FUTURE SRJ
FUTURE STUDIES RESEARCH JOURNAL: TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific Editor: James Terence Coulter Wright
Evaluation: Double Blind Review, pelo SEER/OJS
Review: Grammatical, normative and layout
Received in: 07/31/2014 **Approved in:** 10/07/2014

THE SCIENTIFIC CONTEXT OF PRODUCT PORTFOLIO MANAGEMENT AT MANUFACTURING FIRMS

Alvaro Luiz Neuenfeldt Júnior
Doctorate student in Industrial Engineering and Management by University of Porto, Portugal
alvjr2002@hotmail.com

Sabine Ritter De Paris
Doctorate student in Architecture by University of Porto, Portugal
sa.paris@hotmail.com

Edson Funke
Doctorate student in Production Engineering from the Federal University of Santa Maria, Brazil
edsonfunke@gmail.com

ABSTRACT

Correct product portfolio management is one of the feasible ways of ensuring competitive sustainability before continued market evolution whereby decisions to maintain or exclude an item from the sales offering drives consequences that impact both internal and external contexts. In alignment with this standpoint, the purpose of this study is to identify and pinpoint the conceptual framework on product portfolio management, particularly in as much as existing applications centred on manufacturing sector firms is concerned, so as to allow for the envisioning of possible opportunities of fostering future investigations on the subject matter. To this effect, theoretical-conceptual research was conducted, starting with the primary definition of how this field of study is explored right through to the bibliometric review of existing publications. The end result was the identification a gap in research that focuses on portfolio management at manufacturing companies, particularly in Brazil where only two studies centred on this theme were found, although the country hosts more than 30 types of organizations of this kind.

FUTURE SRJ
FUTURE STUDIES RESEARCH JOURNAL: TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific Editor: James Terence Coulter Wright
Evaluation: Double Blind Review, pelo SEER/OJS
Review: Grammatical, normative and layout
Received in: 07/31/2014 **Approved in:** 10/07/2014

KEY-WORDS: Portfolio management. Manufacturing firms. Business management. Competitiveness.

O CONTEXTO CIENTÍFICO DA GESTÃO DO PORTFÓLIO DE PRODUTOS PARA EMPRESAS DE MANUFATURA

RESUMO

A correta administração do portfólio de produtos é um dos modos viáveis de sustentar-se competitivamente ante as constantes evoluções do mercado, de modo que a decisão por conservar ou excluir um item da carteira de vendas resulta em consequências que serão sentidas tanto interna quanto externamente à organização. Coerentemente ao exposto, na presente pesquisa, o objetivo é identificar e mostrar o contexto bibliométrico sobre da gestão do portfólio de produtos, em específico para aplicações focadas em empresas do setor manufatureiro, de modo a possibilitar a visualização de possíveis oportunidades em prol do fomento de futuras investigações sobre a temática. Para tanto, foi desenvolvida uma pesquisa teórico-conceitual, desde a definição primária da maneira com que o campo de estudo é explorado até a revisão bibliométrica do rol de publicações existentes. Por fim, foi possível visualizar que ainda há espaço para pesquisas voltadas à gestão de portfólio em empresas de manufatura, principalmente tratando-se do contexto brasileiro, onde se observou a existência de apenas dois estudos com esse foco, apesar de aqui existirem de mais de 30 tipos dessas organizações.

PALAVRAS-CHAVE: Gestão do portfólio. Empresas de manufatura. Gestão empresarial. Competitividade.

1 INTRODUCTION

The opening of economies and the ever increasing presence of globally outreaching businesses drove the shift from the former business management model ground on productivity to that in vogue, sustained on competitiveness. In turn, this promotes continued search for solutions capable of optimizing gains across the assortment of operational processes which simultaneously meet customer needs and employ environmental resources in a rational manner (Drucker, 2008; Porter, 2009).

To address such conditions, strategic planning must factor into its assumptions the ability to combine concepts with the development of control mechanisms as of the association of tangible and intangible functions, characteristics of the marketing of manufactured goods, so as to improve the company´s solution offering (Aurich, Mannweiler & Schweitzer, 2010; Beuren , Ferreira & Miguel, 2013).

Miguel (2008), Slack, Chambers, Johnston and Betts (2008) and Lacerda, Ensslin and Ensslin (2011) state that the correct product portfolio management is a feasible way of sustaining competitiveness before constant market changes and that the decision to keep or eliminate a given item from the range sold promotes consequences that shall impact the company internally (as is the case in manufacturing sectors) and externally (marketing sectors).

As a consequence of this contextualization, one of the queries that permeate the scientific-academic environment´s latent concerns involving this field of study refers to the possibilities of identifying the contribution products that belong to a given portfolio may pose before the company´s strategic and manufacturing systems.

Thus, given this context, the proposal´s core objective is to identify and pinpoint the systematic scientific context of product portfolio management, specifically as to the applications that have been conducted at manufacturing sector companies, so as to allow for the envisioning of possible opportunities to foster investigations and contributions on the subject matter.

The study was structured into four sections. After this introduction, section 2 comprises the theoretical contextualization on the mentioned field of study. Section 3 presents the study´s development, from data collection to the ideation of information deemed most relevant before outcomes. Finally, section 4 discusses the final considerations, future expectations and findings involving limitations encountered during the course of the study.

2 FIELD OF STUDY DEFINITIONS

2.1 MANUFACTURING SYSTEMS

One might deem a manufacturing system as being a set of consumer goods' productive processes that employs machines and resorts to task sharing whereby each operator conducts a portion of the work (Gaither, 2001; Slack et al., 2008).

Within this context, industrial management seeks to plan, manage and control the activities of the available labour force and machinery so as to offer products that throughout their composition acquire increased added value, ensuring they become attractive for sales purposes (Jones & Womack, 2003; Batalha, 2008).

To this effect there must be a clear and defined manufacturing flow so tasks may be subdivided into sectors, according to the handling techniques of raw materials and the layout characteristics of the manufacturing plants (Slack et al., 2008).

To ensure full adjustment to existing market conditions, one must also be able to make premises flexible to market changes, according to the industry´s intrinsic characteristics and pertaining physical and technical requirements.

It is via these and other assumptions that industrial activities, from the preliminary development of new item projects to production start, must fully align with strategic management so as to ensure competitive advantages are obtained (Laugeni & Martins, 2006; Scarano, Siluk, Nara, Neuenfeldt Júnior & Da Fontoura, 2014).

Largely, companies must seek to position themselves at an optimal standpoint located between market-in and product-out since in so doing they shall also optimally embrace true customer expectations - without finding themselves in a position of not being physically and from a human resource perspective able to address such a demand – and shall thus increase the possibility of being able to offer goods that shall make them more competitive (Laugeni & Martins, 2006; Batalha, 2008; Neuenfeldt Júnior, Siluk, Soliman & Marques, 2014).

2.2 PRODUCT PORTFOLIO MANAGEMENT

So as to identify potential gains in the field of operation, Oliveira and Rozenfeld (2010), Kester, Griffin, Hultink and Lauche (2011), Lapersonne (2013) and Burin Neto, Jugend, Barbalho and Silva (2013) define that product portfolio management (PPM) engages in a dynamic decision making process to the extent that managing the prioritization of the items that are most relevant before given contexts is deemed one of the most critical tasks to ensure the organization is successful.

Cooper (2011) mentions that the firm must be able to rank the product contribution levels from a three goal standpoint, namely: maximization of value, balance of the list of projects and available materials and orientation according to implemented macro planning assumptions.

Orientation centered on these three points seeks to enhance the reliability that products will be made available to clients, whether these are individual customers or corporations (Oliveira et al., 2012).

Castro and Carvalho (2010) and Burin Neto et al. (2013) make special mention to the way one conducts PPM since the larger the volume of projects undergoing development and/or products already placed on the market, the greater the tendency of there being limitations in terms of time, physical, financial and human resources to execute the organization´s activities.

Therefore, irrespective of the technique one employs, product mix management must take the measuring of the level of relevance into account

when prioritizing which items must remain in detriment of others, given the fact that some products might be redesigned or no longer be sold (Smith & Ierapetritou, 2011; Loos & Miguel, 2012; Burin Neto et al., 2013).

3 RESEARCH DEVELOPMENT

In an attempt to address the previously mentioned introductory assumption, Figure 1 presents the methodological procedures that were herein employed, supporting the understanding of the level of the context´s standing, from primary definition of how the explored field of study is currently exposed right through to final discussions and considerations, resorting as reference, to definitions coined by Da Silva, Toledo Filho and Pinto (2010), Pizzani, Silva and Hossne (2010), Yoshida (2010), Beuren and Miguel (2012), Oliveira and Boente (2012) and Kubota, Ferenhof, Ferreira, Forcellini and Miguel (2013).

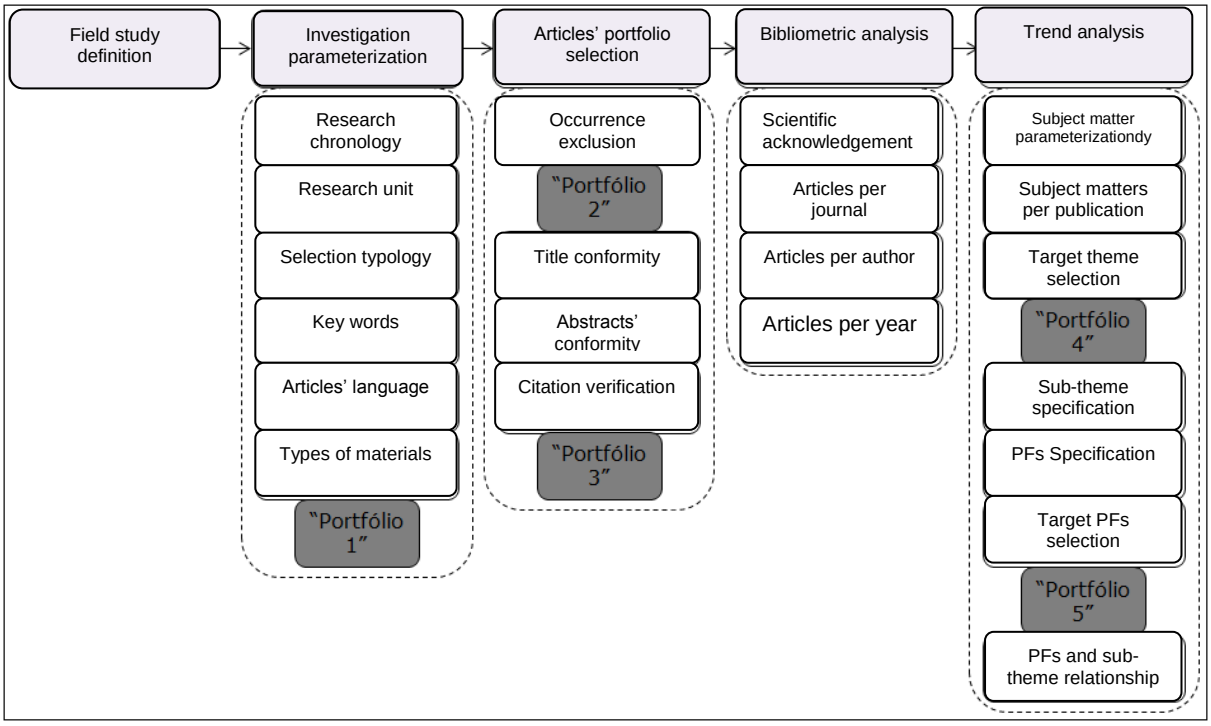


Figure 1: Research methodological stages

Source: Based on Da Silva et al. (2010), Pizzani, Silva and Hossne (2010), Yoshida (2010), Beuren and Miguel (2012), Oliveira and Boente (2012) and Kubota et al. (2013)

Specifically in as much as the stages that comprise the mining of data, for starters, the parameterization of search engines employed was proposed. This approach drove the selection of the Capes Journals Portal´s (2014) research unit which in turn prove to be vital given its ability to aggregate article repositories from the world´s most relevant scientific indexers.

This also enabled the definition of the study´s chronological period, namely, within the range comprised between 1990 and 2014, in addition to setting the desired language (any) and material typology (only published in journals).

Subsequently, there was the need to define the terms that best represented the dynamics and expectations in as much as the object field of study was concerned, based on the assumptions described by Miguel (2008), Slack et al. (2008), and Lacerda et al. (2011), from which the key words product portfolio management, product portfolio measurement and product portfolio were chosen. Once having conducted the search, 526 items were found and this volume was deemed sufficient to comprise the first portfolio´s ("Portfolio 1") set of the context´s articles.

In as much as the selection of the portfolio is concerned, initially undue occurrences, such as duplicate occurrences, reviews, re-editions, announcements, books and book chapters were excluded so as to refine the search and solely keep the unicity of items characterized as being journal papers, thus forming the second, 100 item set ("Portfolio 2").

Next, the titles were read and in greater detail, the abstracts of all the selected works so as to more precisely filter the occurrence of materials that were not directly related to the field of study at hand. To build "Portfolio 3", seven studies were eliminated and the remaining 93 works were listed so that the search for each paper´s number of citations might be collected based on the data banks Google Scholar (2014) offers.

Once collected information was gathered, the final list of articles could be drawn and organized into an electronic spreadsheet enabling the compilation of data required during the next contextualization stages.

For the bibliometric analysis stage, the characteristics of each publication were detailed so as to allow for the visualization of attributes that might provide information of the field of study´s context and also provide interested parties further details.

As per Table 1, for starters, as of such assumptions, 15 of the most representative articles were listed via the previously ideated citations mapping.

Table 1: "Portfolio 3"´s fifteen top articles featuring the most citations

Author	Year	Journal	Citations
Faems, Van Looy and Debackere	2005	Journal of Product Innovation Management	503
Cooper, Edgett and Kleinschmidt	1999	Journal of Product Innovation Management	485
Cooper, Edgett and Kleinschmidt	2000	IEEE Engineering Management Review	485
Cooper, Edgett and Kleinschmidt	2001	R&D Management	386
Rothaermel, Hitt and Jobe	2006	Strategic Management Journal	245
Wynstra and Pierick	2000	European Journal of Purchasing and Supply Management	222
Blau, Pekny, Varma and Bunch	2004	Journal of Product Innovation Management	137
Jiao and Zhang	2005a	Computer-Aided Design	127
Mangun and Thurston	2002	IEEE Transactions on Engineering Management	102
Chao and Kavadias	2008	Management Science	101
Bergh	1998	Journal of Management	100
DelVecchio	2000	Journal of Product & Brand Management	95
Jiao and Zhang	2005b	IIE Transactions	85
Killen, Hunt and Kleinschmidt	2008	International Journal of Quality and Reliability Management	83
Brun and Castelli	2008	International Journal of Production Economics	70

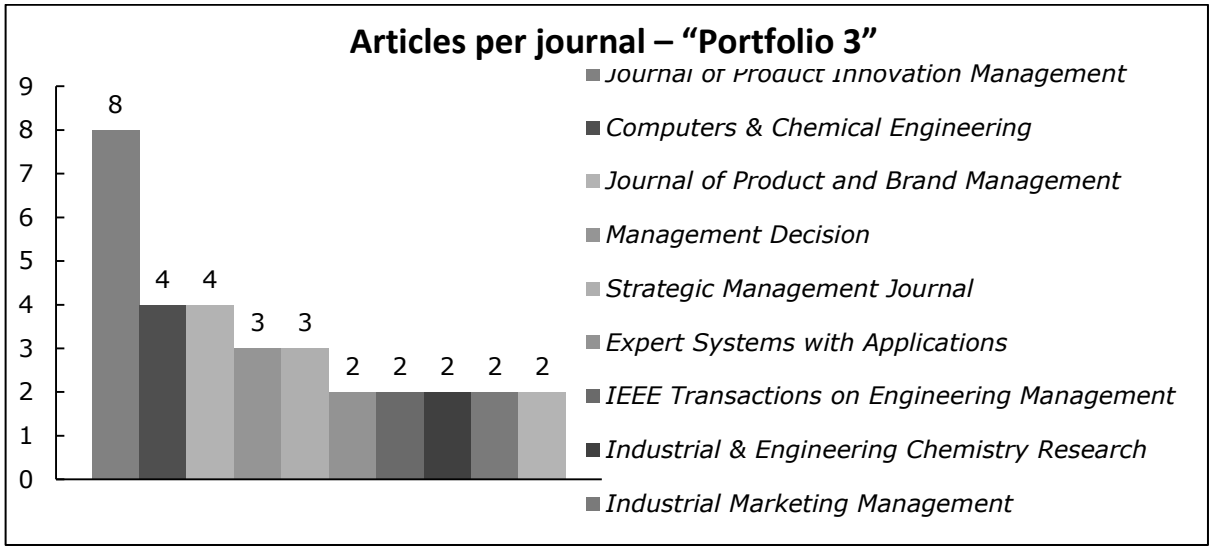
Given the amount of time required to expose articles to the scientific community one notices that none of the works published during the past five

years period (2010-2014) appears amongst those most representative, a fact one expects to observe tends to be compensated for over the next couple of years. In the meantime, articles peaked during the 2000-2009 decade since 86.67% of them date back to this period. The years 2000, 2005 and 2008 are the most representative.

In as much as the authors are concerned, special mention ought to be made to Cooper et al.´s (1999, 2000, 2001) research since they served as prime bibliographical grounding for the fostering of new publications within the product portfolio management field.

To a lesser extent, Jiao and Zhang (2005a, 2005b) arose as reference given the strong correlation of their findings with the theme in the form of applications employing some of the operational research´s assumptions to ensure the managing task is conducted in a less intuitive and more quantitative manner.

Subsequently, as pictured in Graph 1, data was compiled to allow for the visualization of which, amongst "Portfolio 3"´s 68 journals, most fostered product portfolio management related publications. Special mention ought to be made to the Journal of Product Innovation Management since, in addition to featuring the largest volume (eight in all) of articles it also published the two most relevant papers, namely Faems et al. (2005) and Cooper et al. (1999) respectively accounting for 503 and 485 citations.



Graph 1: Major journals ranked per articles comprised by "Portfolio 3"

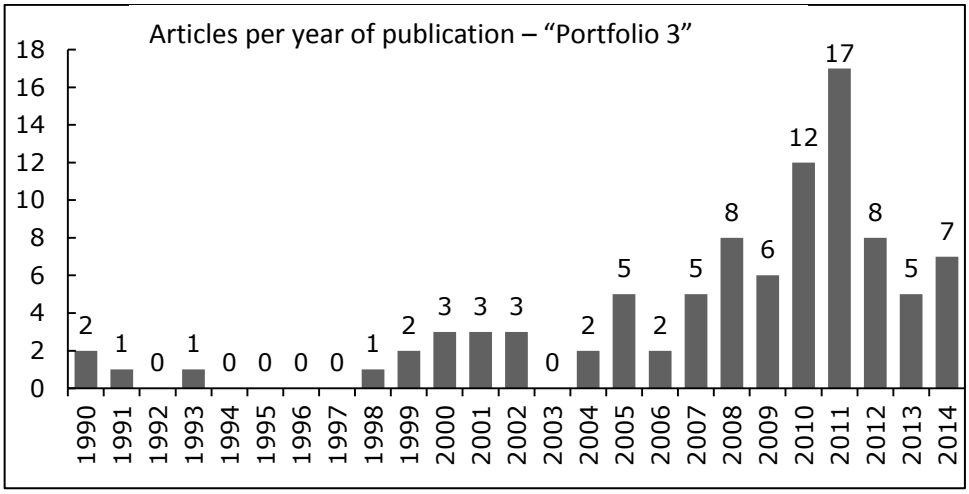
In the most part, the level of concentration of more than one article per journal was of 40.86%, a figure that fits the study´s upfront expectations since before investigations were conducted the general belief was that since the subject matter can be applied in an extensive manner, the dissemination of publications can likewise take on a range of distinct editorial style routes, a profile one can illustrate in a summarized format, as of Graph 2, for instance.

Specifically in terms of articles per author, the largest volume of research (three each) was conducted by Robert G. Cooper (Cooper et al., 1999, 2000, 2001) and Raul O. Chao and Stylianos Kavadias (Chao & Kavadias, 2008; Chao, Kavadias & Gaimon, 2009; Chao and Kavadias, 2013) who in a nutshell focus on practices that centre on applying management and control techniques to new product development at industries in general.

Furthermore, as above mentioned, three additional publications that pertain to the main author Jianxin X. Jiao (Jiao & Zhang, 2005a, 2005b; Jiao, Zhang & Wang, 2007) also explore the context involving the application of techniques that arise from operational research.

In as much as the dispersion of materials comprised by "Portfolio 3" is concerned, during the 1990 and 2014 time frame, Graph 2 illustrates how the theme started, was massively explored and increasingly took on relevance as of 2005, peaked in 2011 and then plunged dramatically in 2012 (52.94%), and 2013 (70.59%).

However, for 2014 expectations include that the number of materials at least near 2011 parameters, suggesting a new growth and dissemination trend for this field of study.



Graph 2: Per annum distribution of "Portfolio 3"´s publications

In the study´s next stage the points that were understood as offering the greatest potential for future study purposes were examined. To this effect, trend analysis posed to elucidate themes that pertained to the field of study and the most commonly explored types of research, in addition to prospecting scientific gaps that suggest perspectives one might explore in future studies.

Thus, based on the above mentioned bibliography, for starters, articles were distributed into five subject matter application centred themes (Portfolio Management, New Products' Development, Management, Performance and Technology) to enable the mapping of each theme´s occurrence frequency as featured in Table 2.

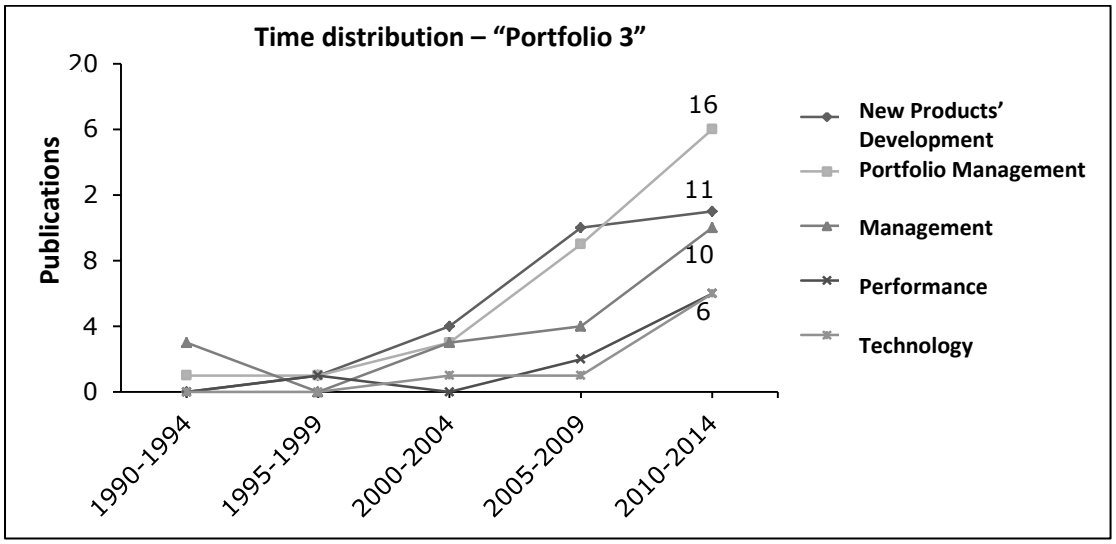
Approximately one third of publications were characterized as strongly influencing the fostering of Portfolio Management (30), closely followed by New Products' Development (26) and Management (20). To a still emerging extent, one finds Performance (9) and Technology (8) which if added, characterizes 18.28% of the total number of items comprised by "Portfolio 3".

Table 2: Per study theme distribution of "Portfolio 3"´s articles

Theme	Total Nr. of articles	Percent
Portfolio Management	30	32.25%

New Products' Development	26	27.96%
Management	20	21.51%
Performance	9	9.68%
Technology	8	8.60%

Thus, to better comprehend the evolution of publication behaviour along time, the proposal included, for each of the previously selected themes, the stratification of data into five "quinquennia" or five-year periods (1990-1994, 1995-1999, 2000-2004, 2005-2009 and 2010-2014), thus generating the outcomes Graph 3 illustrates.



Graph 3: Time distribution of "Portfolio 3"´s publications

Although all of 2014´s publications have not been totalled, one perceives there is an overall, cross-thematic growth in publication volumes trend. Technology arises presenting the highest growth rates, having jumped from an average one article per quinquennia between 2000 and 2009, to six publications between 2010 and 2014, thus featuring as one of the themes that offers the highest potential for future study purposes.

Amongst those themes ranked as most relevant and consolidated before this study´s purposes, over the last quinquennia and particularly in 2011, Portfolio Management arose as that most explored (six publications). This is primarily due to the fact that it can be adopted in a range of practical

circumstances and varies according to the kind of business it is applied to. This is also the case of Management since 50% of publications also appear during the same timeframe.

In contrast, the Product Development scenario presented a drastic reduction in the volume of articles published between 2005-2009 and 2010-2014 (10%) timeframes which corroborates the notion that possibly this trend has already reached its peak use and therefore researchers must be careful to make significant, original contributions to the fostering of this field of study.

In alignment with this study´s core that centres on verifying the bibliographical context of product portfolio management scientific productions, the detailing of information on article profiles before the Portfolio Management target theme was proposed and herein comprises the repository named "Portfolio 4" that in all comprises 30 items.

Subsequently, this repository was simultaneously separated into seven subthemes (Strategic Alliances, Innovation Management, Resources' Management, Financial Management, Portfolio Management, Literature Review and Corporate Simulations) and, into seven Practical Frameworks (PFs), namely: Companies in General, Sales/Services Companies, Manufacturing Companies, High Technology Companies, Medicine, E-commerce and Investment Funds, allotted according to the dispersion Table 3 describes per each article´s intrinsic characteristics.

Table 3: Per subtheme and application "Portfolio 4"´s articles' distribution

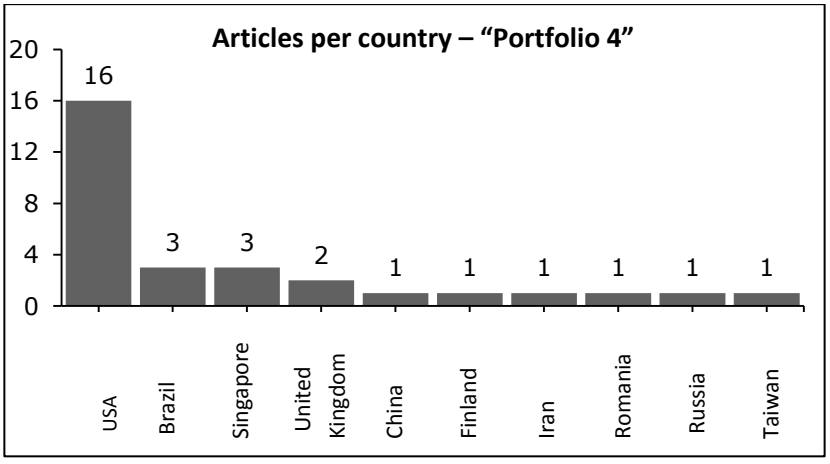
Subthemes	Articles	Applications	Articles
Portfolio Management	11	Companies in General	11
Financial Management	5	Sales/Services Companies	7
Strategic Alliances	5	Manufacturing Companies	6
Corporate Simulations	4	Medicine	2
Resources' Management	3	High Technology Companies	2

Literature review	1	E-commerce	1
Innovation Management	1	Investment Funds	1

Portfolio Management and its applications centered on the herein chosen markets such as that of companies in general, caught the spotlight since each characterizes 11 articles (33.67%), five of which match both (Proctor & Hassard, 1990; Morgan & Daniels, 2001; Jiao & Zhang, 2005a; Jiao et al., 2007; Jugend & Da Silva, 2014).

One might explain such a fact given the extension of the same in relation to others, to the extent that the first is strongly aligned with the Portfolio Management theme that gave rise to repository "Portfolio 4", whilst the second permeates a high level and generic business arena that makes characterization during the course of article checking, more common.

In as much as the distribution of publications according to the location of the top author´s universities is concerned, Graph 4 demonstrates that distribution largely (53.33%) results from researchers that are bond to North-American institutions. This is primarily due to the level of know-how this country features when it comes to product management, as a result of a culture that centers on seeking to control corporate processes, in addition to being widely acknowledged as the world´s current largest economic and scientific power.



Graph 4: Per main author´s country of origin "Portfolio 4"´s articles' distribution

Brazil´s sound standing within this arena deserves special mention given the development of 10% of the total number of productions. This results from the scientific acknowledgement gathered via notable and recent applications proposed by Loos and Miguel (2012), Danilevicz and Ribeiro (2013) and Jugend and Da Silva (2014) that emerged as starting point for future studies centred on this field of study since they propose solutions focused on companies that operate in the country´s trade and industrial contexts.

The following stage of this bibliographical study comprised the verification of characteristics solely centring in applications involving manufacturing companies. This stratification enabled the coining of "Portfolio 5" which comprises six articles in total. Table 4 pictures their profiles *versus* the subtheme, citation frequencies and year of publication.

Table 4: Selected articles comprising "Portfolio 5" covering applications centred on manufacturing companies

Author	Year	Journal	Citations	Subthematic
Lin, Floudas and Kallrath	2005	Journal Of Global Optimization	18	Financial Management
Chen, Vakharia and Alptekinoglu	2008	Production and Operations Management	10	Portfolio Management
Sadeghi and Zandieh	2011	Expert Systems with Applications	4	Corporate Simulation
Smith and Ierapetritou	2011	Computers & Chemical Engineering	3	Corporate Simulation
Danilevicz and Ribeiro	2013	*Gestão & Produção*	0	Innovation Management
Loos and Miguel	2012	*Espacios*	0	Portfolio Management

In a summarized manner, one may state that Lin et al. (2005) describe the construction of a tool that addresses the issue one comes across when attempting to determine the optimal number and capacity of reactors, fully satisfying the needs their markets impose whilst simultaneously reducing product sales expenses.

In turn, Chen et al. (2008) investigated the impact on the behaviour of an industry´s portfolio from the standpoint of three prime factors, namely:

a) the effects of cannibalization per existing functionality amongst its products;

b) cost variation of manufacturing single-function *versus* multi-function items;

c) practiced prices and their impact on cannibalization amongst one or more single-function *versus* multi-function products' study.

Meanwhile, Sadeghi and Zandieh (2011) introduce in their study´s scope the idea of preparing a mathematical model of business games centred on the product portfolio management issue. Smith and Ierapetritou (2011) in their study present a simulation model to optimize integration between those sectors that are held accountable for the product´s ideation, management and industrial operation.

Danilevicz and Ribeiro (2013) demonstrate the ideation of a quantitative model that is capable of supporting innovation centered strategic decision making processes - known as Strategic Innovation Decisions - that in its structure embeds portfolio management and is applied to the automotive and anchorage cable industries. Finally, Loos and Miguel (2012) prepare a study that poses to diagnose the most relevant Product Portfolio Management (PPM) practices at manufacturing companies.

Thus, via the proposed stratification, a reduction from "Portfolio 1" to "Portfolio 5" of 98.86% of researched articles occurred, of which only the six described in Table 4 are directly associated with this research´s field of study. However, these do form a theoretical-scientific set that is deemed of core importance for the execution of new investigations.

Furthermore, during the course of the study observations revealed that there is room for research centred on portfolio management at manufacturing companies, particularly within the Brazilian context where only two studies focused on this theme were identified, despite the existence of more than 30 types of this kind of company in Brazil, according to CNI (2013) data.

Thus, one might state that there is extensive ground for exploration, particularly involving matters that relate to traditional business administration fields, such as financial management and innovation which are amongst those identified as offering the most relevant gaps.

4 CONCLUSIONS

Given the herein elucidated points of discussion, one can state that the portfolio management of consolidated (not new) products at industrial sector companies still features an incipient status in terms of original research that is poorly explored in the academic-scientific arena.

In alignment with this understanding, belief rests in the fact that one of the possible solutions to address the gap might be associated with increased narrowing of ties between universities (particularly amongst research centers) and both private and public entities. Once this takes place, one might state that the possibilities of scientific solution development substantially increase both in terms of quality and volume.

In as much as opportunities are concerned, future expectations include the fostering of the development and application of tools that center on this investigation´s field of study, via research devoted to the building of practical product management tools focused on solving problems one encounters in the industrial arena.

In terms of limitations, one may primarily list the functional limits that are intrinsic to article (*Periódicos CAPES*®) and citation (Google Scholar®) indexation that were chosen to prepare the case study given the fact that the search outcome is directly associated with the level of data and information these portals offer despite their being currently deemed by the scientific community amongst those available, the most complete and comprehensive.

BIBLIOGRAPHY

Aurich, J. C., Mannweiler, C., & Schweitzer, E. (2010). How to design and offer services successfully. *CIRP Journal of Manufacturing Science and Technology, 2*(3), 136-143.

Batalha, M. O. (2008). *Introdução à engenharia de produção*. Rio de Janeiro: Elsevier.

Bergh, D. D. (1998). Product-market uncertainty, portfolio restructuring, and performance: An information-processing and resource-based view. *Journal of Management, 24*(2), 135-155.

Beuren, F. H., & Miguel, P. A. C. (2012). Systematic literature review on product-system services using bibliometric analysis: Main journals, articles, authors and keywords. *Product: Management & Development, 10*(1), 33-40.

Beuren, F. H., Ferreira, M. G. G., & Miguel, P. A. C. (2013). Product-service systems: A literature view on integrated products and services. *Journal of Cleaner Production, 47*, 222-231.

Blau, G. E., Pekny, J. F., Varma, V. A., & Bunch, P. R. (2004). Managing a portfolio of interdependent new product candidates in the pharmaceutical industry. *Journal of Product Innovation Management, 21*(4), 227-245.

Brun, A., & Castelli, C. (2008). Supply chain strategy in the fashion industry: Developing a portfolio model depending on product, retail channel and brand. *International Journal of Production Economics, 116*(2), 169-181.

Burin Neto, F., Jugend, D., Barbalho, S. C. M., & Silva, S. L. (2013). Gestão de portfólio de produtos: Práticas adotadas por uma empresa de base tecnológica de médio porte localizada na cidade de São Carlos-SP. *Gestão da Produção, Operações e Sistemas - Gepros, 8*(1), 67-78.

Castro, H. G., & Carvalho, M. M. (2010). Gerenciamento de portfólio: um estudo exploratório. *Gestão e Produção, 17*(2), 283-296.

Chao, R. O., & Kavadias, S. (2008). A theoretical framework for managing the new product development portfolio: When and how to use strategic buckets. *Management Science, 54*(5), 907-921.

Chao, R. O., Kavadias, S., & Gaimon, C. (2009). Revenue driven resource allocation: Funding authority, incentives, and new product development portfolio management. *Management Science, 55*(9), 1556-1569.

Chao, R. O., & Kavadias, S. (2013). R&D intensity and the new product development portfolio. *IEEE Transactions on Engineering Management, 60*(4), 664-675.

Chen, Y., Vakharia, A. J., & Alptekinoglu, A. (2008). Product portfolio strategies: The case of multifunction products. *Production and Operations Management, 17(6)*, 587-598.

Confederação Nacional da Indústria - CNI. (2013). *Economia brasileira*. Recovered in July 24, 2014, from http://arquivos.portaldaindustria.com.br/app/conteudo_18/2013/12/19/5737/20131219091852130359o.pdf.

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (1999). New product portfolio management: Practices and performance. *Journal of Product Innovation Management, 16*(4), 333-351.

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2000). New product portfolio management: Practices and performance. *IEEE Engineering Management Review, 28*(1), 13-29.

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2001). Portfolio management for new product development: Results of an industry practices study. *R&D Management, 31*(4), 361-380.

Cooper, R. G. (2011). *Winning at new products: Creating value through innovation*. New York: Basic.

Coordenação de Aperfeiçoamento de Pessoal de Nível Superior- Capes. (2014). Periódicos Capes. Recovered in July 21, 2014 from http://www-periodicos-capes-gov-br.ez47.periodicos.capes.gov.br/index.php?option=com_phome&Itemid= 68&.

Danilevicz, A. M. F., & Ribeiro, J. L. D. (2013). Um modelo quantitativo para a gestão da inovação em portfólio de produtos. *Gestão & Produção*, *20*(1), 59-75.

Da Silva, A. J., Toledo Filho, J. R., & Pinto, J. (2010). Análise bibliométrica dos artigos sobre controladoria publicados em periódicos dos programas de pós-

graduação em ciências contábeis recomendados pela Capes. *ABCustos*, *4*(1), 1-17.

DelVecchio, D. (2000). Moving beyond fit: The role of brand portfolio characteristics in consumer evaluations of brand reliability. *Journal of Product & Brand Management, 9*(7), 457-471.

Drucker, P. F. (2008). *Management.* New York: Harper Business.

Faems, D., Van Looy, B., & Debackere, K. (2005). Interorganizational collaboration and innovation: Toward a portfolio approach. *Journal of Product Innovation Management, 22*(3), 238-250.

Gaither, N. (2001). *Administração da produção e operações.* São Paulo: Pioneira Thomson Learning.

Google Scholar. (2014). *Citações.* Recovered in July 24, 2014 from http://scholar.google.com.br/.

Jiao, J. X., & Zhang, Y. Y. (2005a). Product portfolio identification based on association rule mining. *Computer-Aided Design, 37*(2), 149-172.

Jiao, J. X., & Zhang, Y. Y. (2005b). Product portfolio planning with customer-engineering interaction. *IIE Transactions, 37*(9), 801-814.

Jiao, J. X., Zhang, Y. Y., & Wang, Y. (2007). A heuristic genetic algorithm for product portfolio planning. *Computers & Operations Research, 34*(6), 1777-1799.

Jones, D., & Womack, J. (2003). *Lean thinking: banish waste and create wealth in your corporation*. New York: Free Press.

Jugend, D., da Silva, S. L. (2014, March). Product-portfolio management: A framework based on methods, organization, and strategy. *Concurrent Engineering-research And Applications*, *22*(1), 17-28.

Kester, L., Griffin, A., Hultink, E. J., & Lauche, K. (2011). Exploring portfolio decision-making process. *Journal of Product Innovation Management, 28*(5), 641-661.

Killen, C. P., Hunt, R. A., & Kleinschmidt, E. J. (2008). Project portfolio management for product innovation. *International Journal of Quality and Reliability. Management, 25*(1)*,* 24-38.

Kubota, F. I., Ferenhof, H. A., Ferreira, M. G. G., Forcellini, F. A., & Miguel, P. A. C. (2013). Desenvolvimento de plataforma de produto e modularidade: Uma análise bibliométrica. *Teoria e Prática em Administração, 3*(2), 44-69.

Lacerda, R. T. O., Ensslin, L., & Ensslin, S. R. (2011). A performance measurement framework in portfolio management: A constructivist case. *Management Decision, 49*(4), 648-666.

Lapersonne, A. H. H. (2013). Managing multiple sources of competitive advantage in a complex competitive environment. *Future Studies Research Journal, 5*(2), 220–248.

Laugeni, F. P., & Martins, P. G. (2006). *Administração da produção.* São Paulo: Saraiva.

Lin, X. X., Floudas, C. A., & Kallrath, J. (2005). Global solution approach for a nonconvex MINLP problem in product portfolio optimization. *Journal of Global Optimization, 32*(3), 417-431.

Loos, M. J., & Miguel, P. A. C. (2012). Product portfolio management practices based on the PDMA survey: A diagnostic in a textile company. *Espacios, 33*(6), 6-12.

Mangun, D., & Thurston, D. L. (2002). Incorporating component reuse, remanufacture, and recycle into product portfolio design. *IEEE Transactions on Engineering Management, 49*(4), 479-490.

Miguel, P. A. C. (2008a). Portfolio management and new product development implementation: A case study in a manufacturing firm. *International Journal of Quality and Reliability Management, 25*(1), 10-23.

Miguel, P. A. C. (2008b). A case study on portfolio management implementation for new products. *Produção, 18*(2), 388-340.

Neuenfeldt Júnior, A. L., Siluk, J. C. M., Soliman, M., & Marques, K. F. S. (2014). Study to evaluate the performance development of Brazilian franchise segments. *Independent Journal of Management & Production, 5*(2), 381-397.

Morgan, L. O., & Daniels, R. L. (2001). Integrating product mix and technology adoption decisions: A portfolio approach for evaluating advanced technologies

in the automobile industry. *Journal of Operations Management, 19*(2), 219-238.

Oliveira, E. K. F. de, & Boente, D. R. (2012). Análise bibliométrica da produção científica recente sobre contabilidade gerencial. *Organizações em contexto, 8*(15), 199-212.

Oliveira, M. G., & Rozenfeld, H. (2010). Integrating technology roadmapping and portfolio management at the front-end of new product development. *Technological Forecasting and Social Change*, *77*(8), 1339-1354.

Oliveira, M. G., Freitas, J. S., Fleury, A. L., Rozenfeld, H., Phaal, R., Probert, D., & Cheng, L. C. (2012). *Roadmapping: Uma abordagem estratégica para o gerenciamento da inovação em produtos, serviços e tecnologias.* Rio de Janeiro: Elsevier.

Pizzani, L., Silva, R. C. da, & Hossne, W. S. (2010). Análise bibliométrica dos 40 anos da produção científica em Bioética no Brasil e no mundo. *Revista Bioethikos*, *4*(4), 453-460.

Porter, M. (2009). *Competição.* São Paulo: Campus.

Proctor, R A., & Hassard, J. S. (1990). Towards a new model for product portfolio analysis. *Management Decision, 28*(3), 14-24.

Rothaermel, F. T., Hitt, M. A., & Jobe, L. A. (2006). Balancing vertical integration and strategic outsourcing: Effects on product portfolio, product success, and firm performance. *Strategic Management Journal, 27*(11), 1033-1056.

Sadeghi, A., & Zandieh, M. (2011). A game theory-based model for product portfolio management in a competitive market. *Expert Systems with Applications, 38*(7)*,* 7919-7923.

Scarano, T. F., Siluk, J. C. M., Nara, E. O. B., Neuenfeldt Júnior, A. L., & Da Fontoura, F. B. B. (2014). Diagnóstico do desempenho organizacional em empresas do setor metal mecânico, *Espacios*, *35*(3), 1.

Slack, N., Chambers, R., Johnston, R., & Betts, A. (2008). *Operation and process management: Principles and practice for strategic impact.* Lebanon: Prentice Hall.

Smith, B. V., & Ierapetritou, M. G. (2011). Sensitivity-based product portfolio and design integration. *Industrial & Engineering Chemistry Research, 50*(7), 3919-3927.

Wynstra, F., & Pierick, E. (2000). Managing supplier involvement in new product development: A portfolio approach. *European Journal of Purchasing and Supply Management, 6*(1), 49-57.

Yoshida, N. D. (2010). Análise bibliométrica: Um estudo aplicado à previsão tecnológica. *Future Studies Research Journal, 2*(1), 52–85.