Research on Brazilian Multinational Enterprises: Descriptive and predictive analyses

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ARTICLE DETAILS

ABSTRACT

This study aims to review recent research on the internationalization of Brazilian multinational enterprises (I-BMNEs) based on an analysis of 174 published articles that have appeared in international and Brazilian academic journals, books, and conferences. The descriptive analysis includes citation analysis and provides a typology of the leading researchers and school affiliations, as well as the predominant theoretical and methodological approaches. Predictive analysis is based on a novel neural network approach in order to classify features of a manuscript and predict the fit of its publication. We found that research on I-BMNEs is driven by a small number of leading institutions and researchers using case studies as their research method and Uppsala and Eclectic Paradigm models as a theoretical framework. Citation analysis shows that foreign authors are cited in journal publications or translated books. The novel technique and design of the neural network approach was modeled to fit bibliometric studies and the outcomes of the predictive analysis correctly classified 56.25% of the manuscripts. We conclude by providing a set of recommendations to advance I-BMNE research.

1. Introduction

The rise of multinational enterprises has been a major phenomenon over the last decade (BCG, 2006; WRIGHT, ILATOTCHEV, HOSKISSON, PENG; 2005). This partly explains the increase in foreign direct investment (FDI) outflows from emerging countries, which totaled US$553 billion in 2013 and reached 39.2% of global FDI outflows, the highest level ever recorded (UNCTAD, 2014). A series of studies have sought to explain the sudden growth of EMNs (RAMAMURTI; SIGH, 2009; SAUVANT, MCALLISTER, MASCHEK; 2010; BRENNAN, 2011). For political scientists such as Nölke and Taylor (2010) and Nölke (2011), research in this field has become a "new industry."

In order to expand this "new industry", international business scholars have further developed established analytical instruments to account for the emergence of these companies. In some cases, theories such as the OLI framework (DUNNING, 1986), Uppsala Model (JOHANSON; VAHLNE, 1977; 2009) or Product Life Cycle Model (VERNON, 1966) have been extended (RAMAMURTI, 2008). In other instances, scholars have contested dominant internationalization theories, insisting on the need to develop new frameworks (MATHEWS, 2006).

Although FDI from developing countries seems to be a new phenomenon, in fact, it is not recent. The first registered case dates to 1890, when an Argentine firm undertook significant FDI in Latin America (KATZ; KOSACOFF, 1983). In terms of academic publication, the subject received considerable attention in the late 1970s and early 1980s, beginning with Lecraw (1977), Lall (1983) and

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Wells (1983), who offered a theoretical explanation for the specific characteristics of "Third-World" multinational enterprises.

A first wave of investments was made in the early 1980s, primarily by Latin American firms, while the second wave emerged in the early 1990s driven by the flows stemming from Asian Newly Industrializing Economies (DUNNING, HOESEL, NARULA; 1996; CHUDNOVSKY; LOPEZ, 2000). Unlike the first wave of FDI, which consisted mainly of investments aimed at neighboring and other developing countries, with similar or earlier stages of economic development (LALL, 1983; WELLS, 1983), the second wave involves direct resources for emerging as well as developed markets.

Brazilian companies are part of this scenario and their internationalization process has garnered considerable attention from researchers seeking to understand the increasing amount of foreign investments made. For instance, some Brazilian multinational enterprises (BMNEs) have attracted attention in the business press for successful merger and acquisition (M&A) deals of sizeable assets abroad. These include Ambev, South America's largest beverage company, which acquired John Labatt Ltd (Canada) for US$7.8 billion in 2004 (SAUVANT, 2005); JBS-Friboi, Latin America's largest meat producer, which acquired US-based Swift for US$1.4 billion in 2007, making the new company the most powerful force in the global beef business (BCG, 2007); and the Brazilian mining company Vale, which took over Canadian-based INCO in 2007 for US$16.7 billion (SAUVANT, 2008).

Surprisingly, international management studies that focus on the internationalization of BMNEs (I-BMNEs) are still new. Research in this field has not yet gained momentum when compared to other management areas, such as organization studies (BERTERO; KEINERT, 1994; VERGARA; CARVALHO, 1995; RODRIGUES; CARRIERI, 2001; VERGARA; PINTO, 2001), marketing (FROEMMING; LUCE, PERIN, SAMPAIO, BEBER, TREZ, 2000a; 2000b; VIEIRA, 2003), strategy (GOSLING; GONÇALVES, 2004; BIGNETTI; PAIVA, 2002), finance (LEAL; OLIVEIRA, SOLURI, 2003), operations management (ARKADER, 2003), corporate social responsibility (JABBOUR, SANTOS, BARBIERI; 2008), human resources management (TONELLI; CALDAS, LACOMBE, TINOCO, 2003; CALDAS; TINOCO, 2004), and information systems (HOPPEN, 1998; MEIRELLES; HOPPEN, 2005).

Bibliometric indicators have been extensively studied, mostly in international journals. Papavlasopoulos, Poulos, Korfiatis e Bokos (2010) compared journal citations based on the well-known ISI impact factor and their proposal counterpart the *cited distance factor*. These journal-based metrics are problematic in identifying distinctions between different fields of research, primarily health (MANN; AMHERST, MIMNO, McCALLUM, 2006). The Brazilian Coordination for the Improvement of Higher Education Personnel (CAPES)'s Qualis Capes evaluation system for Brazilian journals should be considered by Brazilian authors before submitting a manuscript to a journal (TRZESNIAK, 2006). Thus, there are gaps in investigating bibliometric indicators in Brazil, specifically in terms of classifying manuscripts *a priori* considering the Qualis Capes assessment and understanding citations in the field of business.

This paper aims to address this gap by reviewing recent articles that have published I-BMNEs using both descriptive and predictive analyses. First, the descriptive analysis seeks to provide a typology of the leading researchers and their school affiliations, the evolution of publications during the study period (1991-2012), characterize the predominant theoretical and methodological approaches, and conduct a citation analysis to identify the most cited researchers, their research topics and outputs. Second, a predictive analysis proposes a novel neural network approach to classify features of a manuscript and predict the fit of its publication in the International Business field.

This study is structured as follows: the next section explains the methodology applied to select the sample of articles reviewed for this study. A bibliometric analysis is presented of 174 papers that explore I-BMNEs. After describing the sample, we present our findings based on the total number of published book chapters, books, articles published in national and international journals and those published in EnANPAD proceedings. We also propose a novel neural network approach called Predictive Manuscript Status (PMS) in order to classify features of the manuscripts and predict the fit of their publication. Based on these findings, the conclusion of this study provides a set of recommendations on how I-BMNEs research can be advanced.

2. Methodological procedures

The methodology of this study follows two approaches. The first is descriptive, consisting of a bibliometric study and citation analysis. The second is a predictive analysis using a novel artificial neural network approach to classify papers before submission to a journal or conference.

The bibliometric study consists of four steps: (i) selection of the bibliography search; (ii) evaluation of the collected data; (iii) analysis and interpretation of the collected data; (iv) presentation of results (COOPER; LINDSAY, 1998). A sample of I-BMNEs articles was selected based on an extensive bibliographic search in journals and annals of Brazil's most important academic conferences on management, as well as the catalogs of commercial and university publishers. The article search was conducted using the words "internationalization", "international expansion", "foreign direct investment", "Brazilian firms", "Brazilian multinationals", "Brazil", and "emerging multinationals" in two languages (Portuguese and English). Academic journals selected were those classified as A1, A2 and B1 according to the 2012 Qualis Capes evaluation. Information was collected from journal articles written in English and Portuguese, using the EBSCO, Science Direct, Emerald, and SciELO databases. In addition, since books and articles published in EnANPAD conference annals were included, we checked for repeated articles in terms of study authors, titles, abstracts, keywords, and methodology (e.g. sample size, name of the company in the case study). It is known that articles may initially appear in conference annals and subsequently be published in an academic journal. As such, the most recent version (published in the academic journal) was selected.

We adopted a two-step approach to evaluate the data collected for this study. First, it was important to ensure that only the set of articles directly related to I-BMNEs were analyzed for this study. It should be noted that the present study is based on the premise that internationalization is defined according to whether a multinational company invests outside national borders. Therefore, articles containing cases and information on Brazilian firms that acquired assets abroad by buying existing companies, as well as those who established greenfield or joint venture (JV) investments, were included. However, studies that were limited to exploring the export activities of these firms were not considered, with the exception of those that also included findings on the firms' investments abroad. Second, each article was carefully examined to identify the contributions of specific authors and their leading institutions, as well as categorize the sample, methodologies and theories used in each study.

Two methods were employed to interpret and analyze the collected data. Total and adjusted count measures were compiled to assess the contributions of authors and institutions. These are explained in greater when the results of the bibliometric study are presented.

The descriptive evaluation also includes citation analysis, identifying the type of citations, language of the cited references, reference sources and outlets, most cited authors and papers in I-BMNE research.

Predictive analysis applied the Artificial Neural Network (ANN) approach, which provides powerful pattern classification and pattern recognition capabilities. ANNs are increasingly being used in a number of scientific fields, including health, engineering, computing and business. ANN is an interconnected group of artificial neurons (input, hidden and output neurons. See Exhibit 1) modeled on biological neural networks. It allows organizations to apply learning processes to solve classification and prediction problems. ANN is considered a multivariate, nonlinear and nonparametric statistical approach that generalizes a situation by inferring from samples, even when they contain noisy information (CHENG; TITTERINGTON, 1994).
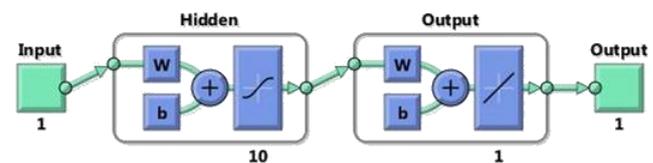
Figure 1: ANN Topology
Source: Papavlasopoulos et al. (2009)

This technique is commonly used to predict business failure and bankruptcy (TANG; CHI, 2004; ARULDOSS; TRAVIS, VENKATESAN, 2015), time series (KAASTRA; BOYD, 1995), business scores (VISHWAKARMA, 1995) and decision making (MARQUES; LACERDA, CAMARGO, TEIXEIRA, 2014). Zhang, Patuwo and Hu (1998) used neural networks to forecast future research and provide guidelines in the business field. Li (1994) designed a list of ANN methodological

techniques in business, forecasting which was most relevant.

Interestingly, Smith and Gupta (2000) and Wong, Lai and Lam (2000) studied the most important ANN types for business and which are better performed by business practitioners and managers. Predicting bankruptcy and financial issues are the predominant business areas for which ANNs are designed (WILSON; SHARDA, 1994; WONG; BODNOVICH, SELVI, 1997).

Specifically for bibliometric research, there are few studies in the literature that propose predicting a manuscript's features based on machine learning language. Papavlasopoulos *et al*. (2009) developed the Cited Distance technique with ANN in the field of bibliometrics to devise an ideal factor to evaluate articles. This methodology, called Predictive Manuscript Status (PMS), is a new approach for bibliometric studies. It consists of a linear and non-linear network classifier that predicts whether or not a manuscript can be previously classified for acceptance by a journal or conference, and can even determine which Qualis Capes classification the article falls under.

Subsection 2.1 (Descriptive analysis) presents several components of published articles on the internationalization of Brazilian multinational enterprises. However, those who believe that compiling an article based on means, medians or regressions of age, amount of references, number of journals or authors cited, or any other characteristics will lead to its successful publication will fail due to

the hidden connections that linear propositions cannot reveal. Our novel proposal goes beyond this and can even identify which Qualis Capes classification the manuscript falls under to help authors decide journal or conference to submit the manuscript to.

The steps taken in this approach are described in the following section.

3. Analyses and discussions

The Brazilian "boom" in international business research or I-BMNEs is quite recent, with its second phase characterized by large amounts of FDI allocated to developing and developed countries. A total of 174 articles were considered for this first I-BMNEs review: 67 chapters from 13 books, 38 articles from the most relevant international and Brazilian academic journals, and 68 from conference annals (Table 1).

It should be noted that the majority of book chapters are from edited volumes. The articles selected are from the EnANPAD (*Encontro Nacional da Associação Nacional de Pós-Graduação e Pesquisa em Administração)* conference annals. We selected manuscripts that were presented and published between 2001 and 2012.

In 2005, the academic association ANPAD (Brazilian Academy of Management) created an International Business subtheme in the Strategy in Organizations division. Since the second wave of internationalization in Brazilian companies is quite

Tab. 1
Sample distribution*

Selected Book Chapters	Academic Journals (38 articles)**		EnANPAD Annals
(67 articles)	International Journals (14 articles)	Brazilian Journals (24 articles)	(68 articles)
Rocha (2002)	Brazilian Administration Review (BAR)	Economia Global e Gestão (EGG)	2001 (4)
Rocha (2003)	Brazilian Business Review (BBR)	Gestão e Regionalidade (G&R)	2002 (5)
Fleury & Fleury (2007a)	European Business Review (EBR)	Revista de Administração	2003 (3)
Almeida (2007)	European Management Journal (EMJ)	Contemporânea (RAC)	2004 (2)
Sobeet (2007)	Intern. Journal of Emerging Markets (IJoEM)	Revista de Admin. da USP (RAUSP)	2005 (2)
Sauvant (2008)	Intern. Journal of Production Economics (IJoPE)	Revista de Administração de	2006 (5)
Vasconcelos (2008a, 2008b)	International Marketing Review (IMR)	Empresas (RAE)	2007 (6)
Ramamurti & Singh (2009)	Journal of Globalization, Competitiveness and	Revista de Administração	2008 (7)
Oliveira Junior (2010)	Governability (GCG)	Mackenzie (RAM)	2009 (9)
Ramsey & Almeida (2010)	Journal of International Business Studies (JIBS)	Revista Eletrônica de	2010 (8)
Fleury (2010)		Administração (REad)	2011 (9)
Fleury & Fleury (2011)			2012 (8)

Source: The authors

Notes: *Number inside ( ) refers to the analyzed articles
   **The oldest article published at the Brazilian journals was 1991, and 2007 for International journals.

recent, our sample is representative of research efforts undertaken in the field. It is important to underscore that the majority of the sample (61%) taken from EnANPAD annals are studies produced in the last five years.

3.1 Descriptive analysis

This section presents our findings on the total sample of recently published book chapters and articles identified in academic journals and EnANPAD annals. First, we present a summary of the leading authors and their institutional affiliation for the 17174 selected articles. Given the large number of co-authored studies, we summarize the types of collaborations that most often led to collaborative publications. Second, we provide a typology for the dominant methodological and theoretical approaches used in I-BMNEs research, as well as the companies most frequently studied. Third, we present the results of the citation analysis of the 6,025 references cited in our sample. Next, we summarize the types of references most often cited by national and international publications, indicating marked differences in the body of literature cited by a study depending on its publication outlet (foreign or domestic). Finally, we rank the top 20 authors most frequently cited in the references.

3.1.1 Authors and institutional affiliation

The number of authors per article in book chapters, academic journals and EnANPAD annals is shown in Table 2 and the distribution follows a similar pattern. Of the 174 articles analyzed, 86% were written by two or more authors (46% by two authors) and just 14% by a single author. The preference for collaborative research papers was confirmed in our findings. There are two possible reasons for the fact that articles

have more than one author. On the one hand, these articles could be the result of collaborative research undertaken by scholars working in teams or the result of the relationships forged between academic advisors and their graduate students.

We then analyzed the number of times author and institution names appear to determine the degree of diversity of contributions to the I-BMNEs field. The methodology used to measure the author contribution is similar to that employed by Morrison and Inkpen (1991) and Inkpen and Beamish (1994). As shown in Table 3, two different measures were adopted to rank author appearance in order so as to prevent inconsistencies regarding each author's contribution, primarily due to the large number of multiple-authored articles in our sample.

The first measure in Table 3 (adjusted appearances) includes a factor to scale the total number of articles written by multiple authors, while the second measure (total appearances) is the sum of the total number of articles for a particular author. For total appearance, the author receives one full credit when his/her name appears in the published article. If a paper was published by two or more authors, a weight-based measure was applied according to the number of co-authors. Articles with 2 authors were assigned a weight of half of a credit, while those with 3 authors received a third, 4 authors a quarter and papers with 5 authors were assigned one fifth of a credit. No distinction was made in credit allocation between the first author and other co-authors.

The review shows that there are a larger number of authors (a total of 241) who have contributed to I-BMNEs research. Due to space limitations, Table 3 only presents a ranking of authors with more than 1.50 credits in the adjusted appearance measure. It is

Tab. 2
Number of authors per article

Number of Authors	Selected Book Chapters		Academic Journals		EnANPAD Annals		TOTAL	
	#P [a]	% [b]	#P [a]	% [b]	#P [a]	% [b]	#P [a]	%
Single author	9	13.4 (36.0)	4	10.5 (16.0)	12	17.6 (48.0)	25	14.4
Two authors	31	46.3 (38.8)	17	44.7 (21.3)	32	47.1 (40.0)	80	46.0
Three authors	17	25.4 (36.2)	12	31.6 (25.5)	18	26.5 (38.3)	47	27.0
Four authors	10	14.9 (47.6)	5	13.2 (23.8)	6	8.8 (28.6)	21	12.1
Five authors	1	1.5 (100.0)	-	-	-	-	1	0.6
Total	67	100.0 (38.5)	38	100.0 (21.8)	68	100.0 (39.1)	174	100.0

Source: The authors
Notes: [a] #P refers to number of papers
        [b] The first information refers to column percentages, while the figures in parenthesis are the row percentages

important to note that this table presents an analysis of a specific period of time (1991-2012). The top 15 names account for 35% of total adjusted appearance indicator points. According to Table 3, the highest number of appearances was recorded for Moacir Oliveira Junior, with a total of 21 articles and a weighted score of 8.70. He is followed by Maria Tereza Fleury, with almost the same number of articles and a weighted score of 7.95. These individuals were the editors of four books considered in this review.

Federal University of Rio de Janeiro (UFRJ), with 20.50 credits in adjusted appearances. Both institutions are public universities, while the third, fourth and fifth institutions on the ranking (Escola de Administração de Empresas da Fundação Getúlio Vargas – EAESP/FGV, Fundação Dom Cabral - FDC, and Escola Superior de Propaganda e Marketing – ESPM) are all private. All of these institutions and their contributors are located in Southeast and South Brazil.

Tab. 3
Author Appearances

Authors [a]	Adjusted Appearances [b]		Total Appearances [c]	
	Rank	Credits	Rank	Credits
Moacir Miranda Oliveira Junior	1	8.70	1	21.0
Maria Tereza Fleury	2	7.95	2	20.0
Felipe Mendes Borini	3	7.25	3	18.0
Ângela da Rocha	4	6.58	4	15.0
Eduardo Vasconcellos	5	6.08	5	15.0
Afonso Fleury	6	4.95	6	12.0
Álvaro Bruno Cyrino	7	3.75	7	9.0
Luiz Carlos Honorio	8	3.50	10	4.0
Itiel Moraes Silva	9	2.00	25	2.0
Erika Penido Barcellos	10	2.00	8	6.0
Renato Cotta de Mello	11	1.83	9	5.0
Astor Eugenio Hexsel	12	1.50	25	2.0
Erika Piros Kovacs	13	1.50	10	4.0
Eva Stal	14	1.50	25	2.0
Brigitte Renata Bezerra de Oliveira	15	1.50	10	4.0

Source: The authors
Notes: [a] 226 authors have between 0.20 to 1.33 adjusted appearances (ADJ).
[b] Adjustments are made for multiple-authorships. Credit for an article with 2 authors is 0.5, 3 authors is 0.33, 4 authors is 0.25, and 5 authors is 0.20.
[c] Total appearances are the absolute number of articles. The author receives one full credit as long as his/her name appears on the published article.

Author affiliations were also analyzed. If an author's home institution was named in the article, this affiliation was assigned a credit. Institutional appearance is also weighted for articles written by authors from different institutions. In this case, the same methodology considered by Lu (2003) was adopted. The maximum credit received by an institution is 1, since only one credit was allocated to articles with more than two authors from the same institution. In some cases, when an author is simultaneously affiliated with two different institutions, each institution was given half a credit.

Eighty different institutions were identified in the sample. Researchers affiliated with the University of Sao Paulo (USP) had the highest number of contributions for I-BMNEs research. This institution had a weighted score of 41.68. This is followed by the

3.1.2. Methods and theoretical approaches most employed

Case studies are the most commonly applied method in I-BMNEs research (54.6% of the total). Other reviews of the Brazilian management literature reported similar findings for strategy (GOSLING; GONÇALVES, 2004), human resource management (TONNELI *et al*., 2003), and corporate social responsibility (JABBOUR *et al*., 2008). According to Robson (2002:178), a case study is a "research strategy that involves an empirical investigation of a particularly contemporary phenomenon within its real context using multiple sources of evidence."

Since the I-BMNEs is considered a "new" phenomenon, a number of authors in our sample have applied this technique based on data collected from interviews, questionnaires, observation and

document analysis. Together, the case studies provide a rich body of information about the internationalization process of Brazilian multinationals. However, it should be noted that 63.5% of the case study samples (61 papers) were based on a single firm. To perform hypothesis testing across different companies, Eisenhardt (1989) argues that case studies that include the experience of multiple companies are preferable to single firm case studies.

Surveys were used by 24.7% of the studies in the sample. This method involves choosing a target group of companies and sending questionnaires. If the sample is small and response ratio low, it is more difficult to apply quantitative analysis using statistical tools. Of the 43 articles that used a survey design, only seven had a sample of 100 or more companies, while eight studies had samples smaller than 50 companies. Thus, there are few published articles that have performed statistical analysis (16 used regression analysis, 9 showed only descriptive statistics, and 7 applied cluster analysis).

The Uppsala and the Eclectic Paradigm models are the most commonly applied theoretical perspectives in I-BMNEs investigations. Three additional models or theoretical approaches that are widely used are "Subsidiary Initiative or Autonomy", "Resource-Based View", and "Core Competences". The Uppsala model explains the internationalization process based on knowledge accumulation (JOHANSON; WIEDERSHEIM-PAUL 1975, JOHANSON; VAHLNE, 1977, 1990). This model is based on the assumption that lack of knowledge about international markets is the major obstacle to foreign operations. However, this knowledge can be acquired by an evolutionary and sequential building-up of foreign commitments over time. A total of 46 articles used this model based on the idea that the internationalization of Brazilian companies follows a process of increasing foreign commitments to international markets.

It should be noted that the application of the Uppsala model in I-BMNEs studies led to different results. While some articles reported findings to support the model, others found only partial support. In addition, some studies argue that the model does not fit the Brazilian context. Given these contrasting findings, a more in-depth discussion of the model's suitability as a theoretical framework for the Brazilian context is an interesting research question to explore in future research.

Dunning's (1977, 1980, 1988) Eclectic Paradigm is the second most frequently applied model in I-BMNEs studies with 13 appearances. This framework is based on three components that determine which firms enter a foreign market, commonly referred to as OLI: ownership, location and internalization advantages. More specifically, ownership advantages refer to firm-specific advantages such as asset power, control, and inter-firm relationships. Location advantages refer to particularities of the market, including the availability and cost of resources. Internalization advantages concern the reduction of transaction and coordination costs. The OLI framework was applied and supported in articles on the internationalization of Brazilian meat companies.

A number of studies examine the same experience in a small sample of Brazilian multinationals. Not surprisingly, the most commonly examined firms in I-BMNEs (Gerdau, Embraer, WEG, Petrobras, Vale, Natura, Odebrecht, Marcopolo, and Tigre) were almost the same companies listed in the Top 25 Brazilian multinational enterprises, ranked in terms of foreign assets, released by the Fundação Dom Cabral in partnership with the Columbia Program on International Investment (FDC, 2012). This implies that research interest in a particular firm is positively related to the degree of its internationalization. Although the international growth of Brazilian multinationals focuses on resource-based activities (FDC, 2012), this study indicates that authors have also shown an interest in companies from medium to high-technology industries, including Embraer, Natura, Weg, Marcopolo, Datasul, and Sabó.

3.1.3 Citation analysis

A citation analysis was performed to examine the most influential authors, studies, and outlets in I-BMNEs research. We were interested in identifying the relevant literature employed by Brazilian scholars working in the field of international business. A total of 6,025 citations were coded. Table 4 summarizes the portion of studies that cite past research by their authors (self-citation), as well as research published in Brazil and abroad.

The first observation in Table 4 refers to the high percentage of citations for foreign scholars (79%), with the highest of these recorded for studies from EnANPAD annals (82%) followed by academic journals (80%). These numbers are higher than the results of previous research in other management

fields. For instance, Vergara and Pinto (2001) found that foreign citation accounted for 63.62% of the Brazilian organization studies literature, with most sources referring to U.S.-based scholars. In the human resource management area, Caldas and Tinoco (2004) also observed a similar outcome (63%) for citation from non-national scholars. More recently, Machado-da-Silva *et al*. (2008) conducted a bibliometric analysis and reported that foreign citations corresponded to 52.4% of the studies cited in select Brazilian academic journals in management.

research, including terminologies. This pattern may also be because Portuguese language materials are less expensive and easier to use than imported books.

A small number of Brazilian scholars were cited in international publications, as shown in Table 5. The figure is slightly better for self-citations, with 27.5% of 193 references published in English (total of 53 publications: 22 academic journals, 12 conference papers, 15 books/book chapters, and 3 reports). Considering all citations of national scholars, only

Tab. 4
Type of citation in I-BMNE research

Number of Authors	Selected Book Chapters		Academic Journals		EnANPAD Annals		TOTAL	
	# Citations	%*	# Citations	%*	# Citations	%*	# Citations	%
Self-citation	108	5.5 (56.0)	46	2.8 (23.8)	39	1.6 (20.2)	**193**	**3.2**
Citation of foreign scholars	1,471	75.1 (31.0)	1,316	79.3 (27.7)	1,960	81.5 (41.3)	**4,747**	**78.8**
Citation of national scholars	380	19.4 (35.0)	298	18.0 (27.5)	407	16.9 (37.56)	**1,085**	**18.0**
Total	1,959	100.0 (32.5)	1,660	100.0 (27.5)	2,406	100.0 (39.9)	2,583	100

Source: The authors
Notes: * The first information refers to column percentages, while the figures in parenthesis are the row percentages

This result is directly related to an outcome mentioned in the previous section, whereby a number of studies applied theoretical approaches developed in other countries. The concentration of citations from foreign sources is positive in that it underscores that Brazilian scholars are aware of the discussion underway in the international business literature. In other words, Brazilian authors are not isolated and are learning intensively from knowledge produced beyond their borders. However, as noted earlier, this emphasis is also negative in the sense that national research predominantly focuses on simply describing and replicating foreign approaches.

Another interesting finding is the number of foreign citations for books translated into Portuguese. Among the references published in Portuguese, 18% were translations of research produced in a foreign language. This implies that some authors preferred to use a translated version rather than the original work, indicating a trend in Brazilian research to expanded the reading and understanding of foreign materials by translating them into Portuguese. This trend may also suggest that scholars in this area are more familiar with the Portuguese version of these studies than the original

3.6% of the total come from research papers published in international outlets (total of 39 publications: 17 academic journals, 7 conference papers, 8 books/book chapters, and 7 others). There are several possible explanations for these findings: (1) authors in the I-BMNEs area focused on research published by foreign scholars; (2) the authors did not intend to cite and promote other national scholars who had published their work internationally; (3) only a few Brazilian scholars in the I-BMNEs field published academic papers in foreign outlets (i.e. English). The most likely explanation is the last item on this list.

With regard to this issue, Mesquita (2008) suggested a need for national scholars to actively insert themselves into the international community by publishing articles in a foreign language. Based on data for research papers published in English and the authors' nationality, the author found that Brazilian scholars are far behind in terms of international publication when compared to researchers from BRICS countries (China, India, Russia and South Africa).

Tab. 5
Language of the cited references in I-BMNE research

Number of Authors	National language		Foreign language		TOTAL	
	# Citations	% *	# Citations	% *	# Citations	%
Self-citation	140	9.5 (72.5)	53	1.2 (27.5)	**193**	**3.2**
Citation of foreign scholars	282	19.2 (5.9)	4,465	98.0 (94.1)	**4,747**	**78.8**
Citation of national scholars	1,046	64.2 (96.4)	39	0.9 (3.6)	**1,085**	**18.0**
Total	**1,468**	**100.0 (24.4)**	**4,557**	**100.0 (75.6)**	**6,025**	**100.0**

Source: The authors
Notes: * The first information refers to column percentages, while the figures in parenthesis are the row percentages.

3.1.4 Reference sources and outlets

Table 6 shows the types of references most commonly cited in e I-BMNEs studies. There is a significant difference between the top 5 sources referenced in domestic and international publications. Books are the most common source of references (almost 36%) for domestic publication, which is similar to the results found by Vieira (2003) in the area of marketing and by Caldas and Tinoco (2004) in the field of human resources management.

result of a rigorous peer review process. In particular, conference papers are well-known as research to be considered as still underway (BERTERO *et al.*, 1999).

In terms of international publication, academic journals are the most influential source in I-BMNEs studies. The total number of article citations in international publications is three times higher than the number of book citations. For international outlets, Brazilian researchers are more likely to refer to refereed academic materials in a variety of

Tab. 6
Reference sources in I-BMNE research

Reference sources	Domestic Publication	
	# Citations	%
Books	523	35.6
Book chapters	226	15.4
Academic Journals	161	11.0
Conference Annals	158	10.8
Webpages	106	7.2
Others	295	20.1
Total	**1,468**	**100.0**

Reference sources	International Publication	
	# Citations	%
Academic Journals	2,867	62.9
Books	926	20.3
Book chapters	317	7.0
Report	141	3.1
Working papers	83	1.8
Others	223	4.9
Total	**4,557**	**100.0**

Source: The authors

The book most frequently cited as a reference source was a translated book on case study method. In fact, 240 (49%) of the 494 national books that were cited were foreign materials translated into Portuguese. Book chapters were the second most common reference source (15.4%) for domestic publication. Other sources, such as web pages and conference annals, were also used. The former were generally based on the company's homepage information used to develop case studies, while the latter refer to articles published in the EnANPAD conference annals. Although some books and book chapters were refereed materials, it should be noted that most of the sources in these top 4 citations were not the

international journals (total of 2,729 citations from 374 outlets) rather than domestic journals (159 citations from 45 outlets).

In the ranking list of outlets, only the Harvard Business Review is not considered an academic journal. The most influential outlet for I-BMNEs studies is the Journal of International Business Studies (JIBS), which has almost four times more citations than the second on the list (Strategic Management Journal, SMJ). In fact, this result is logical and expected, since the JIBS is the premier outlet for international business research (DUBOIS;

Tab. 7
Reference sources in I-BMNE research

Top Domestic Outlets	Type [*]	#A [**]	Top International Outlets	Type [*]	#A [**]
EnANPAD annals	Co-An	112	Journal of International Business Studies	Ac-Jo	515
Revista de Administração Contemporânea (RAC)	Ac-Jo	31	Strategic Management Journal	Ac-Jo	263
Revista de Administração de Empresas (RAE)	Ac-Jo	30	Harvard Business Review	Bz-Mg	139
Internacionalização de Empresas Brasileiras (FDC)	Bk-Ch	29	International Marketing Review	Ac-Jo	110
A internacionalização das empresas brasileiras (ROCHA)	Bk-Ch	24	Management International Review	Ac-Jo	104
As novas fronteiras: A multinacionalização das empresas brasileiras (ROCHA)	Bk-Ch	23	Academy of Management Review	Ac-Jo	102
Revista de Administração da USP (RAUSP)	Ac-Jo	22	International Business Review	Ac-Jo	78
Revista EXAME	Bz-Mg	22	Journal of International Marketing	Ac-Jo	76
Universidade de São Paulo (USP)	Report	19	Academy of Management Journal	Ac-Jo	70
Internacionalização e os países emergentes (FLEURY & FLEURY)	Bk-Ch	18	Journal of Management Studies	Ac-Jo	56

Source: The authors
Notes: * Co-An (Conference annals); Ac-Jo (Academic journals); Bk-Ch (Book chapters); Bz-Mg (Business magazine).
   ** Total number of articles

REEB, 2000; CANABAL; WHITE III, 2008). Werner (2002) also considered the JIBS and SMJ as the top journals among premium management journals. Likewise, only a small number of citations came from domestic academic journals. Only three domestic journals (RAC, RAE, and RAUSP) were among the top 10 most commonly cited outlets for I-BMNEs studies.

created according to the number of authors for each cited article. A total of 4,776 authors were cited in the 174 articles that comprise our sample.

John Dunning was the most cited author, with a total of 157 citations (adjusted citations=145.50), following by Jan Johanson (adjusted citations=104.83). Jan Johanson and Jan-Erik Vahlne

Tab. 8
Most cited authors

Rank	Adjusted Citations [a]		Total Citations [b]	
	Authors	Credits	Authors	Credits
1	Dunning, J.H.	145.50	Johanson, J.	213
2	Johanson, J.	104.83	Dunning, J.H.	157
3	Porter, M.	73.37	Vahlne, J-E.	145
4	Vahlne, J-E.	71.33	Ghoshal, S.	123
5	Birkinshaw, J.	65.00	Birkinshaw, J.	117
6	Ghoshal, S.	62.03	Bartlett, C.A.	97
7	Unctad	57.00	**Rocha, A. [**]**	84
8	**Rocha, A.[**]**	51.75	Porter, M.	77
9	Bartlett, C.A.	50.00	**Fleury, M.T.L. [**]**	73
10	Yin, R.K.	42.00	**Fleury, A. [**]**	69
11	Rugman, A.M.	41.00	Unctad	57
12	Barney, J.B.	40.50	Rugman, A.M.	56
13	**Fleury, M.T.L. [**]**	35.53	Forsgren, M.	52
14	**Fleury, A. [**]**	34.12	Wiedersheim-Paul, F.	47
15	Vernon, R.	27.00	Barney, J.B.	45

Source: The authors
Notes: [a] Adjustments are made for multiple-authorships. Credit for an article with 2 authors is 0.5, 3 authors is 0.33, 4 authors is 0.25, and 5 authors is 0.20.
   [b] Total citations are the absolute number of articles. The author receives one full credit as long as his/her name appears on the published article.
   ** Brazilian scholars

3.1.5 Most influential authors and research

To create a ranking of the authors cited in I-BMNEs, we followed the same procedures described earlier. For "total citations", all authors received 1 full credit as long as their name appeared on the reference list, while for "adjusted citations" a weight measure was

(adjusted citations=71.33) are from a Norwegian school that developed the Uppsala model, while John Dunning from the University of Reading designed the Eclectic Paradigm framework. As previously mentioned, the most frequently cited authors in I-BMNEs studies were foreign scholars (17 out 20).

Only three Brazilian scholars are among the top 20 most-cited authors (i.e. Angela da Rocha, Maria Tereza Fleury and Afonso Fleury). These authors are also the editors of five books examined in this review and the main contributors to the I-BMNEs field (See Table 8).

As shown in Table 9, the most cited studies in I-BMNEs researched were identified from 6,025 citations in 174 articles included in this study. The ranking also reveals the top 10 most influential studies published in academic journals (7), books (4), and a business magazine (1). For academic journals (all international), 3 were related to the Uppsala Model (JOHANSON; VAHLNE, 1977, 1990; JOHANSON; WIEDERSHEIM-PAUL, 1975) and another 3 to the Eclectic Paradigm (DUNNING, 1980, 1988, 1993), which is in accordance with the main theoretical approaches used by I-BMNEs scholars mentioned earlier.

(one) and those in Portuguese, 0 (zero). The result is formalized by the following mathematical pattern ρ:

$$\rho = [a1 \; a2 \; a3 \ldots aj \ldots aJ], where$$
$$aj = 1, \forall j$$
$$\in [1, J-2], \quad \textit{if the article was published in a}$$
$$\textit{Qualis Capes A1 or A2 Journals}$$
$$aj = 0, \forall j \in [1, J-2], otherwise,$$
$$aJ - 1 = 1, if \; article \; is \; in \; English,$$
$$aj = 0, otherwise,$$
$$aj = 1, if \; article \; a \; Quantitative \; Approach,$$
$$aj = 0, therwise,$$
$$\vdots$$
$$where \; J \; is \; the \; total \; number \; of \; attributes \; and \; aj \; is \; the$$
$$j - th \; attribute$$

Eq.1

We also added the following attributes to complete this step: age of the article, number of citations and which conference or Qualis Capes journal classification the article was published under (A1, A2 and B1). Values for these attributes were normalized because the range of values was higher than 1.

The second step was the Training Process, which

Tab. 9
Most cited researches

Ranking	Authors	Outlets	Type*	Total Citations
1	Johanson & Vahlne (1977)	Journal of International Business Studies	Ac - Jo	69
2	Johanson & Wiedersheim-Paul (1975)	Journal of Management Studies	Ac - Jo	30
3	Bartlett & Ghoshal (2000)	Harvard Business Review	Bz - Mg	29
4	Johanson & Vahlne (1990)	International Marketing Review	Ac - Jo	29
5	Dunning (1988)	Journal of International Business Studies	Ac - Jo	26
6	Barney (1991)	Journal of Management	Ac - Jo	21
7	Nohria & Ghoshal (1997)	The differentiated network: Organizing multinational corporations for value creation	Book	20
8	Dunning (1980)	Journal of International Business Studies	Ac - Jo	20
9	Doz, Santos & Willianson (2001)	From global to metanational: how companies win in the knowledge economy	Book	19
10	Dunning (1993)	Multinational Enterprises and the Global Economy	Book	19
10	Buckley & Casson (1976)	The future of the multinational enterprise	Book	19
10	Birkinshaw, Hood & Jonsson (1998)	Strategic Management Journal	Ac - Jo	19

Source: The authors
Notes: * Ac-Jo (Academic journals); Bz- Mg (Business magazine)

3.2. Predictive analysis

As previously discussed, this study was divided into descriptive and predictive parts, outlining the main features of the I-BMNEs studies. This section discusses predictive features. The proposed approach is divided into 3 steps. The first step, denominated Feature Vectors, included all data identified in the descriptive analysis. For instance, articles written in English were attributed a value of 1

involved classifying the group of articles in the dataset using the Feature Vectors step. Ninety articles published in different scientific journals and conferences in order to obtain a randomly distributed set of attributes. We highlighted the ones that were published in Qualis Capes journals, called target articles. For each article was highlighted, a pattern was compiled according to its attributes. The same was done with articles not published in Qualis Capes

journals, called non-target articles. This produced a group of sets with target and non-target articles.

The last step is the Classification Process, in which each of these 90 articles is assigned a classification score. Articles are classified as target or non-target according to their low or high score. This step was key to understanding the weight of the attributes in each group in order to classify manuscripts as a priori. Two different neural network techniques were assessed (cascade and multilayer perception (MLP)). For both these techniques, the hidden layer consisted of ten neurons and the output layer of only one neuron. It is important to that the adjustable parameters of the output label value were randomly set within a range of -1 to +1.

The Cascade Neural Network (CN) consists of neurons where the number of ρ inputs increases from one layer to the next. The neural network starts without hidden neurons, with one neuron added and trained at each iteration so that it automatically provides a minimal size for the neural network. Schetinin (2003, p.2) describes the architecture of the CN with the following equation:

$$z_r = \int (u, w) = 1/(1 + \exp(-\Sigma\Sigma_i^\sigma u_i w_i)) \qquad \text{Eq.2}$$

where the output z_r of the r-th neuron with p=r+1 inputs as followed above and "where r=1, 2, … is the number of layer, ʃ is an activation function, $u = u_1 \dots u_p$, is a px1 input vector of the r-th neuron, and w_0, …, w_p are the components of weight vector w".

The Multilayer Perceptron (MLP) network consists of more than one layer of feedforward neurons where values only move from input to hidden to output layers. This type of network consists of layers of interconnected neurons with biases and weights, using the back propagation algorithm. According to Haykin (2009), the output of the k-th neuron yi(t), k = 1; …, c, is given by

$$y_k(t) = \tanh \left[\sum_{i=1}^{q} m_{ki}(t) \tanh \left(\sum_{j=0}^{p} w_{ij}(t) x_j(t) \right) - \theta_k(t) \right] \qquad \text{Eq.2}$$

where x(t) is the current input vector feature; $w_i(t) = [w_{i1} \ w_{i2} \dots w_{iq}]^T$ is the weight vector of the *i*-th hidden neuron; m_{ki} is the weight connecting *i*-th hidden neuron to the *k*-th output neuron. The parameter Θ_k is the bias of the *k*-th output neuron.

Both types of neural network were tested and the results for the Cascade Neural Network correctly classified only 37.5% of the manuscripts. However, the MLP Network correctly classified 56.25%, which represents an increase of 50% in relation to the Cascade Neural Network. The MLP was trained by using a learning step of 0.01 for 100 epochs, the number of hidden layers was set to 10 and the number of output layers was set to 1. Exhibit 2 shows the results of the MLP Network, where the intersection of both lines (blue and red) indicates correct classification of a manuscript. The numbers in the x axis represent the number of papers trained with the PMS approach and -.2.5 and +2.5 in the y axis represent the classification of papers published in conferences and A1 journals, respectively. This implies that the proposed algorithm can be effectively used to train neural networks applied to bibliometric studies.
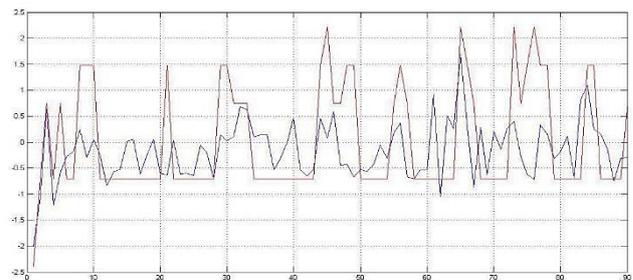

Figure 2: Results of the Classification Process
Source: Predictive Manuscripts Status (PMS)

4. Final considerations

I-BMNEs research is still new. Most of the recently published studies were multiple-author articles and were largely produced as part of the academic advisory relationship typical in graduate studies. Advisors and graduates from the University of São Paulo and the Federal University of Rio de Janeiro, which are the two top-ranked institutions in terms of published studies in this field, are responsible for almost 40% of the research published in the three data sources examined in this study.

Case studies are the most commonly used method in the field of I-BMNEs research. Surveys were used in some cases, but based on samples of 50 companies or less. A small number of articles conducted statistical analysis. The Uppsala model is the leading theoretical approach in the studies analyzed, followed by the OLI model. Regardless of the theoretical approach employed by Brazilian scholars, their interest in researching a particular firm seems

to be positively related to the size of the company and its degree of internationalization. This study, considers 174 articles that encompass another 6,025 articles written by 4,776 different authors. Our analysis shows that a large number of citations reference studies produced by foreign scholars. Not surprisingly, the top 3 authors cited in the ranking are foreign authors who developed the two most commonly used theories in the I-BMNEs field. This shows that Brazilian authors base their research on the internationalization of Brazilian multinationals on theoretical approaches and models created in other developed countries.

We have identified some important findings regarding the scope and nature of I-BMNEs research. The results of our study provide some valuable insights on the types of research activities that should be undertaken. There has been limited application of theoretical approaches and research methods in the I-BMNEs field. In order to build a stronger research core and conduct more rigorous hypothesis testing, multi-case studies and the analysis of larger samples of companies should be priorities when studying the internationalization of Brazilian multinationals. Institutional and regional research efforts concentrated in top institutions in the southeast of the country could be decentralized in order to better encompass the internationalization experiences of companies and researchers from Mid-West, North and Northeast Brazil.

It is also important to underscore that only a small number of I-BMEs papers have been published in international outlets: only 14 from 1991-2012. We believe that improving this number is an obvious and reasonable goal for Brazilians in the I-BMNEs research field. "Internationalization" should not be restricted to the research topic investigated by Brazilian authors, but also applied to the diffusion of this knowledge so it can be shared with international academia. Our results also indicate a need to increase the number of publications by national scholars in international peer-reviewed journals with a high impact factor. In order for I-BMNEs research to contribute significantly to the international business literature, it must strive to attain internationalization of its academic production.

In terms of the proposed novel approach employed in predictive analysis, the training algorithm was applied to a real-world problem related to the classification of I-BMNEs papers. The

MLP PMS approach successfully learned (automatically) and classified the quality of a manuscript. The findings show that the MLP correctly classified 56.25% of the testing manuscripts, while the Cascade provided only 37.5% correct classifications. Thus, the MLP algorithm applied to the PMS approach performed 50% better than the Cascade neural network technique. This shows that the proposed algorithm design can be effectively applied in neural networks to bibliometric studies.

The outcomes confirm the originality of this predictive proposal and shed light on classifying manuscripts considering Qualis Capes assessment, a unique Brazilian system for evaluating journals. The PMS approach also bridged another gap when using articles already published in the business field. The findings show that this approach can help senior and new researchers *a priori* to submit a manuscript to Qualis Capes journals or conferences in the business field. The results can also be generalized to other areas of academia, so that replications and comparisons should be expected for further research.

Although this study presented some interesting and important findings for the I-BMNEs literature, there were also limitations. First, the study period (1991-2012) descriptive analysis results to this specific time. Future research could expand the number of articles by considering recent publications on I-BMNEs. Second, the keywords selected to search for I-BMNEs could affect the results for author appearances. Further research could include more keywords when selecting articles for I-BMNEs studies. Third, the analysis was conducted using internationalization of generic firms, that is, from different industry sectors. This was due to the limited number of Brazilian cases. However, additional studies could perform an in-depth analysis of Brazilian internationalization by sector. A limitation of the predictive study was the low number of papers to train due to the small size of I-BMNEs studies. We suggest replicating the PMS approach in a large sample of manuscripts in other research fields (strategy, finance, marketing, etc.) to confirm the effectiveness of the PMS. Secondly, although the PMS approach correctly classified 56.25% of the articles, it is still a low percentage considering the results of neural networks in other research fields, such as. finance and health. Indeed, the results indicate that the proposed approach is promising for bibliometric studies and we suggest creating different topology

designs and a classification committee of neural network techniques to compare classification results based on different approaches.

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Pesquisa sobre empresas multinacionais brasileiras: Análises descritivas e preditivas

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DETALHES DO ARTIGO

RESUMO

Este estudo visa examinar pesquisas recentes sobre a internacionalização de empresas multinacionais brasileiras (I-BMNEs) com base na análise de 174 artigos publicados que apareceram em periódicos acadêmicos, livros e conferências internacionais e brasileiras. A análise descritiva inclui a análise de citações e fornece uma tipologia dos principais pesquisadores e faculdades, bem como as abordagens teóricas e metodológicas predominantes. A análise preditiva é baseada em uma nova abordagem de rede neural a fim de classificar as características de um manuscrito e prever a adequação de sua publicação. Constatamos que as pesquisas sobre I-BMNEs são realizadas por um pequeno número de instituições e pesquisadores líderes, usando estudos de caso como seu método de pesquisa e modelos de Uppsala e de Paradigma Eclético como estrutura teórica. A análise de citações mostra que autores estrangeiros são citados em periódicos ou em livros traduzidos. A nova técnica e estrutura da abordagem de rede neural foi criada para adequar os estudos bibliométricos e os resultados da análise preditiva classificaram corretamente 56,25% dos manuscritos. Concluímos fornecendo um conjunto de recomendações para avançar as pesquisas sobre I-BMNEs.