ABSTRACT NUMBER: 015-0454

Product-mix decision: a bibliometric analysis of international academic publishing

ABRAÃO FREIRES SARAIVA JÚNIOR - Polytechnic School - University of São Paulo

Address: Av. Prof. Almeida Prado, Travessa 2, Nº 128 - Cidade Universitária - São Paulo/SP - Brazil - Zip code: 05508-070

E-mail: abraaofsjr@gmail.com

Telephone: +55 11 8829–4729

REINALDO PACHECO DA COSTA - Polytechnic School - University of São Paulo

Address: Av. Prof. Almeida Prado, Travessa 2, Nº 128 - Cidade Universitária - São Paulo/SP - Brazil - Zip code: 05508-070

E-mail: rpcosta@usp.br

Telephone: +55 11 3091–5399 r. 408

POMS 21st Annual Conference

Vancouver, Canada

May 7 to May 10, 2010

1. INTRODUCTION

This study addresses the theme "product-mix decision". In a Marketing perspective, can be understood as the set of all product types that a seller places for sale to buyers (KOTLER, 1984). In a Production and Operations Management perspective, a vision that is shared by the current research, product-mix decision can be understood as the definition of the optimum quantity to be produced for each type of product in a given period, considering these products compete for limited resources (HODGES; MOORE, 1970) in order to maximize the firm economic result (FREDENDALL; LEA, 1997).

In this context, the aim is to characterize the academic literature on product-mix decision published in international journals with respect to (i) the countries where the studies were originated, (ii) the main journals that publish the studies, (iii) the research approach used, and (iv) the highlights in terms of authors and publications cited. To direct the study in order to attain the objective, the following research questions are defined: What are the highlights of product-mix decision research in the world (institutions, countries, authors and journals)? What are the research approaches mostly used in product-mix decision academic publications that appeared in international journals?

The paper is organized into five sections considering this introduction (1), namely: (2) conceptualization of the theme under study and theme positioning in Production Management and Operations field; (3) research methodology; (4) findings presentation and analysis; and (5) conclusions, limitations and recommendations for future research.

2. PRODUCT-MIX DECISION AND ITS INSERTION IN THE PRODUCTION AND OPERATIONS MANAGEMENT FIELD

The models for decision (e.g. TSAI *et al.*, 2007), selection (e.g., VASANT; BARSOUM, 2006), optimization (e.g. WANG *et al.*, 2009) or determination (e.g.

KASILINGAM, 1992) of product-mix are dedicated to treat the same problem: how to define the ideal products production and sale mix for a certain period in order to maximize the company economic output? In other words, as affirmed by Mabin and Davies (2003, pp. 669), “underlying the Product Mix problem is the dilemma: Which product should be given priority in production and sales?” This kind of questioning is present in managers’ thinking, regardless of the market structure (monopoly, oligopoly, perfect competition, etc.) in which a firm is inserted, because knowing "what" and "how much" to produce are key questions for any business, be it in manufacturing or services. Thereby, the relevance of the research is anchored in the fact that the product-mix decision problems are some of the most critical issues in manufacturing (BEGED-DOV, 1983; WANG *et al*., 2009), having an important role in predicting future returns and economic robustness of business (HASUIKE; ISHII, 2009).

Regarding companies that work with one product type, analysis methods from the Microeconomics field (e.g. analysis of marginal costs and revenues) have made important contributions to determine the optimum quantity of products to be manufactured and sold. However, the increasing variety of products demanded by consumers with the opening of the international market and the consequent increasing production process complexity (in terms of Cooper and Kaplan (1988)) with regard to engineering processes, quality assurance, production programming and processing, among others, led the models based solely on costs and revenues marginal analysis to lose explanatory and normative power. To fill this gap, the research fields of Production and Operations Management and Managerial Accounting presented concepts and techniques aimed at understanding the production process and the costs of business activities. The development of programming models (e.g. linear programming), costing methods (e.g. Direct/Variable Costing and Activity-Based Costing - ABC), and production management approaches (e.g. Theory of Constraints) can be mentioned.

From the second half of the twentieth century, mathematical models (e.g. HODGES; MOORE, 1970; GRINNELL, 1976) and heuristics (e.g. GOLDRATT, 1990; KEE, 2001) have been developed in order to determine the products-mix to be produced and sold by a company in a given planning period. Historically, the evolution of mathematical models and heuristics on product-mix decision was directly related to the development of two research strands:

i). Mathematical techniques and algorithms: This statement can be verified from the analysis of the following academic publications: (1a) Byrd Jr. and Moore (1978) that used linear programming to construct a model for product-mix decision; (1b) Onwubolu and Muting (2001a, 2001b) that worked on the selection of product mix using genetic algorithms; (1c) Onwubolu (2001) that proposed a decision model for product-mix using tabu search-based algorithm; (1d) Vasant and Barsoum (2006) that addressed the product-mix decision using fuzzy linear programming; and (1e) Wu, Chang and Chiou (2006) that used a psycho-clonal algorithm to construct a model for product-mix selection.

ii). New ways of costing products: This can be verified from the analysis of the following academic publications: (2a) Grinnell (1976) that compared a model for product-mix decision based on Absorption Costing with another model based on Direct/Variable Costing method; (2b) Patterson (1992) that compared a model for product-mix decision based on the Theory of Constraints (throughput accounting) with another model based on Direct/Variable Costing method (2c) Kee (1995) and Kee and Schmidt (2000) that compared a decision model for product-mix decision based on the Theory of Constraints (throughput accounting) with other models based on ABC; and (2d) Kee (2001) that compared three models for product-mix decision based on ABC.

Within the Production and Operations Management knowledge field, devoted to the study of "the process of design, planning, controlling and executing operations in manufacturing and services industries" (BERTRAND; FRANSOO, 2002, pp. 241), the planning activity, which incorporates the product-mix decision, can be segmented according to the timeframe to be reached. In a paper published in the International Journal of Production Research, Bahl, Taj and Corcoran (1991) present a taxonomy of typical decisions regarding the planning activity (with the insertion of the product-mix decision), as shown in Figure 1:

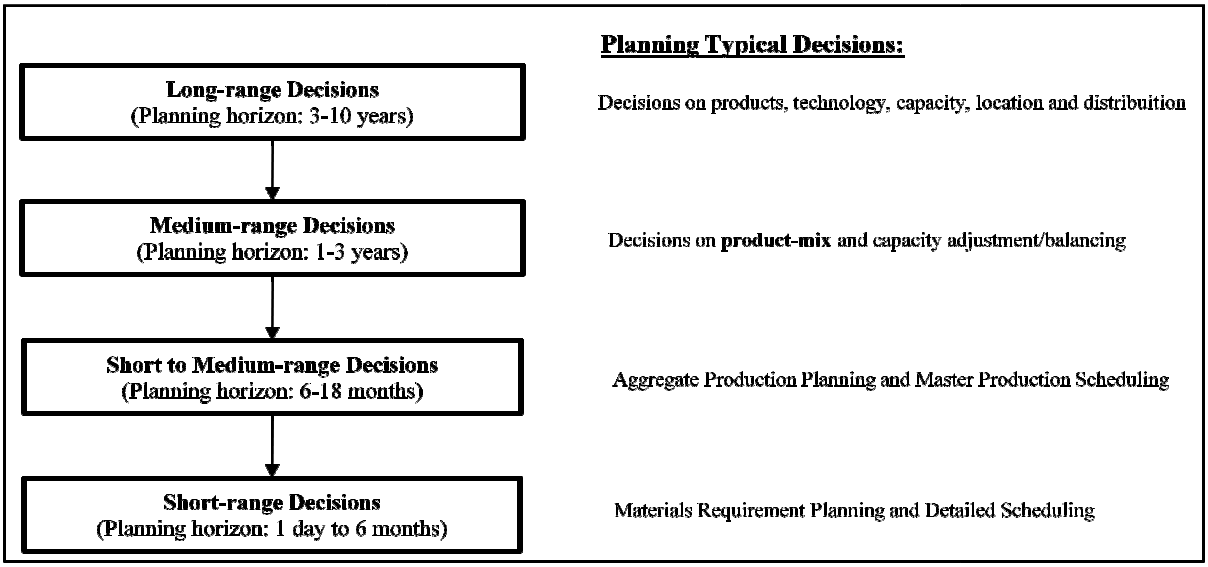

Figure 1 - A hierarchy of managerial decisions in manufacturing
Source: Bahl, Taj e Corcoran (1991)

Although the planning horizon exposed by Bahl, Taj and Corcoran (1991) to define the product-mix may seem long for the scenario of rapid change and dynamism which companies face today, it is appropriate to classify the product-mix decision as a planning activity for periods close to 1 year (KEE, 2001), because such a decision require a commitment of various resources and departments/units from a company.

3. METHODOLOGY

The objective and the research questions are addressed in a descriptive way from a Bibliometric Analysis (also known as Bibliometrics), along whit a Citation Analysis, on

international publishing about product-mix decision. The first studies of bibliometric analysis occurred in the early twentieth century and its concept can be found in Spinak (1996, pp. 34) as "application of statistical analysis to study the characteristics of using and creating documents". In other words, a bibliometric analysis is the application of statistics on bibliography.

Studies have used bibliometrics in different areas and for several purposes, such as a productivity, frequency distribution measure and frequency measure of authors, words or phrases in texts on a particular subject, performance measures, and establishing core areas of dispersion on a given subject. Along with the application of another method, the citation analysis, trends in research areas, institutions, countries and means of research publishing (e.g. journals) can be traced (PILKINGTON; MEREDITH, 2009). Thereby, a bibliometric analysis applied in conjunction with citation analysis is fundamental for understanding scientific communication, such as that related to the product-mix decision research area.

As stated in the research objective, the proposal is to examine how studies on product-mix decision are characterized internationally. For this, initially (first stage), a wide-range bibliographic survey of academic studies that had some indication of possible contribution to research on product-mix decision was carried out. Sources for obtaining the data are the internet portals Scopus®, ProQuest® and Web of Science®. The three portals offer an extensive database which condenses the international publications on the most varied issues of journals (academic and non-academic), newspapers, dissertations, theses, books and conference proceedings. Thus, the potential of information on international research publications present in Scopus®, ProQuest® and Web of Science® justifies the choice of these data sources for this research.

After that (second stage), a statistical analysis of publications prospected was conducted in order to characterize them in terms of publication channels (journals), countries

where the studies were generated, and research approaches used. Finally (third stage), the highlights in terms of authors and publications were identified. A general framework of the Bibliometric Analysis applied in this study is shown in Figure 2:

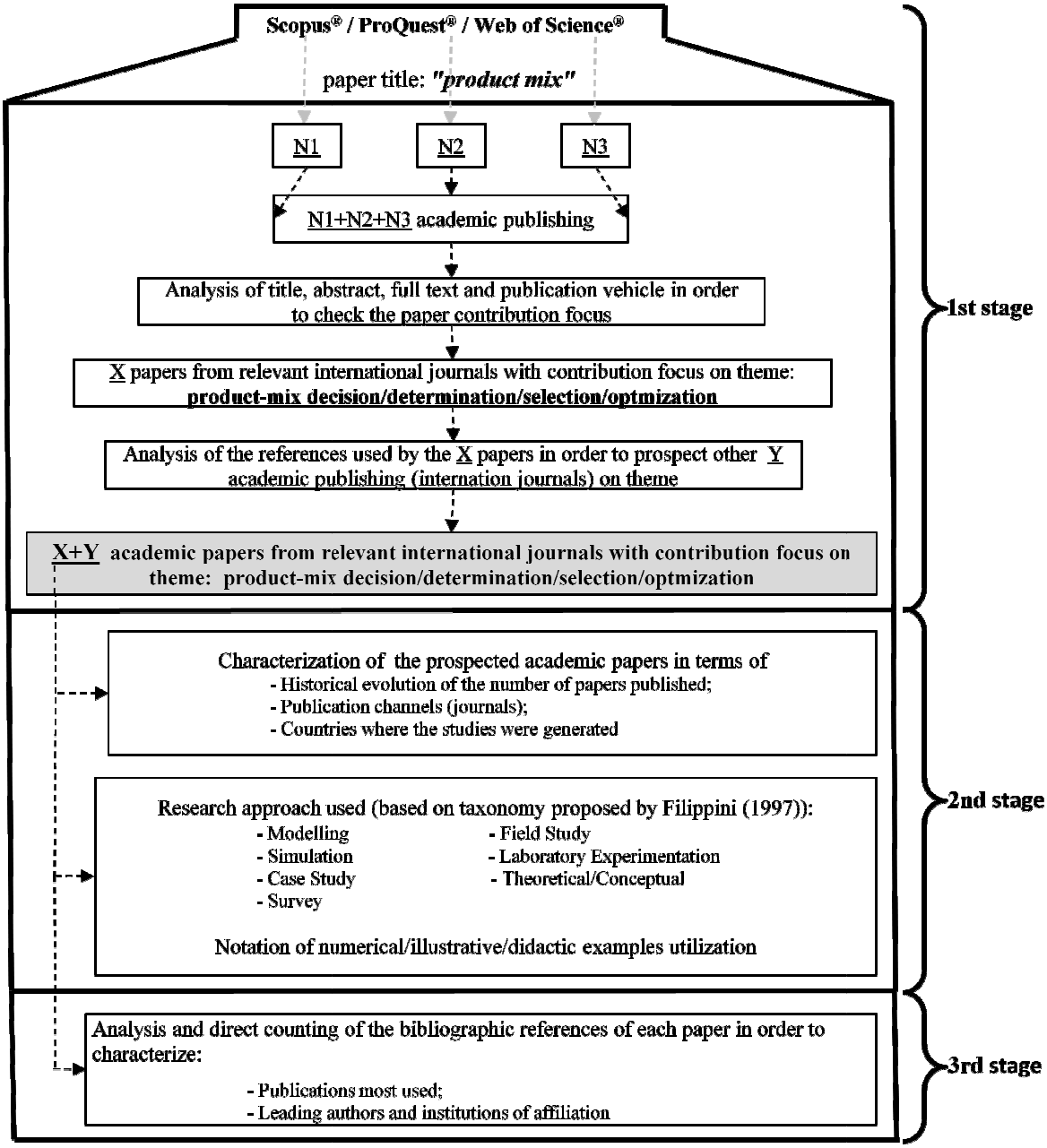

Figure 2 - General framework of the Bibliometric Analysis applied

3.1. First stage research

The initial survey consisted of a search in the Internet portals Scopus®, ProQuest® and Web of Science® of all the prospected academic publications which contained the words "product mix" in their title, using the criteria presented in Figures 3, 4 and 5, respectively:

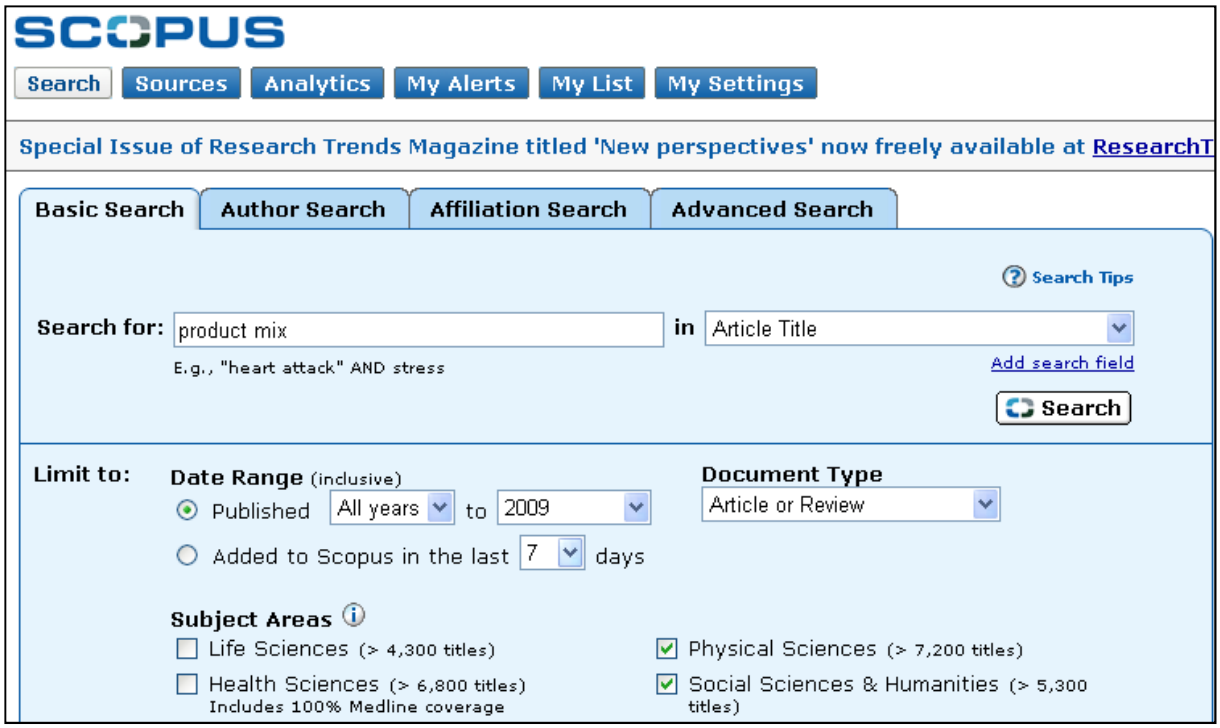

Figure 3 - Search for academic publications carried out in Scopus®

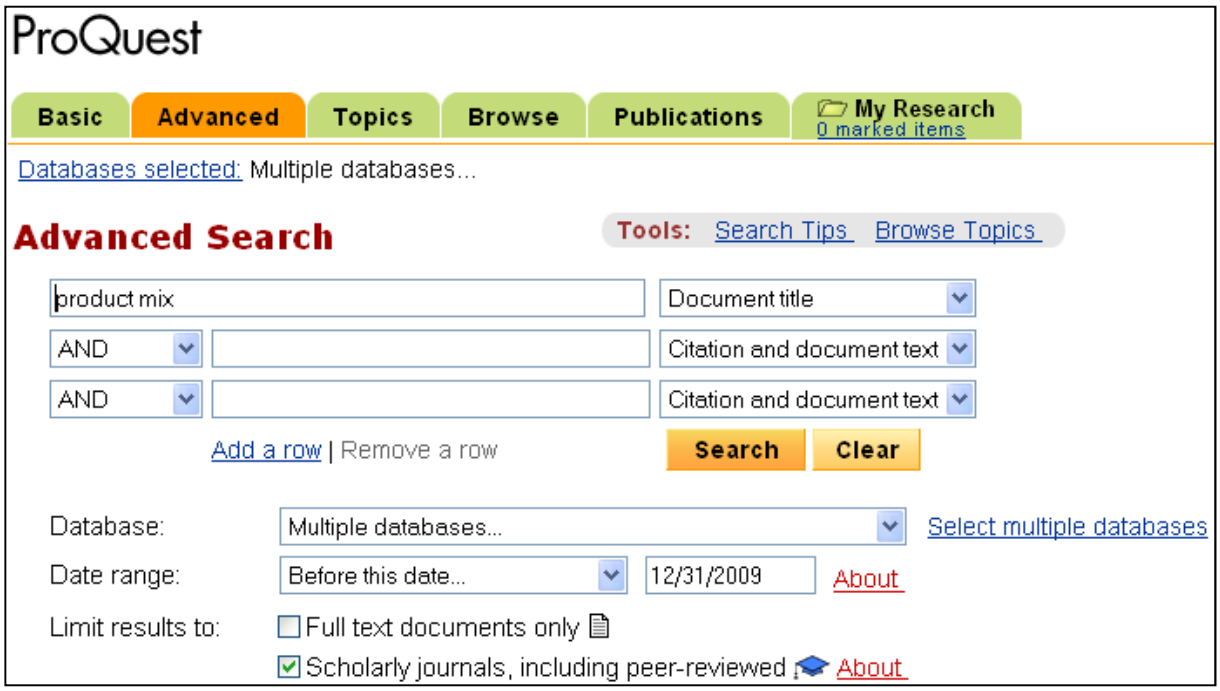

Figure 4 - Search for academic publications carried out in ProQuest®

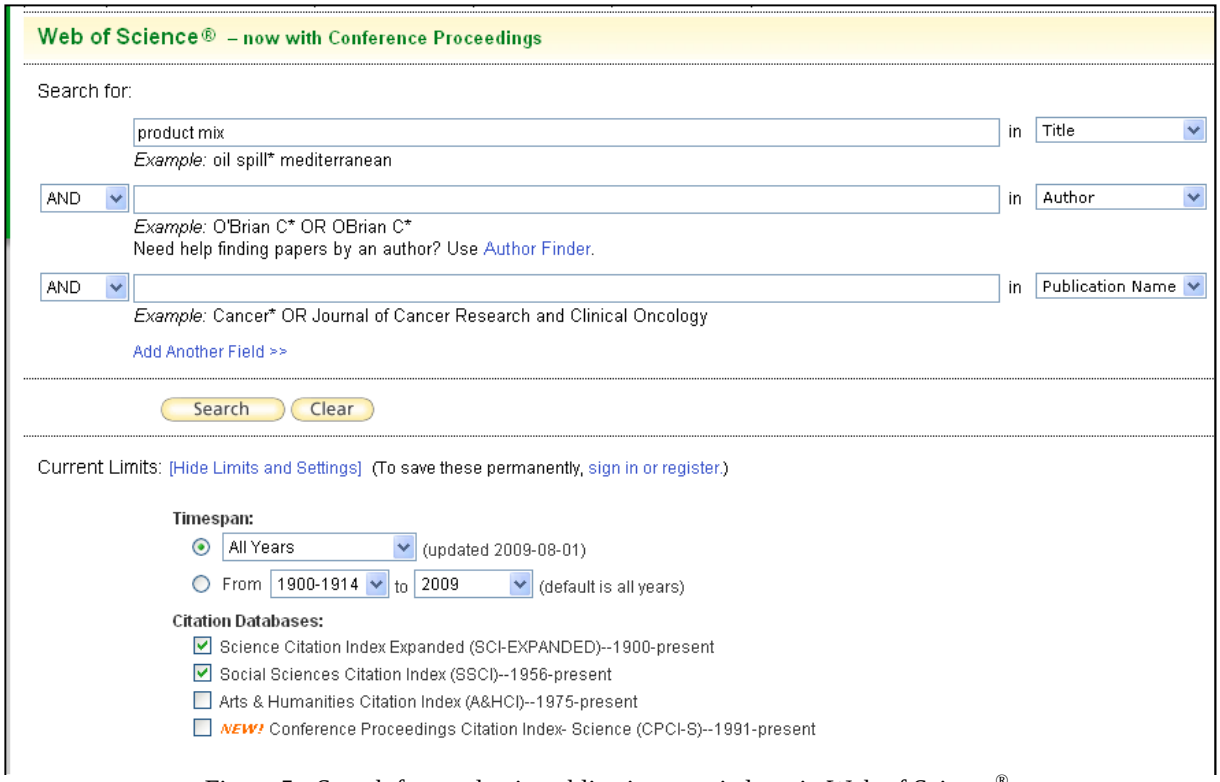

Figure 5 - Search for academic publications carried out in Web of Science®

It is worth mentioning that only papers published in international academic journals are selected in the survey. In this way, texts in books, conference proceedings, dissertations and theses were disregarded. Each paper prospected from the three surveys had the title, abstract, keywords, the publication vehicle and, in some cases, the full text examined to verify if the focus of theoretical contribution concentrated on the field of product-mix decision/ determination/optimization/selection. Then, the references of the prospected papers were analyzed in order to survey other academic publications (international journals) which were not addressed by the three databases explored.

3.2. Second stage research

This stage was devoted to characterize the academic literature surveyed in the previous stage. First, a chart was built to illustrate the numerical evolution of the papers over time. Then, tables with frequency distributions (absolute, relative and cumulative) and graphics were constructed in order to characterize the distribution of publications along the publication

channels (journals) and the countries and institutions to which the papers authors are affiliated.

The characterization followed with the analysis and classification of research approaches used in each publication. For this classification, the taxonomy proposed by Filippini (1997) was applied; it is dedicated to researches in the Production and Operations Management academic field. The taxonomy is presented and described in Table 1:

Research Approach Taxonomy (FILIPPINI, 1997)	**Research Approach General Description**
Modelling	Use of mathematical techniques to describe the operation of a system or part of a production system
Simulation	Use of computational techniques to simulate the operation of production systems from mathematical models
Survey	Use of a single instrument to collect data (usually a questionnaire), applied to large-size samples, using sampling techniques and statistical analysis
Case Study	In-depth analysis of one or more objects (cases), with the use of multiple instruments for data collection and the interaction between the researcher and the research subject
Field Study	Other research methods (mainly qualitative approach). Presence of field data, with little or without formal organization of the research method
Laboratory Experimentation	Study of the causal relationship between two variables of a system under conditions controlled by the researcher
Theoretical/Conceptual	Conceptual discussions from literature reviews. Conceptual modelling based on perceptions and experiences of the author

Table 1 - Taxonomy of research approaches used in Production and Operations Management research
Source: Adapted from Filippini (1997)

The choice of the taxonomy proposed by Filippini (1997) derives from the fact that it has been repeatedly cited as a basis for studies on academic production of journals and conference proceedings in the Production and Operations Management field. As examples, can be cited the studies carried out by Nieto *et al*. (1999) and Rungtusanatham *et al*. (2003).

In each publication prospected the use or not of numerical/illustrative/didactic examples to clarify the proposals and discussions held by the papers authors was verified. It is worth mentioning that more than one research approach was found in the same article, that is, there was a combination of research approaches. From the characterization of the research

approaches used in the product-mix decision publications, the way in which researchers have been working on the theme and have been making contributions to academy could be observed.

3.3. Third stage research

This stage was characterized by the search of the main highlights in terms of authors and publications in the product-mix decision research, in addition to the identification of the institutions to which the authors are affiliated. For this, a citation analysis on the same papers database examined in the second stage was carried out. In order to verify the citation or not of a particular author or publication, the references of each paper was analyzed. An author or publication was accounted for each citation present in the section "References" of papers.

After accounting the citations, tables were designed with frequencies distributions (absolute, relative and cumulative) of authors and publications cited. In order to facilitate the results visualization, the 20 highlights (with higher relative frequency of citations) in terms of authors, along with the institutions and countries to which they are affiliated, and publications are shown through a table.

4. RESULTS PRESENTATION AND ANALYSIS

This section is dedicated to expose the results of bibliometric analysis carried in the academic publications searched in the portals Scopus®, ProQuest® and Web of Science®. The results are presented for each stage research.

4.1. First stage results

The search in the Scopus® database brought 159 academic publications, while the ProQuest® presented 104 and the Web of Science® 138. After examining the title, the abstract, the keywords, the publication channel, and in some cases, the full text of each paper prospected, it was found that 45 of them had a theoretical contribution focus concentrated in

the product-mix decision theme and were published in international academic journals directly or indirectly related to research in Production Management and Operations. From the analysis of the "References" for each of the 45 articles, 25 other publications from international journals were identified and prospected, totaling 70 academic papers about product-mix decision (see Appendix A).

4.2. Second stage results

Based on the 70 articles, the evolution of the number of publications (international journals) on the subject over time was characterized, as shown in Figure 6:

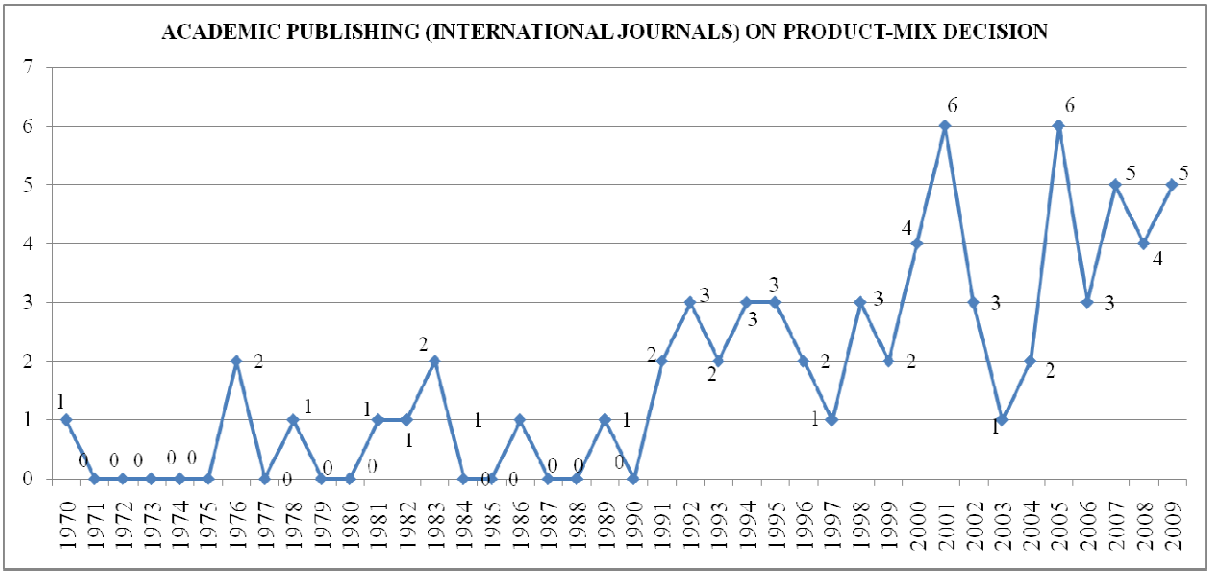

Figure 6 - Annual academic production on product-mix decision published in international journals

Based on Figure 6, one can observe that the academic publishing on product-mix decision showed a considerable increase as from 1991. An explanation for this finding relates to the fact that the number of publications that provide theoretical support for the product-mix decision in the context of Production and Operations Management field and related areas (e.g. Managerial Accounting) began to intensify in the late 1980s (e.g. GOLDRATT; COX, 1984; GOLDRATT; FOX, 1986; COOPER; KAPLAN, 1988).

In order to characterize the distribution of publications in relation to the journals which published the research, tables were built with absolute, relative and cumulative

frequency distributions of incidence of each journal. To view the results, the data were presented as a Paretto chart, as shown in Figure 7:

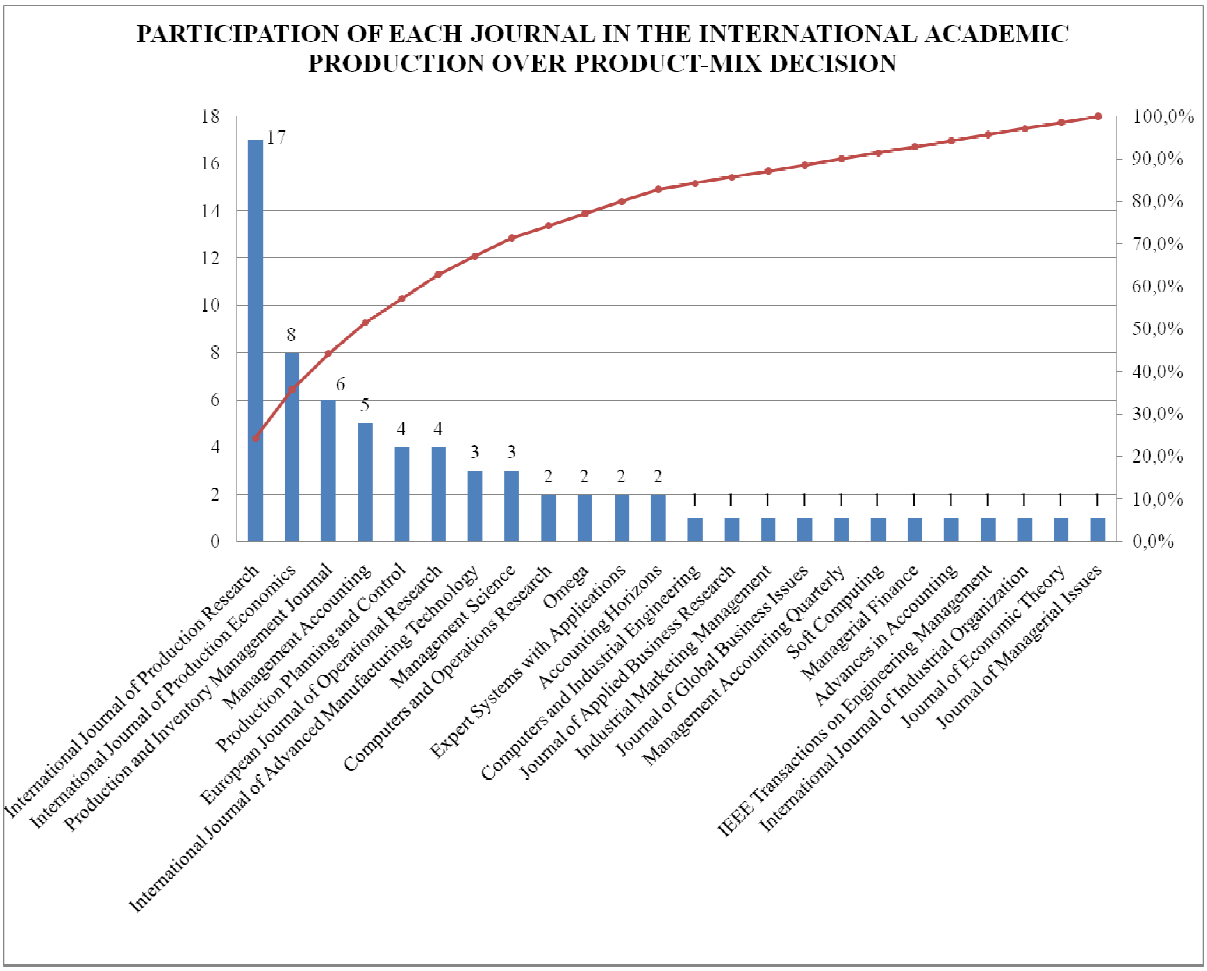

Figure 7 - Distribution per journal of the product-mix decision academic publications

Based on Figure 7, one can conclude that 71% of the publications (50 out of 70) are concentrated in about 33% of journals (8 out of 24) and that the main vehicles for disseminating the research on product-mix decision are closely related to the Production and Operations Management academic field (International Journal of Production Research – IJPR; International Journal of Production Economics – IJPE; and Production and Inventory Management Journal - PIMJ).

In order to characterize the distribution of publications per countries which host the institutions to which the papers authors are affiliated, tables with frequency distributions of absolute, relative and cumulative frequency of incidence of each country have also been

constructed. The results were presented as a Paretto chart, as shown in Figure 8:

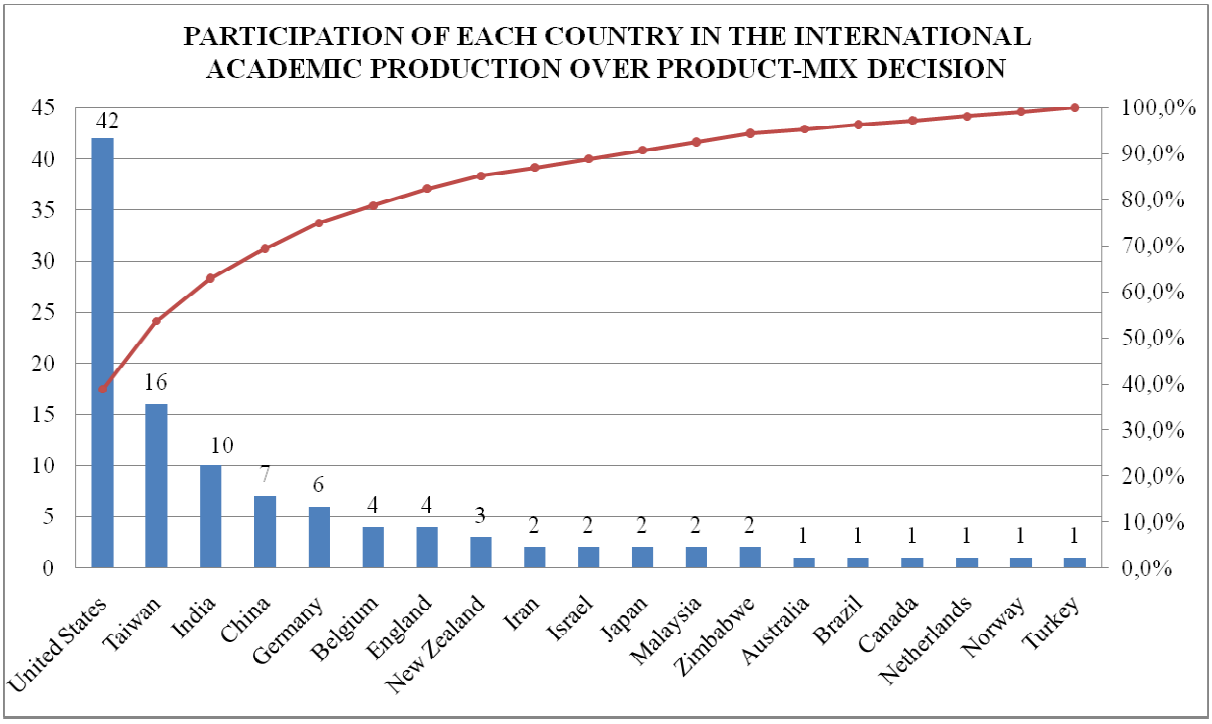

Figure 8 - Distribution per country of the product-mix decision academic publications

Observing Figure 8, it can be seen that about 70% of the publications authors (75 out of 108) are concentrated in only 21% of the countries that host the institutions to which the papers authors are affiliated (4 out of 19). It should be noted that there is a strong research concentration in American universities and that the researchers from institutions in Eastern countries (Taiwan, India and China) have an important contribution to the international academic production on product-mix decision.

In order to characterize the prospected papers per research approach (based on the taxonomy proposed by Filippini (1997)), tables with absolute, relative and cumulative frequency distributions of the incidence of each research approaches were built. To facilitate the results visualization, a Paretto chart was used, as shown in Figure 9:

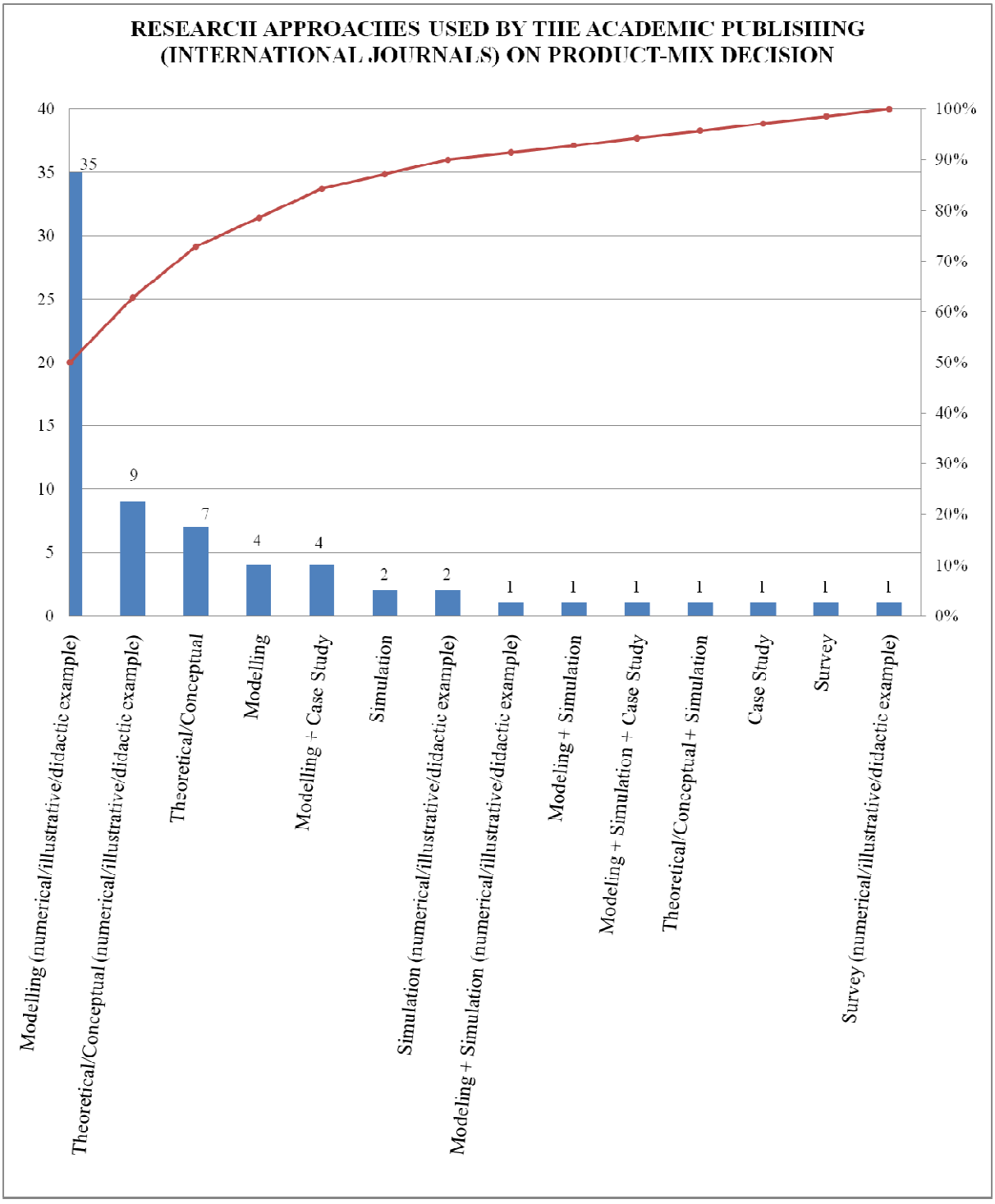

Figure 9 - Distribution per research approach of the product-mix decision academic publications

The analysis of Figure 9 reveals that more than 77% of the publications (54 out of 70) were addressed by the authors from two research approaches: Modelling and Theoretical/Conceptual. Considering only papers that explored the Modelling and Theoretical/Conceptual research approaches along with the use of

numerical/illustrative/didactic examples, the percentage is reduced to 61%. The great incidence of Modelling research approach with the use of numerical/illustrative/didactic examples that covers 49% (34 out of 70) of the prospected papers should be highlighted.

4.3. Third stage results

From the analysis of the section "References" of the 70 papers surveyed, the number of citations of each authors and publications was accounted. After constructing a table with frequency distributions, it could be seen the highlights in terms of authors and publications cited. Table 2 presents the 20 most cited authors (with higher relative frequency of citations) along with the institutions and countries in which the researches were developed:

AUTOR	RELATIVE FREQUENCY OF CITATIONS (IN SECTION "REFERENCES")	INSTITUITION / AFFILIATION	COUNTRY
Gerhard **Plenert**	9.0%	Institute of Business Management - Brigham Young University	United States
Richard L. **Luebbe**	6.3%	Miami University	United States
Byron J. **Finch**	6.3%	Miami University	United States
Lawrence. D. **Fredendall**	5.1%	Clemson University	United States
Bih-Ru **Lea**	5.1%	Clemson University	United States
Robert **Kee**	4.4%	Culverhouse School of Accountancy - University of Alabama	United States
Terry **Lee**	4.4%	Institute of Business Management - Brigham Young University	United States
Mike C. **Patterson**	3.5%	Division of Business Administration - Midwestern State University	United States
Shu-Hsing **Chung**	2.8%	National Chiao Tung University	Taiwan
Godfrey C. **Onwuboluy**	2.8%	National University of Science and Technology	Zimbabwe
Charles **Schmidt**	2.5%	Culverhouse School of Accountancy - University of Alabama	United States
Jaydeep **Balakrishnan**	2.5%	Faculty of Management - University of Calgary	Canada
Clarence J. **Maday**	2.5%	College of Engeneering - North Carolina State University	United States
Alan J. **Posnack**	2.5%	Productivity Partiners	United States
Tien-Chun **Hsu**	2.1%	National Chiao Tung University	Taiwan
Chun Hung **Cheng**	2.1%	Chung Cheng University	Taiwan
Michael **Mutingi**	1.6%	National University of Science and Technology	Zimbabwe
Nils Arne **Bakke**	1.4%	Gesellschaft für Technologie Transfer	Germany
Roland **Hellberg**	1.4%	Norwegian School of Management	Norway
Victoria J. **Mabin**	1.4%	School of Business and Public Management - Victoria University of Wellington	New Zealand

Table 2 - Authors most cited by the papers on product-mix decision

It is noteworthy that the 20 authors listed represent approximately 70% of the authors cited in the papers "References" section (301 of a total of 432 citations). One can highlight the concentration of the main authors in universities of the United States and the occurrence

of two researchers from the Republic of Zimbabwe (Godfrey C. Onwuboluy and Michael Mutingi).

In order to characterize the highlights in terms of publications cited by the prospected papers on product-mix decision, the 20 most cited publications (relative frequency) were considered, as shown in Table 3:

ACADEMIC PUBLICATION	FRELATIVE FREQUENCY
LUEBBE, R.; FINCH, B. Theory of constraints and linear programming: a comparison. International Journal of Production Research, v. 30, n. 6, pp. 1471-1478, 1992	8.8%
PLENERT, G. Optimizing theory of constraints when multiple constrained resources exist. European Journal of Operational Research, v. 70, pp. 126-133, 1993	8.0%
FREDENDALL, L. D., LEA, B. R. Improving the product mix heuristic in the theory of constraints. International Journal of Production Research, v. 35, n. 6, pp. 1535-1544, 1997	6.8%
LEE, T., N.; PLENERT, G. Optimizing theory of constraints when new product alternatives exist. Production and Inventory Management Journal, v. 34, n. 3, pp. 51-57, 1993	6.8%
PATTERSON, M. C. The Product-Mix Decision: A Comparison of Theory of Constraints and Labor-Based Management Accounting. Production and Inventory Management Journal. Alexandria, v. 33, n. 3, pp. 80-85, 1992	6.4%
KEE, R; SCHMIDT, C. Comparative analysis of utilizing activity-based costing and the theory of constraints for making product-mix decisions. International Journal of Production Economics, v. 63, n. 1, p. 1-17, 2000	4.4%
POSNACK, A. J. Theory of constraints; Improper applications yield improper. Production and Inventory Management Journal, v. 35, n. 1, pp. 85-86, 1994	4.4%
MADAY, C. J. Proper use of constraint management. Production and Inventory Management Journal, v. 35, n. 1, pp. 84, 1994	4.4%
HSU, T.-C., CHUNG, S.-H. The TOC-based algorithm for solving product mix problems. Production Planning and Control, v. 9, n. 1, p. 36-46, 1998	3.6%
BALAKRISHNAN, J.; CHENG, C. H. Theory of Constraints and linear programming; a re-examination. International Journal of Production Research, v. 38, n. 6, pp. 1459-1463, 2000	3.6%
KEE, R. Integrating activity-based costing with the theory of constraints to enhance production-related decision-making. Accounting Horizons, v. 9, n. 4, pp. 48-61, 1995	2.8%
HOLMEM, J. S. ABC vs. TOC: it's a matter of time. Management Accounting (New York, N.Y.), v. 76, pp. 37-40, 1995	2.4%
SOUREN, R.; AHN, H.; SCHMITZ, C. Optimal product mix decisions based on the theory of constraints? Exposing rarely emphasized premises of throughput accounting. International Journal of Production Research, v. 43, n. 2, pp. 361–374, 2005	2.0%
ARYANEZHAD, M.B., KOMIJAN, A.R. An improved algorithm for optimizing product mix under the theory of constraints. International Journal of Production Research, v. 42, n. 20, pp. 4221-4233, 2004	2.0%
LEA, B.-R.; FREDENDALL, L. D. The impact of management accounting, product structure, product mix algorithm, and planning horizon on manufacturing performance. International Journal of Production Economics, v. 79, n. 3, pp. 279-299, 2002	2.0%
FINCH, B. J.; LUEBBE, R. L. Response to 'Theory of constraints and linear programming; a re-examination'. International Journal of Production Research, v. 38, n. 6, p. 1465-1466, 2000	2.0%
ONWUBOLU, G. C. Tabu search-based algorithm for the TOC product mix decision. International Journal of Production Research, v. 39, n. 10, pp. 2065-2076, 2001	2.0%

SPOEDE, C.; HENKE, E.; UMBLE. M. Using activity analysis to locate profitability drivers. Management Accounting; v. 75, n. 11, pp. 43-48, 1994	2.0%
MABIN, V. J.; DAVIES, J. Framework for understanding the complementary nature of TOC frames: Insights from the product mix dilemma. International Journal of Production Research, v. 41, n. 4, pp. 661-680, 2003	1.6%
BHATTACHARYA, A.; VASANT, P. Soft-sensing of level of satisfaction in TOC product-mix decision heuristic using robust fuzzy-LP. European Journal of Operational Research, v. 177, n. 1, pp. 55-70, 2007	1.6%

Table 3 - Publications most cited by the papers on product-mix decision

From Table 3, one can verify that out of the 5 most cited publications, 4 are from the first half of the 1990s. Disregarding the position (ranking) of publications regarding the relative frequency of citations, the most current publication is the paper by Bhattacharya and Vasant (2007). However, when the ranking of citations is taken into account, the most current work considered as a highlight is the one developed by Kee and Schmidt (2000), occupying the sixth position in the ranking.

5. CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Underlying the product-mix decision problem is the dilemma: what products should be given priority for production and sale? This kind of questioning is present in the managers' mind, regardless of the market structure (monopoly, oligopoly, perfect competition, etc.) in which the firm is inserted, because knowing "what" and "how many" to produce are key questions for any business, such as the firms based on manufacturing processes. Thereby, product-mix decision problem is one of the most critical issues in manufacturing, having an important role in predicting future returns and the economic strength of companies. Given the relevance of the subject addressed in this study, its main contribution is the characterization of academic publications on the theme "product-mix decision" published in international journals regarding (i) the countries where the studies were originated, (ii) the main journals that publish the studies, (iii) the research approach used, and (iv) the highlights in terms of

authors and publications cited. This characterization lists the highlights and positions the research on product-mix decision so far, serving as a guide to facilitate the development of future research on the theme. Thus, the objective was attained and the research questions were answered.

The limitations of this study lie mainly on the databases used (ProQuest®, Scopus® and Web of Knowledge®), not because of their inefficiency, but because this research has focused only on the international level that limits the inference of the study to other research universes that are not included in the database used, such as conference proceedings, dissertations and theses, for example. Another limitation is related to the subjectivity in the process of classification of the research approaches used by each publication prospected and analyzed.

For future research, the suggestion is to conduct an analysis focusing on other scientific production data sources to ratify or complement the results presented herein. Finally, this study is thought to contribute as a reference for future research on product-mix decision under the aegis of Production and Operations Management.

REFERENCES

BAHL, H. C.; TAJ, S.; CORCORAN, W. Linear-programming model formulation for optimal product-mix decisions in material-requirements-planning environments. International Journal of Production Research, v. 29, n. 5, pp. 1025-1034, 1991

BEGED-DOV, A. G. Determination of optimal product mix by marginal analysis. International Journal of Production Research, v. 21, n. 6, pp. 909-918, 1983

BERTRAND, J. W.; FRANSOO, J. C. Operations Management Research Methodologies using quantitative modeling, International Journal of Operations and Production Management, v. 22, n. 2, pp. 241-264, 2002

BHATTACHARYA, A.; VASANT, P. Soft-sensing of level of satisfaction in TOC product-mix decision heuristic using robust fuzzy-LP. European Journal of Operational Research, v. 177, n. 1, pp. 55-70, 2007

BYRD JR., J.; MOORE, L. T. The Application of a product mix linear programming model in corporate policy making. Management Science, v. 24, n. 13, pp. 1342-1350, 1978

COOPER, R.; KAPLAN, R. How cost accounting distorts product costs. Management Accounting, v. 69, n. 10, pp. 20-27, 1988

FILIPPINI, R. Operations management research: some reflections on evolution, models and empirical studies in OM. International Journal of Operations and Production Management, v. 17, n. 7, pp. 655-70, 1997

FINCH, B. J.; LUEBBE, R. L. Response to 'Theory of constraints and linear programming; a re-examination'. International Journal of Production Research, v. 38, n. 6, pp. 1465-1466, 2000

FREDENDALL, L. D.; LEA, B. R. Improving the product mix heuristic in the theory of constraints. International Journal of Production Research, v. 35, n. 6, pp. 1535-1544, 1997

GOLDRATT, E. M. The Haystack Syndrome: Sifting Information Out of the Data Ocean. North River Press, Croton-on-Hudson, NY, 1990

GOLDRATT, E. M.; COX, J. The goal: a process of ongoing improvement. Croton-on-Hudson: North River Press, 1984

GOLDRATT, E. M.; FOX, R. E. The Race. Croton-on-Hudson: North River Press, 1986.

GRINNELL, D. J. Product mix decisions: direct costing vs. absorption costing. Management Accounting, v. 58, n. 2, pp. 36, 1976

HASUIKE, T.; ISHII, H. On flexible product-mix decision problems under randomness and fuzziness. Omega, v. 37, n. 4, pp. 770-787, 2009

HODGES, S. D.; MOORE, P. G. The product-mix problem under stochastic seasonal demand. Management Science, v. 17, n. 2, pp.107-114, 1970

HODGES, S. D.; MOORE, P. G. The product-mix problem under stochastic seasonal demand. Management Science, v. 17, n. 2, pp.107-114, 1970

KASILINGAM, R. G. Product mix determination in the presence of alternate process plans and stochastic demand. Computers and Industrial Engineering, v. 29, n. 1-4, pp. 249-253, 1992

KEE, R. Evaluating the economics of short- and long-run production-related. Journal of Managerial Issues, v. 13, n. 2, pp. 139-158, 2001

KEE, R. Integrating activity-based costing with the theory of constraints to enhance production-related decision-making. Accounting Horizons, v. 9, n. 4, pp. 48-61, 1995

KEE, R. The sufficiency of product and variable costs for production-related decisions when economies of scope are present. International Journal of Production Economics, v. 114, n. 2, pp. 682-696, 2008

KEE, R; SCHMIDT, C. Comparative analysis of utilizing activity-based costing and the theory of constraints for making product-mix decisions. International Journal of Production Economics, v. 63, n. 1, pp. 1-17, 2000

KOTLER, P. Marketing Management: Analysis, Planning, and Control. New Jersey: Prentice-Hall, 1984

KRAJEWSKI, L. J.; RITZMAN, L. P. Operations management: strategy and analysis. 5th ed. New York: Addison-Wesley, 1999

MABIN, V. J.; DAVIES, J. Framework for understanding the complementary nature of TOC frames: Insights from the product mix dilemma. International Journal of Production Research, v. 41, n. 4, pp. 661-680, 2003

NIETO, M.; ARIAS, D.; MINGUELA, B.; RODRIGUES, A. The evolution of operations management contents: an analysis of the most relevant textbooks. Industrial Management and Data Systems, v. 99, n. 8, pp. 345-352, 1999

ONWUBOLU, G. C. Tabu search-based algorithm for the TOC product mix decision. International Journal of Production Research, v. 39, n. 10, pp. 2065-2076, 2001

ONWUBOLU, G. C.; MUTING, M. A genetic algorithm approach to the theory of constraints product mix problems. Production Planning and Control, v. 12, n. 1, pp. 21-27, 2001a

ONWUBOLU, G. C.; MUTING, M. Optimizing the multiple constrained resources product mix problem using genetic algorithms. International Journal of Production Research, v. 39, n. pp, p. 1897-1910, 2001b

PATTERSON, M. C. The Product-Mix Decision: A Comparison of Theory of Constraints and Labor-Based Management Accounting. Production and Inventory Management Journal, v. 33, n. 3, pp. 80-85, 1992

PILKINGTON, A.; MEREDITH, J. The evolution of the intellectual structure of operations management-1980-2006: a citation/co-citation analysis. Journal of Operations Management, v. 27, n. 3, pp. 185-202, 2009

PROQUEST®. Advanced Search. Avaliable in: <http://proquest.umi.com/login>. Accessed in: 12/31/2009

RUNGTUSANATHAM, M. J.; CHOI, T.Y.; HOLLINGWORTH, D. G.; WU, Z.; FORZA, C. Survey research in operations management: historical analyses. Journal of Operations Management, v. 21, n. 4, pp. 475-488, 2003.

SCOPUS®. Basic Search. Disponível em: <http://www.scopus.com/home.url>. Acesso em: 31 de dezembro de 2009

SPINAK, E. Diccionario enciclopédico de bibliometría, cienciometría y informetría. Montevideo, 1996

TSAI, W.-H.; LAI, C-W.; CHANG, J. C. An algorithm for optimizing joint products decision based on the Theory of Constraints. International Journal of Production Research, v. 45, n. 15, pp. 3421-3437, 2007

VASANT, P.; BARSOUM, N. N. Fuzzy optimization of units products in mix-product selection problem using fuzzy linear programming approach. Soft Computing, v. 10, n. 2, pp. 144-151, 2006

VASANT, P.; BARSOUM, N. N. Fuzzy optimization of units products in mix-product selection problem using fuzzy linear programming approach. Soft Computing, v. 10, n. 2, pp. 144-151, 2006

WANG, J. Q.; SUN, S. D.; SI, S. B.; YANG, H. A. Theory of constraints product mix optimisation based on immune algorithm. International Journal of Production Research, v. 47, n. 16, pp. 4521-4543, 2009

WEB OF SCIENCE®. Search. Avaliable in: <http://apps.isiknowledge.com/WOS_GeneralSearch_input.do?highlighted_tab=WOS&product=WOS&last_prod=WOS&SID=Z2g5md5njBMhnHG9m5f&search_mode=GeneralSearch>. Accessed in: 12/31/2009

WU, M.-C.; CHANG, W.-J.; CHIOU, C.-W. Product-mix decision in a mixed-yield wafer fabrication scenario. International Journal of Advanced Manufacturing Technology, v. 29, n. 7-8, p. 746-752, 2006

APPENDIX A - ACADEMIC PUBLICATIONS PROSPECTED IN THE FIRST STAGE RESEARCH

Nº	ACADEMIC PUBLICATION	YEAR
1	LINHARES, A. Theory of constraints and the combinatorial complexity of the product mix decision. International Journal of Production Economics (*in press*)	2009
2	HASUIKE, T.; ISHII, H. On flexible product-mix decision problems under randomness and fuzziness. Omega, v. 37, n. 4, pp. 770-787	2009
3	HASUIKE, T., ISHII, H. Product mix problems considering several probabilistic conditions and flexibility of constraints. Computers and Industrial Engineering, v. 56, n. 3, pp. 918-936	2009
4	SRIDHARAN, V. G.; KRISHNAN, R.; VERGAUWEN, P.; ARTHANARI, T. The TOC-ABC Choice Debate for Product Mix Decisions: Introducing Asset Specificity as an Alternate Explanation. Journal of Global Business Issues, v. 3, n. 1, pp. 105-110	2009
5	WANG, J. Q.; SUN, S. D.; SI, S. B.; YANG, H. A. Theory of constraints product mix optimisation based on immune algorithm. International Journal of Production Research, v. 47, n. 16, pp. 4521-4543	2009
6	KEE, R. The sufficiency of product and variable costs for production-related decisions when economies of scope are present. International Journal of Production Economics, v. 114, n. 2, pp. 682-696	2008
7	TSAI, W. H.; LAI, C. W.; TSENG, L. J.; CHOU, W. C. Embedding management discretionary power into an ABC model for a joint products mix decision. International Journal of Production Economics, v. 115, n. 1, pp. 210-220	2008
8	CHUNG, S.-H., LEE, A.H.-I., KANG, H.-Y., LAI, C.-W. A DEA window analysis on the product family mix selection for a semiconductor fabricator. Expert Systems with Applications, v. 35, n. 1-2, pp. 379-388	2008
9	BHATTACHARYA, A.; VASANT, P.; SARKAR, B.; MUKHERJEE, S. K. A fully fuzzified, intelligent theory-of-constraints product-mix decision. International Journal of Production Research, v. 46, n. 3, pp. 789-815	2008
10	TSAI, W-H.; LAI, C-W. Outsourcing or capacity expansions; Application of activity-based costing model on joint products decisions. Computers and Operations Research, v. 34, n. 12, p. 3666-3681	2007
11	TSAI, W-H.; LAI, C-W.; CHANG, J. C. An algorithm for optimizing joint products decision based on the Theory of Constraints. International Journal of Production Research, v. 45, n. 15, pp. 3421-3437	2007
12	LOCKHART, J.; TAYLOR, A. Enviromental considerations in product mix decisions using ABC and TOC. Management Accounting Quarterly, v. 9, n. 1, pp. 13-21	2007
13	WANG, F. K.; DU, T.; WEN, F. C. Product mix in the TFT-LCD industry. Production Planning and Control, v. 18, n. 7, pp. 584-591	2007
14	BHATTACHARYA, A.; VASANT, P. Soft-sensing of level of satisfaction in TOC product-mix decision heuristic using robust fuzzy-LP. European Journal of Operational Research, v. 177, n. 1, pp. 55-70	2007
15	SINGH, R. K.; PRAKASH, K. S.; TIWARI, M. K. Psycho-clonal based approach to solve a TOC product mix decision problem . International Journal of Advanced Manufacturing Technology, v. 29, n. 11-12, pp. 1194-1202	2006
16	WU, M.-C.; CHANG, W.-J.; CHIOU, C.-W. Product-mix decision in a mixed-yield wafer fabrication scenario. International Journal of Advanced Manufacturing Technology, v. 29, n. 7-8, pp. 746-752	2006
17	VASANT, P.; BARSOUM, N. N. Fuzzy optimization of units products in mix-product selection problem using fuzzy linear programming approach. Soft Computing, v. 10, n. 2, pp. 144-151	2006
18	BAYOU, M. E.; REINSTEIN, A. Analyzing the Product-mix Decision by Using a Fuzzy Hierarchical Model. Managerial Finance, v. 31, n. 3, pp. 35-48	2005
19	LETMATHE, P.; BALAKRISHNAN, N. Environmental considerations on the optimal product mix. European Journal of Operational Research, v. 167, n. 2, pp. 398-412	2005
20	MISHRA, N.; PRAKASH, M. K.; SHANKAR, R.; CHAN, F.T. Hybrid tabu-simulated annealing based approach to solve multi-constraint product mix decision problem. Expert Systems with Applications, v. 29, n. 2, pp. 446-454	2005

21	CHUNG, S.-H.; LEE, A.H.; PEARN, W. L. Product mix optimization for semiconductor manufacturing based on AHP and ANP analysis. International Journal of Advanced Manufacturing Technology, v. 25, n. 11-12, pp. 1144-1156	2005
22	CHUNG, S.-H.; LEE, A. H.; PEARN, W. L. Analytic network process (ANP) approach for product mix planning in semiconductor fabricator. International Journal of Production Economics, v. 96, n. 1, pp. 15-36	2005
23	SOUREN, R.; AHN, H.; SCHMITZ, C. Optimal product mix decisions based on the theory of constraints? Exposing rarely emphasized premises of throughput accounting. International Journal of Production Research, v. 43, n. 2, pp. 361–374	2005
24	KÖKSAL, G. Selecting quality improvement projects and product mix together in manufacturing: An improvement of a theory of constraints-based approach by incorporating quality loss. International Journal of Production Research, v. 42, n. 23, pp. 5009-5029	2004
25	ARYANEZHAD, M.B., KOMIJAN, A.R. An improved algorithm for optimizing product mix under the theory of constraints. International Journal of Production Research, v. 42, n. 20, pp. 4221-4233	2004
26	MABIN, V. J.; DAVIES, J. Framework for understanding the complementary nature of TOC frames: Insights from the product mix dilemma. International Journal of Production Research, v. 41, n. 4, pp. 661-680	2003
27	BOYD; COX III, J. F. Optimal decision making using cost accounting information. International Journal of Production Research, v. 40, n. 8, pp.1879-1898	2002
28	HAKA, S.; JACOBS, F.; MARSHALL, R. Fixed cost allocation and the constrained product mix decision . Advances in Accounting, v. 19, pp. 71-88	2002
29	LEA, B.-R.; FREDENDALL, L. D. The impact of management accounting, product structure, product mix algorithm, and planning horizon on manufacturing performance. International Journal of Production Economics, v. 79, n. 3, pp. 279-299	2002
30	BLACKSTONE JR., J. H. Theory of constraints - a status report. International Journal of Production Research, v. 39, n. 6, pp. 1053-1080	2001
31	KEE, R. Evaluating the economics of short- and long-run production-related decisions. Journal of Managerial Issues, Vv 13, n. 2, pp. 139-158	2001
32	MABIN, V. J. Toward a greater understanding of linear programming, theory of constraints, and the product mix problem. Production and Inventory Management Journal, v. 42, n. 3-4, pp. 52-54	2001
33	ONWUBOLU, G. C. Tabu search-based algorithm for the TOC product mix decision. International Journal of Production Research, v. 39, n. 10, pp. 2065-2076	2001
34	ONWUBOLU, G.C.; MUTING, M. Optimizing the multiple constrained resources product mix problem using genetic algorithms. International Journal of Production Research, v. 39, n. 9, pp. 1897-1910	2001
35	ONWUBOLU, G.C.; MUTING, M. A genetic algorithm approach to the theory of constraints product mix problems. Production Planning and Control, v. 12, n. 1, pp. 21-27	2001
36	BALAKRISHNAN, J. ; CHENG, C. H. Theory of Constraints and linear programming; a re-examination. International Journal of Production Research, v. 38, n. 6, pp. 1459-1463	2000
37	COMAN, A.; RONEN, B. Production outsourcing; a linear programming model for the Theory-Of-Constraints. International Journal of Production Research, v. 38, n. 7, pp. 1631-1639	2000
38	FINCH, B. J.; LUEBBE, R. L. Response to 'Theory of constraints and linear programming; a re-examination'. International Journal of Production Research, v. 38, n. 6, pp. 1465-1466	2000
39	KEE, R; SCHMIDT, C. Comparative analysis of utilizing activity-based costing and the theory of constraints for making product-mix decisions. International Journal of Production Economics, v. 63, n. 1, pp. 1-17	2000
40	BALAKRISHNAN, J. Using theory of constraints in teaching LP and vice versa; advantages and caveats. Production and Inventory Management Journal, v. 40, n. 2, pp. 11-16	1999
41	COOPER, R.; SLAGMULDER, R. Integrating activity-based costing and the theory of constraints. Management Accounting (New York, N.Y.), v. 80, n. 8, pp. 20-1	1999
42	DEMMY, S., TALBOTT, T. Improve Internal Reporting with ABC and TOC. Management Accounting (New York, N.Y.)AV. 80, n. 5, pp. 18-20	1998
43	YAHYA-ZADEH, M. Product-mix decisions under activity-based costing with resource constraints and non-proportional activity costs. Journal of Applied Business Research, v. 14, n. 4, pp. 39-45	1998
44	HSU, T.-C., CHUNG, S.-H. The TOC-based algorithm for solving product mix problems. Production Planning and Control, v. 9, n. 1, pp. 36-46	1998
45	FREDENDALL, L.D., LEA, B.R. Improving the product mix heuristic in the theory of constraints. International Journal of Production Research, v. 35, n. 6, pp. 1535-1544	1997

46	BALAKRISHNAN, R.; SIVARAMAKRISHNAN, K. Is assigning capacity costs to individual products necessary for capacity planning? Accounting Horizons, v. 10, n. 3, pp. 1-11	1996
47	LEE, T., PLENERT, G. Maximizing product mix profitability - What's the best analysis tool. Production Planning and Control, v. 7, n. 6, pp. 547-553	1996
48	HOLMEM, J. S. ABC vs. TOC: it's a matter of time. Management Accounting (New York, N.Y.), v. 76, pp. 37-40	1995
49	KEE, R. Integrating activity-based costing with the theory of constraints to enhance production-related decision-making. Accounting Horizons, v. 9, n. 4, pp. 48-61	1995
50	MALIK, S. A.; SULLIVAN, W. G. Impact of ABC information on product mix and costing decisions. IEEE Transactions on Engineering Management, v. 42, n. 2, pp. 171-176	1995
51	SPOEDE, C.; HENKE, E.; UMBLE. M. Using activity analysis to locate profitability drivers. Management Accounting; v. 75, n. 11, pp. 43-48	1994
52	POSNACK, A. J. Theory of constraints; Improper applications yield improper. Production and Inventory Management Journal, v. 35, n. 1, pp. 85-86	1994
53	MADAY, C. J. Proper use of constraint management. Production and Inventory Management Journal, v. 35, n. 1, pp. 84	1994
54	PLENERT, G. Optimizing theory of constraints when multiple constrained resources exist.. European Journal of Operational Research, v. 70, pp. 126-133	1993
55	LEE, T., N.; PLENERT, G. Optimizing theory of constraints when new product alternatives exist. Production and Inventory Management Journal, v. 34, n. 3, pp. 51-57	1993
56	LUEBBE, R.; FINCH, B. Theory of constraints and linear programming: a comparison. International Journal of Production Research, v. 30, n. 6, pp. 1471-1478	1992
57	PATTERSON, M. C. The Product-Mix Decision: A Comparison of Theory of Constraints and Labor-Based Management Accounting. Production and Inventory Management Journal. Alexandria, v. 33, n. 3, pp. 80-85	1992
58	SOUTH, J. B.; OLIVER, J. E. A value-added approach to product mix decisions. Industrial Marketing Management, v. 21, n. 2, pp. 167-171	1992
59	BAKKE, N. A.; HELLBERG, R. Relevance lost; A critical discussion of different cost accounting principles in connection with decision making for both short and long term production scheduling. International Journal of Production Economics, v. 24, n. 1-2, pp. 1-18	1991
60	BAHL, H. C.; TAJ, S.; CORCORAN, W. Linear-programming model formulation for optimal product-mix decisions in material-requirements-planning environments. International Journal of Production Research, v. 29, n. 5, pp. 1025-1034	1991
61	CHANDER, P.; LERUTH, L. The optimal product mix for a monopolist in the presence of congestion effects. A model and some results. International Journal of Industrial Organization, v. 7, n. 4, pp. 437-449	1989
62	GABSZEWICZ, J.; SHAKED, A.; SUTTON, J.; THISSE, J. Segmenting the market: The monopolist's optimal product mix. Journal of Economic Theory, v. 39, n. 2, pp. 273-289	1986
63	BEGED-DOV, A. G. Determination of optimal product mix by marginal analysis. International Journal of Production Research, v. 21, n. 6, pp. 909-918	1983
64	KNOLMAYER, G. A simulation study of some simplification strategies in the development of product-mix models. European Journal of Operational Research, v. 12, n. 4, pp. 339-347	1983
65	KNOLMAYER, G. Computational experiments in the formulation of linear product-mix and non-convex production-investment models. Computers and Operations Research, v. 9, n. 3, pp. 207-219	1982
66	REEVES, G. R.; SWEIGART, J. R. Product-Mix Models When Learning Effects Are Present. Management Science, v. 27, n. 2, pp. 204-212	1981
67	BYRD JR., J.; MOORE, L. T. The Application of a Product Mix Linear Programming Model in Corporate Policy Making. Management Science, v. 24, n. 13, pp. 1342-1350	1978
68	GRINNELL, D. J. Product mix decisions: direct costing vs. absorption costing. Management Accounting, v. 58, n. 2, pp. 36	1976
69	REEVES, G. R. Inventory decisions in product-mix models. Omega, v. 4, n. 3, pp. 339-340	1976
70	HODGES, S. D.; MOORE, P. G. The product-mix problem under stochastic seasonal demand. Management Science, v. 17, n. 2, pp.107-114	1970