above-mentioned reasons, for the management discipline the citations count has become an indicator to elaborate rankings of the most prominent institutions in the world in the research on management (e.g., Kirkpatrick and Locke 1992 or/and Podsakoff et al. 2008). The use of this approach allowed Podsakoff et al. (2008, p. 659, table 4) to present the ranking of the 100 most important international institutions in the academic field of management.

We perceive a consensus in the literature on the relevance and the advantages of the impact as a measure to evaluate the performance of authors, institutions and countries. de Bellis (2009, p. 183) gives three reasons why politicians and science managers began to pay unprecedented attention to citation analysis: convenient, quickly understood, easy calculated and applied. The generalization of citation counts to measure impact has gained alike defenders and detractors. For science in general the citation count to measure impact has been criticized. E.g., Adams (2014) states that the citation count is not responsive to field or career stage or van Raan (2005) evidences that citation count could be improper for

research performance evaluation. Nevertheless, the most frequent critique citation count receives to measure impact is the self-citation phenomena (Avkiran 2012; Glanzel and Thijs 2004; Liemu and Koricheva 2005; Pearson et al. 2004; Smart and Bayer 1986; Tagliacozzo 1977). According to Smart and Bayer (1986) self-citations are bibliographic references by authors to one or more of their previous publications.

The self-citation trend fostered a conversation about the effect or non-effect of self-citation on articles' impact (Glanzel and Thijs 2004; Van Raan 1998, 2008). Authors are not in agreement as to whether or not self-citation affects scientific impact.

van Raan (2005) points out that self-citation could effect the phenomenon of citation in such a way that citation counts could lose its role as a reliable measure of impact. As (de Bellis 2009) stated, that one of the objections raised against the significance of citation counts is the ambiguous role of self-citations and Smart and Bayer (1986): "Self-citations could be especially troublesome in the use of citation rates to assess the relative impact of single versus multiple authored articles since the presence of multiple authors would enhance the likelihood of self-citations, and thus "inflate" the total citation counts of collaborative research".

According to these ideas many authors claim for the exclusion of self-citations while assessing the impact. Zhivotovsky and Krutovsky (2008, p. 375): "This calls for exclusion of self-citations from the h-index, and likely also from any other citation indexes, to achieve a more objective evaluation of the published research impact of individual scientists". (Ferrara and Romero 2013, p. 2333) states: "Although not fair, a robust indicator should discount self-citations to measure impact".

Conversely, authors as Carley et al. (2013, p. 777) states that the relationship between the number of authors and self-citation suggests that research collaboration, including international collaboration, will be more apt to include self-citations in these papers' reference lists. Other research authors have reported both results including self-citation and excluding it e.g., (Smart and Bayer 1986).

To overcome the problem of self-citation Hirsch (2005) presented the h-index. Although this index became the most famous indicator to measure impact, it has the limitation of not rewarding high numbers of citations (Egghe 2012, p. 2118). Later, Egghe (2006) presented the g-index which could be a more accurate measure to study the impact at the level of countries (Liu and Fang 2012; Schreiber 2010, 2013a, b) because it is a measure of overall impact but it is also a size dependent measure which could introduce bias in the analysis. For example, in the present study the countries with a higher scientific output are the ones with higher g index.

In our data revision we found that from 9,456 citations of 1,079 LA–C articles on management only 198 are self-citations (2.09 %). This proportion is significantly lower than 15.1 % for co-authored articles and 21.6 % for international co-authored articles reported by Van Raan (1998, p. 426). The self-citations have a minimum of 0 and a maximum of 6, a median of 0.00 and standard deviation of .295. This value is considerably lower than that of the discipline in general for the stage 1990–2010, which was 1 and standard deviation of 1.21. This result also shows a lower result to previous studies on the self-citation phenomena at country levels (e.g., see Jaffe 2011).

Another constraint the needed to be solved was the age of the article. To analyze a 21 years time span implies that the articles published in 1990 have higher probability of receiving a greater number of citations than those published in the year 2010, which introduces a bias in the analysis. To overcome this limitation, we adjusted the impact. To do this we calculated an adjusted citation impact (ACI) of each article by means of the formula $ACI = (TC - SC)/(RY - PY)$, where TC is the times the article is cited, SC self-citations, RY is the year of review and PY is the year of having published the article. This

way, the ACI is the result of dividing the total number of external citations each article received by the number of years lapsed from the appearance of the article until the moment that the review is carried out, in this case, the year 2014.

Independent variables

Collaboration There is a general consensus that the growth in multiple-authorship is evidence of an increase in collaboration. Subramanyam (1983, p. 35) has pointed out: “Although the assessment of collaboration using co-authorship is by no means perfect, it nevertheless has certain advantages such as: Firstly, it is invariant and verifiable. Secondly, it is a relatively inexpensive and practical method. Thirdly, the process of ascertaining collaboration does not affect the process of collaboration itself. Some would argue that bibliometric studies are non-intrusive and indeed non-reactive, that is, the measurement does not affect the collaboration process”. The Academic collaboration has many advantages to scientific research see Cimenler et al. (2014, p. 668, table 1).

Although many studies on collaboration have been conducted e.g. (Braun and Glanzel 2001; Glänzel 2002; Glänzel and Schubert 2005; Katz and Martin 1997; Van Raan 1998) little has been published on what is exactly meant by the concept of collaboration or on the adequacy of attempting to measure it through co-authorship. (Katz and Martin 1997, p. 16) state that research collaboration could be defined as the working of researchers to achieve the common goal of producing new scientific knowledge.

Collaboration can be understood as a communication network with its own dynamics. In general, collaboration appears when a scientific community reaches a level of maturity that makes it visible in a network of actors at national or international levels. This occurs through the quantity of publications as well as the quantity of researchers from different institutions and countries that collaborate for the elaboration and dissemination of this knowledge.

As Van Raan (1998) points out: “Collaboration is possible in many ways: exchange of researchers and students, joint research facilities and work meetings, organization of international conferences, division of tasks in a larger and broadly defined research program, or, almost the opposite, close cooperation in a well-defined project”. The academic collaboration, in the context of the present research, is understood by the latent structure formed by the group of countries that share and/or rationalize resources to generate, transfer and disseminate new scientific knowledge on the management discipline.

Thus, collaboration refers to the number of authors, institutions and countries that participate in the publication of the article. For the quantitative analysis we codified this variable as categorical with two levels (1) collaboration and (2) no collaboration. To codify the variable we took into account the number of signing authors of an article. Thus, an article in which two or more authors participated we coded it multi-authored as a measure of the existence of collaboration. When the article is single authored then there is no collaboration. When coding the variables we found 18 cases in which the articles are single authored but the author signed with two or more institutions or countries. We codified these special cases as “collaboration”

The level of collaboration International collaboration is essential in modern science and for developing nations this is a way for closing the gap with respect to more developed nations (Vogel 1997, p. 253). As (Van Raan 1998) points out co-publications will never provide a complete picture of international scientific collaborations but it allows one to determine important aspects of international collaboration, such as its possible influence on

the impact of articles. Previous studies about international collaboration have been conducted by Rousseau 2000, Van Raan 1998, Vogel 1997, Yu et al. 2014).

For the present study the level of collaboration is measured by the number of countries implicated in the publication of LA–C articles on management. Thus, the patterns of collaboration can include the participation of authors from one institution within a country, by authors from different institutions within a country or by two or more authors from two or more countries. Thus we codified this variable with two categories (1) domestic collaboration and (2) international collaboration. To codify the level of collaboration we have used three data: the number of signing authors (NAU), which we obtained in the field (AU) of the registration ISI of each article; the number of participant institutions in the article (NCS) which we got in the field of addresses assigned by ISI (C1) in each article. In 17 cases we were in doubt about the information to carry out the coding process. To clarify the information we used the web pages of the institutions for confirmation. The third data is the number of participant countries in the article (NCU), which we also obtained in the field (C1).

There are four possible behaviors according to the number of representatives of each of these data. This way, When $NAU = 1, NCS = 1,$ and $NCU = 1,$ there is no collaboration. When $NAU > 1, NCS = 1,$ and $NCU = 1,$ the collaboration is of type intra institutional, since there are multiple authors from the same institution and from the same country who have participated in the article. When $NAU > 1, NCS > 1,$ and $NCU = 1,$ the collaboration is at an inter-institutional level, because more than one author from more than one

Table 1 Scientific output, citation patterns and collaboration of 19 LA–C countries

Country	Scientific output		Collaboration ($n = 1,079$)		Level of collaboration ($n = 860$)							
			No collaboration	Collaboration	Domestic				International			
	<i>n</i>	%	Times cited	Self-citations	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Argentina	48	4.4	423	8	15	31.3	33	68.8	15	45.5	18	54.5
Barbados	10	.9	124	0	6	60	4	40	3	75	1	25
Bolivia	3	.3	109	0	0	0	3	100	0	0	3	100
Brazil	476	44.1	3,929	116	64	13.4	412	86.6	261	62.3	151	36.7
Colombia	74	6.9	231	11	28	37.8	46	62.2	22	47.8	24	52.2
Chile	149	13.8	2,013	28	20	134	129	86.6	52	40.3	77	59.7
Costa Rica	13	1.2	134	1	1	7.7	12	92.3	4	33.3	8	66.7
Cuba	2	.2	1	0	0	0	2	100	0	0	2	100
Ecuador	4	.4	1	0	1	25	3	75	1	33.3	2	66.7
Granada	1	.1	4	0	0	0	1	100	0	0	1	100
Guatemala	1	.1	82	0	0	0	1	100	0	0	1	100
Guyana	1	.1	49	0	0	0	1	100	0	0	1	100
Jamaica	4	.4	17	0	1	25	3	75	0	0	3	100
Mexico	148	13.7	1,867	16	39	26.4	109	73.6	33	30.3	76	79.7
Nicaragua	4	.4	1	0	1	25	3	75	2	66.7	1	33.3
Panama	2	.2	17	0	0	0	2	100	1	50	1	50
Peru	20	1.9	147	2	9	45	11	55	0	0	11	100
Uruguay	10	.9	87	4	2	20	8	80	4	50	4	50
Venezuela	109	10.1	218	12	32	29.4	77	70.6	57	74	20	26
Total	1,079	100	9,454	198	219	22	860	78	455	52.9	405	47.1

institution from the same country have participated in the article. These three cases we codified as domestic collaboration. If $NAU > 1$, $NCS > 1$ and, $NCU > 1$, then we codified it as international collaboration level.

Analysis

Description of the sample

When we applied the first inclusion/exclusion criterion it allowed selecting the population when finding 1,335 articles in the category *Management* in the Social Science Citation Index database. Eleven Latin American countries did not accumulate publications on management in the analyzed stage. They are: Bahamas, Belize, Dominican Republic, El Salvador, French Guiana, Guadeloupe, Haiti, Honduras, Martinique, and Paraguay. The second exclusion criterion resulted in the reduction of 256 articles, appearing 1,079 articles in 119 journals of the 2010 JCR edition (category management). This way, the sample for the study consisted of 1,079 articles published by the 19 Latin American countries that published at least one article during the time span analyzed.

Table 1 shows the scientific output per each LA–C country. Of the 1,079 articles, four countries Brazil, Chile, Mexico and Venezuela, account for 81.74 % of the overall Latin American scientific *oeuvre* on management. Brazil accounts for the largest percentage (44.1 %), followed by Chile (13.8 %), Mexico (13.7 %) and Venezuela (10.1 %). Each of the 15 remaining countries account for less than 10 % of the scientific production on management in the region: Colombia (6.9 %), Argentina (4.40 %), Peru (1.9 %), Costa Rica (1.2 %). The rest of the countries show percentages below 1 %.

Collaboration patterns of LA–C research on management at micro level

There were 2,817 authors that participated in the 1,079 LA–C articles analyzed. The range has a minimum 1 and a maximum of 49 authors. The median is two authors per article with a standard deviation of .965. We report the median because it is a better measure of central tendency than the mean when the frequency distribution is skewed (Morgan et al. 2013, p. 47). Our results were similar than those reported by Rousseau (2000) for theoretical physics. Higher results were found by Rousseau (2000) for theoretical and analytical chemistry which was 3 authors per article. An impressive 79.6 % of the Latin American scientific output on management between 1990 and 2010 was published through collaboration. This results shows a higher proportion than the one reported by Rodríguez-Pereira et al. (2000, p. 309) for Brazilian management science, results reported by Hudson (1996) for papers published in the American Economic Review (39.6 %) and in the Journal of Political Economics (54.9 %).

The patterns found in the micro level (collaboration inter-researchers) show that out of the 1,079 articles 219 papers (20.3 %) are single-authored (Table 2). This is a lower proportion in comparison to the discipline in general for the same time frame which was 44.3 % (42,501 articles). The 39.9 % are signed by two authors. This is also a superior proportion than that of the discipline in general which is 31.9 % (30, 610 articles). The 24.9 % are signed by three authors, a higher proportion than that of the discipline in general, which is 16.8 % (16,096 papers), and 14.9 % are signed by more than three authors, higher than 7.1 % (6,829 articles) of the discipline in general.

Table 2 shows the collaboration patterns at the micro level by country individually. Articles with the co-authorship of two researchers prevail in Brazil, Chile, Costa Rica, Cuba, Granada, Mexico, Nicaragua, Panamá and Uruguay. Jamaica and Ecuador published articles mainly through the collaboration among three authors. Bolivia, Guatemala and Guyana by more than three authors, while Barbados, Colombia and Peru the single authored articles prevailed. Abbasi et al. (2010, p. 6) found a similar behavior for science in general, while Liu et al. (2005, p. 1472, table 3) found more discreet values for digital libraries. This may demonstrate that the research teams on management in Latin America are small and the existence of laboratory research and experimentation is scarce.

Collaboration patterns of Latin American research on management at meso level

At the meso level (inter-institutions collaboration) in the 860 articles published through collaboration, 2,062 institutions participated, a minimum of 1 and a maximum of 29 with a median of two institutions per article and a standard deviation of .839.

The proportion of articles published in collaboration by authors within one institution is 29.2 % (251 articles) which is lower than that reported by (Yu et al. 2014) (52.45 %, $n = 66,504$) for Clinical Cardiology. The collaboration between two institutions accounts for 50.2 % which is a higher proportion than the 26.3 % reported by (Yu et al. 2014). Collaboration between three institutions accounts for 14.2 % which is superior to the 9.94 %, $n = 12,601$ of (Yu et al. 2014). The collaboration among more than 3 institutions accounts for 6.4 %.

Table 2 LA–C collaboration patterns at the level micro $N = 1,079$

LA–C	Number of authors (four categories)								Total
	1	%	2	%	3	%	>3	%	
Argentina	15	31.3	15	31.3	12	25	6	12.5	48
Barbados	6	60	3	30	1	10	0	0	10
Bolivia	0	0	0	0	1	33.3	2	66.7	3
Brazil	64	13.4	203	42.6	129	27.1	80	16.8	476
Colombia	28	37.8	26	35.1	14	18.9	6	8.1	74
Chile	20	13.4	61	40.9	46	30.9	22	14.8	149
Costa Rica	1	7.7	8	61.5	2	15.4	2	15.4	13
Cuba	0	0	2	100	0	0	0	0	2
Ecuador	1	25	1	25	2	50	0	0	4
Granada	0	0	1	100	0	0	0	0	1
Guatemala	0	0	0	0	0	0	1	100	1
Guyana	0	0	0	0	0	0	1	100	1
Jamaica	1	25	0	0	3	75	0	0	4
Mexico	39	26.4	56	37.8	26	17.6	27	18.2	148
Nicaragua	1	25	3	75	0	0	0	0	4
Panama	0	0	1	50	1	50	0	0	2
Peru	9	45	7	35	2	10	2	10	20
Uruguay	2	20	5	50	2	20	1	10	10
Venezuela	32	29.4	38	34.9	28	25.7	11	10.1	109
Total	219	20.3	430	39.9	269	24.9	161	14.9	1,079

Table 3 presents the patterns of collaboration at level meso for each LA–C country. For Barbados and Venezuela collaboration among authors from the same institution prevails. In countries such as Argentina, Brazil, Colombia, Chile, Cuba, Grenada, Guyana, Jamaica, Mexico, Nicaragua, Peru, Uruguay the collaboration between authors from two institutions prevail and for Bolivia and Guatemala the collaboration with the participation of authors from more than three institutions prevails.

Collaboration patterns of Latin American research on management at macro level

There were 75 countries that participated in the 860 articles published through collaboration, with minimum of 1 and a maximum of 25, a median of one and standard deviation of .678. At the macro level (inter–countries) articles through domestic collaboration prevails which accounts for the 53.2 % (458 papers). The 46.7 % (402 articles) were published through the international collaboration. From the international collaboration level stratum articles published with the participation of two countries accounts for 37.9 %. This is a higher proportion than that reported by (Yu et al. 2014) for the field of Clinical Cardiology (11.54 %, $n = 14627$). The articles published with the participation of three countries account for 6.6 % higher than (2.19 %, $n = 2775$) reported by (Yu et al. 2014), and the articles published with the participation of three countries 2.2 % which is also superior than (Yu et al. 2014) who reported $n = 1,034$, 2.2 %. Finally 2.2 % of articles were published with the participation of more than three countries.

Table 3 LA–C collaboration patterns at the level meso $N = 860$

LA–C	Number of articles	Number of institutions involved (four categories)							
		1	%	2	%	3	%	>3	%
Argentina	33	9	27.3	15	45.5	7	21.2	2	6.1
Barbados	4	3	75.0	0	0	1	25	0	0
Bolivia	3	0	0	1	33.3	0	0	2	66.7
Brazil	412	116	28.2	205	49.8	63	15.3	28	6.8
Colombia	46	10	21.7	28	60.9	5	10.9	3	6.5
Chile	129	39	30.2	67	51.9	17	13.2	6	4.7
Costa Rica	12	3	25	4	33.3	4	33.3	1	8.3
Cuba	2	0	0	2	100	0	0	0	0
Ecuador	3	1	33.3	1	33.3	1	33.3	0	0
Granada	1	0	0	1	100	0	0	0	0
Guatemala	1	0	0	0	0	0	0	1	100
Guyana	1	0	0	1	100	0	0	0	0
Jamaica	3	0	0	2	66.7	1	33.3	0	0
Mexico	109	22	20.2	67	61.5	13	11.9	7	6.4
Nicaragua	3	0	0	3	100	0	0	0	0
Panama	2	1	50	1	50	0	0	0	0
Peru	11	0	0	6	54.5	3	27.3	2	18.2
Uruguay	8	0	0	7	87.5	1	12.5	0	0
Venezuela	77	47	61	21	27.3	6	7.8	3	3.9
Total	860	251	29.2	432	50.2	122	14.2	55	6.4

Table 4 presents the patterns of collaboration at the macro level for each LA–C country. The patterns of collaboration at this level show a prevalence of domestic collaboration. This collaboration among institutions within the same country prevails in Barbados, Brazil, Colombia, Costa Rica, Nicaragua, Panama, Uruguay and Venezuela. Alternatively, collaboration between two countries prevails in Bolivia, Chile, Cuba, Grenada, Guyana, Jamaica, Mexico and Peru. Finally in Guatemala the collaboration among more than three countries is the dominant trend.

For all LA–C countries, the regional collaboration is low. Chile has the largest regional academic exchange in its publications (1.73 %) followed by Brazil 1.20 % and Argentina 1.15 %.

As to authors from countries with which the Latin American authors collaborate, according to the number of articles in collaboration, 26.79 % come from Europe, 19.72 % from North America, and 5.19 % from Asia. Rusell et al. (2007, p. 180) found that in Latin America, for science in general, 78 % of the works are signed by authors coming from universities in the U.S. or Europe. The values found for the management discipline in the region, are inferior to those reported by the referred authors.

Citation patterns of Latin American articles on management

Table 1 shows the values of the patterns of scientific production and the patterns of citations according to the independent variables. The 1,079 articles analyzed received 9,256 external citations. 29.9 % of articles (316) did not received citations, 12.4 % (134

Table 4 LA–C collaboration patterns at the level macro $N = 860$

LA–C	Number of articles	Number of countries involved (four categories)							
		1	%	2	%	3	%	>3	%
Argentina	33	15	45.5	15	45.5	3	9.1	0	0
Barbados	4	3	75	1	25	0	0	0	0
Bolivia	3	0	0	2	66.7	0	0	1	33.3
Brazil	412	265	64.3	122	29.6	18	4.4	7	1.7
Colombia	46	22	47.8	18	39.1	4	8.7	2	4.3
Chile	129	52	40.3	63	48.8	12	9.3	2	1.6
Costa Rica	12	4	33.3	3	25	4	33.3	1	8.3
Cuba	2	0	0	2	100	0	0	0	0
Ecuador	3	1	33.3	1	33.3	1	33.3	0	0
Granada	1	0	0	1	100	0	0	0	0
Guatemala	1	0	0	0	0	0	0	1	100
Guyana	1	0	0	1	100	0	0	0	0
Jamaica	3	0	0	3	100	0	0	0	0
Mexico	109	33	30.3	67	61.5	6	5.5	3	2.8
Nicaragua	3	2	66.7	1	33.3	0	0	0	0
Panama	2	1	50.0	1	50	0	0	0	0
Peru	11	0	0	7	63.6	3	27.3	1	9.1
Uruguay	8	4	50	3	37.5	1	12.5	0	0
Venezuela	77	57	74	14	18.2	5	6.5	1	1.3
Total	860	459	53.4	325	37.8	57	6.6	19	2.2

papers) received 1 citation, which is a proportion higher than that reported by (Garfield 1988) for Social Sciences 48.5 % (523 articles) received between 2 and 24 citations. 8.5 % (92 articles) received between 25 and 99 citations which is superior to the results (3.6 %) reported by (Garfield 1988). 0.6 % (7 papers) received more than 100 citations which is a higher proportion than the .4 % reported by (Garfield 1988).

The external citations have a minimum of 0 and a maximum of 304, a median of 3 and standard deviation of 18.28. The median of citations per articles in the management discipline, taking into account the overall scientific production in the document type “articles” in the 172 JCR journals of the discipline, for the period 1990–2010 was 3, $SD = 79.91$ (96,035 documents). This result shows that the median of Latin American articles on management is similar to the median for the discipline in general worldwide. If we were to report the difference using the value of the mean as the central tendency measure, the Latin American articles on management would be cited 10.77 times below the overall citation mean of the discipline ($LA-C = 8.73$, Overall discipline = 19.50). So this bias would be caused by the skewedness of the distributions of citation counts because extreme values would inflate the value of the citation counts mean.

Results

As we stated in the method section we used the Adjusted Citation Impact to test the research hypothesis. The dependent variable ACI has a minimum of 0.00 a maximum of 21.714 with a median of .312, and a standard deviation 1.605. The variance of 2.577 and skewness 4.135, (Shapiro–Wilk W -statistic = .585, $p < .001$) reflect extreme variances and high skewedness, consistent with the results of previous studies about research publication and citation patterns (Adams 2013; Smart and Bayer 1986) and more recent (Hanna-Mari et al. 2014, p. 828). The distribution of this variable follows a hyperbolic pattern (see Fig. 1) as described by the Power Law and confirmed in the Lotka’s Law.

Table 5 shows the mean ranks of the variable ACI according to patterns of collaboration. As can be observed, articles published through collaboration show a greater impact than articles published by a single author. Articles published through collaboration have 1.22 points impact more than the articles published without collaboration. This results is similar to that reported by Smart and Bayer (1986) for clinical psychology, management science and educational measurement and it is contrary to those reported by Rousseau (2000) for mathematics and theoretical physics. If we were to report including self-citation in the analysis similar results would appeared.

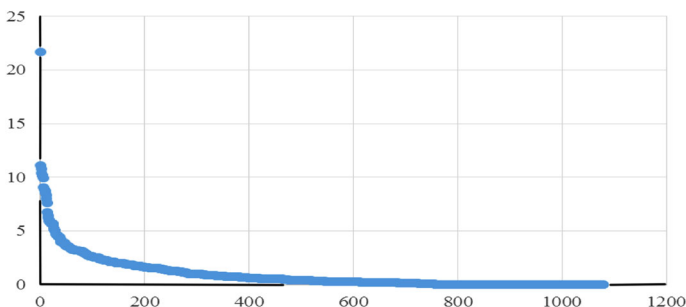


Fig. 1 Lotka distribution of the variable adjusted citation impact

A positive Spearman Rho correlation between the impact (ACI) of LA–C countries research on management and the variable collaboration was found $r_s = .133$ $p = .001$, a medium effect according to Cohen (1988) guidelines for Social Sciences.

We ran a Mann–Whitney rank sum test nonparametric to test for statistically significant differences on ranks between the two groups (collaboration vs. no collaboration) and the ACI of Latin-American articles about management because the normal distribution of the dependent variable was not met and the variances are unequal $Levene = 29.025$, $p = .001$. The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (Mann–Whitney U Statistic = 196193, $p < .001$). The 860 articles published through collaboration have higher ranks (560.78) than the 219 articles published without collaboration (458.40) on the ACI $U = 76,299$, $p = .001$, $r = .133$ a medium or typical effect according to Cohen (1988) guidelines. As the Mann–Whitney U nonparametric test does not provide in the output the r for effect size measure we calculated it using the Morgan et al. (2013, p. 179) conversion formula $r = \frac{z}{\sqrt{N}}$. The values of z and N are provided in the U test statistic table. According to the results the first hypothesis is sustained.

At the international collaboration level 83.3 % (335 articles) received citations and 16.7 % (67 papers) did not receive citations. For articles published with domestic collaboration 60.5 % (277 papers) received citations and 39.5 % (181 articles) did not. Table 5 shows the mean rank of the variable ACI for the level of collaboration. As can be observed, articles published through international collaboration show a greater impact than articles published through domestic collaboration. The articles published through international collaboration have 1.59 times more impact than the articles published through domestic collaboration. This result is similar than those reported by Rodríguez-Pereira et al. (2000) for Brazilian management science by Rousseau (2000) for mathematics, theoretical physics and for theoretical and analytical chemistry and by (Hanna-Mari et al. 2014, p. 832) for Natural sciences, Engineering, Medical and health sciences, Agriculture and forestry, Social sciences and Humanities. If we were to report including self-citation on the analysis, similar results would appear.

An association between impact and level of collaboration was found $r_s = .337$ $p = .001$. The result suggests collaboration plays an important role in the impact of articles.

We ran a Mann–Whitney rank sum test nonparametric to test for statistically significant differences on ranks between the two groups of level of collaboration (domestic vs. international) and, the ACI of Latin-American articles about management. The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (Mann–Whitney U Statistic = 397830,

Table 5 Mean ranks for adjusted citation impact and predictors variables ($N = 1,079$)

	<i>N</i>	%	Mean rank
<i>Collaboration</i>			
No collaboration	219	20.3	458.88
Collaboration	860	79.7	560.66
<i>Level of collaboration</i>			
Domestic	458	53.25	325.99
International	402	46.75	518.81

$p < .001$). There was a statistically significant difference on ACI between papers published through international collaboration (518.81, $n = 402$) and those published through domestic collaboration (325.99, $n = 458$), $U = 57019.5$, $p = .001$, $r = -.33$, a larger than typical effect according to Cohen (1988) guidelines. This result supports the second hypothesis.

Discussion and conclusions

The scientific output of LA–C research on management has increased significantly in the last 23 years. While in 1990 there were just six articles in journals of the discipline in the JCR, in the year 2001, 20 articles appeared, and in 2012, 241 were published. The pattern of growth described could be associated to the fact that during the time span analyzed, five journals of the region reached their inclusion in the database *ISI Web of Knowledge*. These results support Gómez et al. (1999, p. 444) who reported that the scientific production of the Latin American region for science in general, shows a positive correlation between the number of published articles and the existence of national journals in the main databases.

The impact of the Latin American articles on management in the stage analyzed depends on the academic collaboration. 71.30 % of Latin American articles published through academic collaboration were cited at least one time. This finding is higher than the values found in previous researches on the topic by (Acedo et al. 2006) and that of Rodríguez-Pereira et al. (2000, p. 309) but lower than Smart and Bayer (1986, p. 302, table 2). However, Acedo et al. (2006) found that no differences are apparent when comparing co-authored papers to those that are single-authored within the management journals. The result found in the present study opposes the one reported by the cited authors, for the behavior of the impact of the publications on management of the region is different than the general patterns shown in the discipline.

29.7 % of Latin American articles on management were not cited. This lack of citation could be due to the fact that a 27.96 % of articles are published in ISI Latin American journals. We can find the explanation to this behavior in the results presented by Cetto and Alonso-Gamboa (1998, p. 92) who concluded that the lack of visibility, insufficient material of good quality, precarious resources, limited readership and lack of institutional policies of recognition, support and promotion of the journals produced “at home,” pressures scientists to publish their best papers abroad. Also, Collazo-Reyes et al. (2008, p. 159) found for science in general, that Latin American and Caribbean journals with the highest impact factors also have the highest percentage of citations and papers published by authors coming from countries outside the LA–C geographical region. Also, we should keep in mind the results reported by Podsakoff et al. (2008, p. 653) that for the discipline management in general, a scarce number of articles achieve a high number of citations while a great number do not achieve any citations. This phenomenon has been described previously for science in general in what was called “Lotka’s Law” (Lotka 1926) or “Mathews Effect” Merton (1968, 1988).

Acosta et al. (2011, p. 63) found that for science in general, the greater the difference in the economic development of regions, the fewer the number of collaborations among their researchers. The results achieved in the present study oppose those described before by the authors mentioned. This behavior is conditioned by the achievement of the development of a social capital of the leading countries in the academic research of the discipline at the global level. This result has contributed to increasing impact in the Latin American publications but with the limitation of not having favored the generation and dissemination of

new knowledge on the main stream research fronts of the discipline at the international level.

The level of collaboration is associated to the impact of the Latin American publications on management. Although the patterns of collaboration at country level show a prevalence of domestic collaboration, the international coauthored articles showed higher impact and describes a similar pattern to that reported by Rousseau (2000) and Rodríguez-Pereira et al. (2000). This conclusion does not support Adams (2013, p. 558) findings that the impact of the publications on countries of emergent economies is associated to an increase in the domestic collaboration. The present research shows a behavior contrary to the one reported by the mentioned author and it is typical of developed economies, not of developing ones.

The findings indicate that the development of the networks of collaboration is a favorable strategy to reach competitive advantages by means of development of social capital of academic institutions. Additionally it could favor the growth of the economies through the development of the absorptive capacities for those countries with potential possibilities of achieving Knowledge based economies. It could have important implications to countries with developing economies that may possess resources and intellectual capacities to foster knowledge creation. The countries that do not foster international collaboration networks face the risk of their stagnation. However, this opportunity also imposes a challenge to the less developed nations to retain their scientists as intellectual property or research talent.

The regional collaboration among Latin American countries is very small (7.46 %). The answer to this behavior could be found in the preference of the researchers of the region to collaborate with authors of institutions coming from the leading countries in the research on management to reach access to scarce resources and to overcome the constraint of language barriers (Li 2014; Tietze and Dick 2012). However, it is advisable to do research about the perception of Latin American academicians on the phenomenon of collaboration and the elements that must be considered. This may encourage policies favorable to regional scientific development.

As scientific policies, the national Latin American institutions and universities should focus on: (1) to foster the basic research on management in the main research fronts. (2) The creation of new knowledge on the discipline to increase the possibility of their inclusion in mainstream journals. (3) To avoid the excessive replication of precedent studies carried out in other socio-economic and cultural contexts. These lines would contribute to the progressive development of the recognition of the Latin American researchers on management by the rest of the international scientific community. To stop being receivers in order to become emissors of knowledge should be the vision of the Latin American research on management in the coming years.

The present research opens the way to new research questions such as: What is the intellectual structure of the research on management in Latin America? What is the intellectual influence of North American and European researches on the managerial practice in Latin America? Do the journals where the Latin American articles on management are published influence their impact? Does the language in which the articles are published influence their impact? The answer to the formulated questions can constitute new lines of investigation for the scientific community that researches the topic in the region.

At the global level, it would be possible to contribute knowledge to this conversation by means of the extension of the study carried out to include the network of collaboration at the international level incorporating all the geographical areas to contrast the results obtained.

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