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DECISION-MAKING PERFORMANCE IN SMART COMPANIES DRIVEN BY MARKET-DRIVEN TECHNOLOGICAL INNOVATIONS: DO MANAGEMENT ACCOUNTING ARTIFACTS MATTER?

Abstract: This research aims to examine the relationship between management accounting artifacts and decision performance in market-driven innovation environments. Through a systematic review, sixty-nine artifacts were identified. For better organization and understanding, five groups were formed: Methods and Costing Systems; Philosophy and Management Models; Business Strategy and Monitoring; Programming and Control; and Methods of Measurement, Evaluation and Performance Measures. Using a scalar judgment matrix, a survey was applied to professionals involved in the decision-making process in smart multinational companies in Brazil. The findings indicated a substantial effect of artifacts on decision-making performance, with emphasis on the Programming and Control group. This research is original and has implications for management practice and academics.
Keywords: Decision-making, Management accounting, Artifacts, Market-driven technological innovations, Multinationals, Brazil.

1. INTRODUCTION

Industry 4.0 is an initiative of Germany and has proved to be a term adopted globally in the last decade (Xu et.al., 2021). Rapid advances in manufacturing technologies and applications in industries help to increase productivity. The term Industry 4.0 represents the fourth industrial revolution which is defined as a new level of organization and control over the entire product lifecycle value chain; is geared towards increasingly individualized customer needs (Vaidya, Ambad, and Bhosle, 2018). The purpose of Industry 4.0 highlights how humanity will develop the relationship between human beings and the market in new business models that are increasingly intelligent, systematized and innovative, prioritizing the reduction of time in decision making. This study examines the relationship between management accounting artifacts and decision performance in market-driven innovation environments. Incorrect information affects the decision-making process throughout the system (Özcan and Akkaya, 2020).

Management accounting, which is a management decision support system, brings together techniques or artifacts that favor information for smart companies to act more quickly in environments of radical innovation. This environment of frequent change in the corporate sector and the current economic situation of the market are aspects that encourage organizations to seek effective artifacts for decision making. This emerging market has been working on the need for evolved information systems to obtain information as close to real time as possible according to production to support decisions to be taken by company managers. The integration between the managerial and productive universe can stimulate the intelligent use of your data that add economic value to the good. The industry has demanded increasingly enhanced information to reconfigure its economic and management activities, with this, accounting information provides a test of how the data of the decisions to undertake in relation to the company directing the required financial return will be shaped.

The Management Accounting system as a generator of information, seeks to monitor and adapt to these transformations and evolutions of the market for smart companies (Ojra, Opute, and Alsolmi, 2021). These companies, when applied in a managerial aspect, allow the accounting reports to be congruent, bringing observations of the evolution of growth and

evolution of the business in anticipation of the future, being able to provide important evaluation information both for the external and internal environment with great relevance to the strategic plans, budget, business and others. Therefore, management accounting as a management information system presents itself as an efficient instrument to support managers in the decision-making process, but for this process to be successful, it is necessary to have plausible and feasible mechanisms to facilitate this information. Among the accounting reporting tools are Cash Flow, Costing Systems, Budget, Tax Planning, Balance Sheet, Income Statement for the Year, among others.
There are few studies that relate the artifacts of management accounting and the performance of the decision-making process in smart companies. Thus, this study started from a gap in the literature on accounting techniques applied in the decision-making process with the objective of verifying the positive gains translated by the influence of management accounting in the decision-making processes in environments of innovations guided by the market of companies. smart from Brazil. This study presents contributions: (i) advances in the body of knowledge; (ii) it improves the understanding of the relevance of management accounting artifacts for the performance of decisions in the context of smart industries with Orientation to Technological Innovations Guided by the Market; and (iii) improves understanding of the role of management accounting as a guide for managers in choosing artifacts for decision making; (iv) highlight the important role that management accounting plays in driving the performance of smart companies. Thus, this study is important and demands more studies to improve knowledge in management accounting in the context of smart industries. This article is systematized according to the following sections: the theoretical framework, the applied methodology, underlying results and analyses, and finally, the conclusions and final recommendations of the research.

2. THEORETICAL BACKGROUND

The Fourth Industrial Revolution originated in 2011 from a project in the German government's high-tech strategy. SmartFactory is one of the main associated initiatives of Industry 4.0 (Zuehlke, 2010). Venturelli (2017) highlights that Industry 4.0, as an evolution of production systems, supports decision-making based on a Big Data database. Smart industries have a definition based on the IoT – Internet of Things, which is the connection of all mechanisms creating information in a database and also in the Machine to Machine that is improved by the IoT, through a type of intelligence artificial way to exchange information between systems, independently for decision making (Venturelli, 2017). In this context, digitization can be seen as a key driver of innovation (Niewöhner et.al., 2020). The new digital technologies associated with Industry 4.0 (AI, big data, digital twins, IoT, cobots, etc.) open up new opportunities to support decision making. Digital technologies can facilitate collaboration and provide more flexibility and more real-time information, transforming the way manufacturing networks are defined (Delorme et.al., 2021). Thus, new methodologies and information-facilitating approaches are needed to support decisions in smart companies with guidelines for technological innovations guided by the market. Our article focuses on the role of management accounting artifacts, as mechanisms that facilitate financial and non-financial accounting information to support managerial decision-making in the field of smart companies with guidelines for market-driven technological innovations. Specifically, our study addresses the relationship between management accounting artifacts and decision-making performance in Brazilian multinational companies, with guidelines for technological innovations guided by the market. This is one of the few studies that addresses this relationship. Green and Amenkhienan (1992) signaled the existence of a significant mismatch between innovations in manufacturing and innovations in the area of management accounting, although many changes are taking place, large and extensive companies continue to rely on outdated accounting models. This concept reaffirms the need for management models to be updated according to market variations in innovation environments to be actively in development work with their variables presented by managers. Thus, we emphasize that there may be a gap between theory and practice in companies because many of them did not introduce important artifacts in their decision making. Several studies (Spickova and Myskova, 2015; Maher, 2000; Ghobakhloo and Fathi, 2020; Bjornenak and Olson, 1999) have highlighted the artifacts of management accounting. Activity-Based Costing/Activity-Based Management, Just-in-Time, Customer Profitability Analysis, EVA, Kaizen, Non-Financial Measures, Quality and Time Costs, Strategic Profitability Analysis, Supply Chain, Target Costing, Cost Accounting Earnings and Value Chain, Activity Based Management, Distributed Information System, Balanced Scorecard, Life Cycle Costing, Accounting for Strategic Management; attribute costing, brand equity budgeting, brand equity monitoring, competitor cost assessment, competitive position monitoring, competitor assessment based on public accounting information, etc. Accounting management tools or artifacts are intended to add or add value to the company's customers. Soutes (2006) argues that management accounting artifacts correspond to activities, instruments, tools and management models used by company managers to perform their administrative functions and, mainly, to use them as a basis in the decision-making process.

3. METHODOLOGY

This research is qualitative-quantitative, exploratory and descriptive and was initially elaborated from the specialized literature, using the Google Scholar, Emerald and Science Direct databases, in which the variables referring to the "artifacts/techniques" of accounting were extracted. managerial. Then, a survey was carried out with specialists from Brazilian multinational companies oriented towards technological innovations guided by the market. In this way, management accounting artifacts were raised from the state of the art. For better organization and understanding, the variables were organized into 5 groups, they are: Group 1: Methods and Costing Systems; Group 2: Philosophy and

Management Models; Group 3: Strategy and Business Monitoring; Group 4: Programming and Control; and Group 5: Measurement Method, Evaluation and Performance Measures. Subsequently, a scalar/judgment matrix-type questionnaire was prepared, in order to present, by importance (1 - Irrelevant; 5 - Extreme influence) in order to assess, based on the perception of experts, the influence of managerial accounting artifacts in decision-making processes in market-driven innovation environments in smart companies in Brazil. Then the specialists were selected, by technical and scientific criteria, with experience and knowledge about the object of investigation. Before the final application, three pre-tests were applied to verify possible inconsistencies in the aforementioned data collection instrument, such as redundancy, understanding, response time, among others. After the necessary adjustments, the questionnaire was definitively submitted. 110 questionnaires were submitted and 38 returned answered. This sample is considered consistent, since it involves specialists: managers, directors, financial analysts, controllers. The complete time considering the elaboration and application of the aforementioned instrument was two months (from September/2021 to October 2021). Data were analyzed based on expert responses.

4. RESULTS AND UNDERLYING ANALYSIS

4.1 Analysis by Group

In this section the results and underlying analysis of the research are presented. Thus, at first, the results will be presented and analyzed by group: Methods and Costing System, Philosophy and Management Models, Strategy and Monitoring of the Business, Programming and Control and Method of Measurement, Evaluation and Performance Measures. Then, a joint analysis of all the results will be elaborated, showing the global influence of the Management Accounting artifacts for decision making. These procedures are detailed below.

- **Group 1: "Methods and Costing System"**

Figure 1 shows the results of the Group: "Methods and Costing System" and its component variables. In other words, this group highlights the opinion of experts on the influence of artifacts on the decision-making process in market-driven innovation environments in smart companies in Brazil.

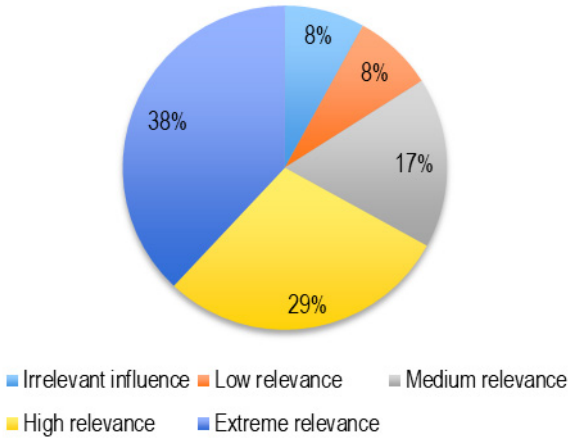

Figure 1: Group - "Methods and Costing System"

Combining the results presented in Figure 1, it is possible to state that most experts (67%) consider that the accounting artifacts: "Cost Methods" positively and significantly influence the decision-making process. The main variables that make up this group are the costs: Absorption, Variable, ABC, Standard and Target-Cost. In fact, managing production costs is one of the biggest challenges for companies. And in this sense, smart companies seek to systematically improve costing methodologies towards achieving gains in sustainable competitive advantages. According to Bórnia (2002), the analysis of a cost system should take into account two aspects. The first refers to the type of information generated by the system. In this sense, one should question whether the information provided is adequate to the company's needs or whether there is a demand for new reports. The second perspective considers the operation of the system, that is, it indicates how the data is processed to obtain the necessary information. Kaplan and Norton (1997) reveal that companies need costing systems to perform three main tasks: (a) evaluate inventories and measure production costs to meet legal requirements; (b) forecast operating expenses; (c) provide economic feedback on the efficiency of the management process.

As already highlighted, radical innovation environments require high agility and flexibility in organizations/productive systems. This presupposes plausible and feasible information, that is, complete, useful, timely and opportune for the decision-making process. And accounting presents itself as an efficient system to support accounting-management decisions, in particular providing information regarding production costs. They often come up against legal requirements on the imposition of rules in the technical implementation of costing systems that do not lead to more

efficient decision-making, as is the case in question of absorption costing systems, due to the high subjectivity in the apportionment of fixed costs, thus leaving inaccuracies in the information.

Group: “Philosophy and Management Models”

Figure 2 highlights the results of the Group: “Philosophy and Management Models”. In other words, Figure 2 presents the experts' view of the influence of the Philosophy and Management Models Group and its Artifacts on the performance of the decision-making process in environments of market-driven innovation in smart companies in Brazil.

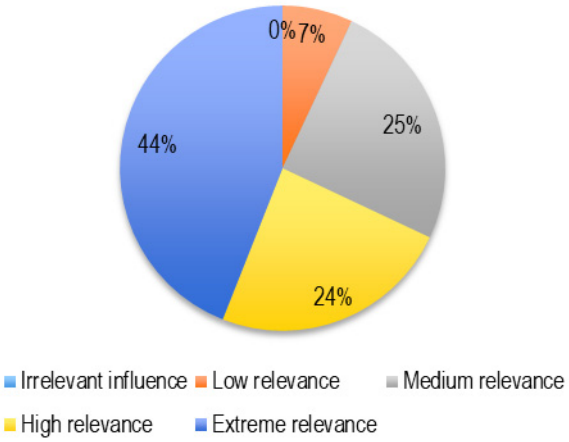

Figure 2: Group - “Philosophy and Management Model”

The results (Figure 2) indicate that the artifacts of Philosophy and Management Models are extremely relevant (5) for most respondents (68%). Artifacts in this group are: business budget, simulation, Kaizen, Balanced Scorecard (BSC), Just in Time, Theory of Constraints, Value-Based Management, and Strategic Planning. In the view of specialists, Management Models, BSC, Strategic Planning and Budget are among the most relevant practices for an efficient performance of companies. Machado (1997, p.86) suggests that the “management model is a set of principles emanating from the company's beliefs and values that guide the decisions and actions of managers, whose impact will be directly verified in the organization's assets”. The BSC has been widely used to measure not only quantitative variables, but also qualitative ones. The Budget artifact is nothing more than a company's economic-financial plan. Zdanowicz (2004, p. 244) points out that: “Budget is an instrument that describes a general plan of operations and/or capital, guided by the objectives and goals outlined by the top management for a given period of time”. Thus, the budget brings numerous advantages, such as cost minimization, cost containment and Cash Flow Planning, anticipating cash needs, where decisions to be taken in a clear and precise way can be predicted in advance. The Strategic Planning artifact, on the other hand, is considered extremely important by most specialists, as it describes where the company should go, establishing directions to reach its goals. In addition, in a competitive environment, strategic planning is indispensable in the decision-making process, as all decision-making must be based on the strategies adopted by organizations in their planning.

Group: “Business Strategy and Monitoring”

Figure 3 presents the results of the importance of managerial artifacts in the “Business Strategy and Monitoring” group in decision making in market-driven innovation environments in smart companies in Brazil.

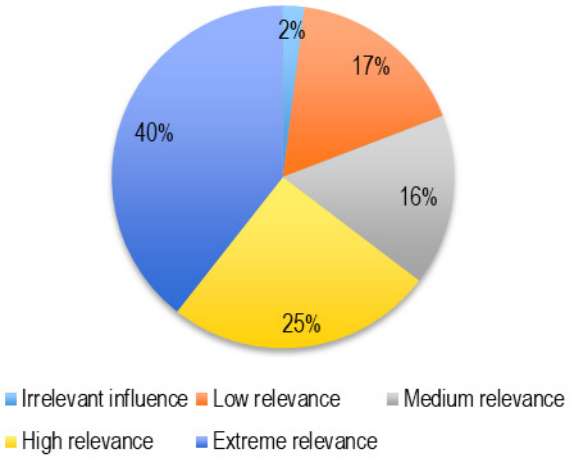

Figure 3: Group - “Business Strategy and Monitoring”

The findings presented in Figure 3 show that 64% of the respondents judged the management practices of this group as of great importance for achieving the performance of the decision-making process in environments of market-driven innovation in smart companies in Brazil. In this group, the following artifacts were considered: Simulation of Corporate Governance Practices, Business Intelligence and Risk Management. These business strategy and monitoring activities are necessary both to measure the results obtained and to assess the progress of the company's global and specific objectives, through the monitoring of goals and indicators. The most outstanding management practice was Business Intelligence, in which 70% of the specialists classified it as level 5. This artifact arose from the need to improve the decision-making process of organizations, focusing on the agility of analyzing a large number of data, and transforming them into reliable information for the company's top management. In a highly competitive environment, such as Industry 4.0, information plays a fundamental role in business success, and obtaining information quickly and in a structured way is made possible by the Business Intelligence artifact, which will bring a competitive edge and contribute to the decision-making process. Business Intelligence is a set of strategies aimed at the corporate environment with the main objective of improving the company's performance, through data analysis, in which the manager becomes more capable of creating a comprehensive view of all internal routines. , its relationship with the company's profits and the points that need improvement. In this way, the decision-making process becomes more intelligent and effective.

- **Group: “Programming and Control”**

Figure 4 shows the results of the “Programming and Control” group and its variables, highlighting the importance of these accounting practices in the decision-making process in environments of market-driven innovation in smart companies in Brazil.

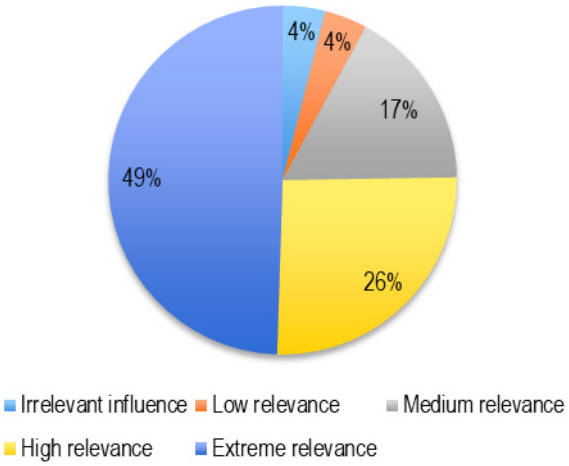

Figure 4: - Group: "Programming and Control"

The findings indicated in Figure 4 indicate that 76% of the respondents classified the management practices of this group at the level of extreme importance (5) for achieving performance in the decision-making process. This group includes budget, equity and tax projections. Bonney (2000) highlights that one of the main functions of Scheduling and Control and its associated systems is to plan and control so that the company meets production requirements in the most

efficient way possible, he basically states that scheduling and control plans everything that is related to the activities of a company, in an extremely detailed way, regardless of its field of activity. For the majority (62%) of respondents, the most relevant artifact (5) is Tax Planning. Godoi and Ferraz (2012) suggest that tax planning is the activity by which taxpayers organize the execution of their economic activities in order to provoke the lowest possible tax incidence, as well as not to infringe the legal system.

Group: "Measurement, Evaluation and Performance Measurement Method"

Figure 5 shows the artifacts of the "Measurement, Evaluation and Performance Measurement Method" group, according to their level of importance in decision making in market-driven innovation environments in smart companies in Brazil.

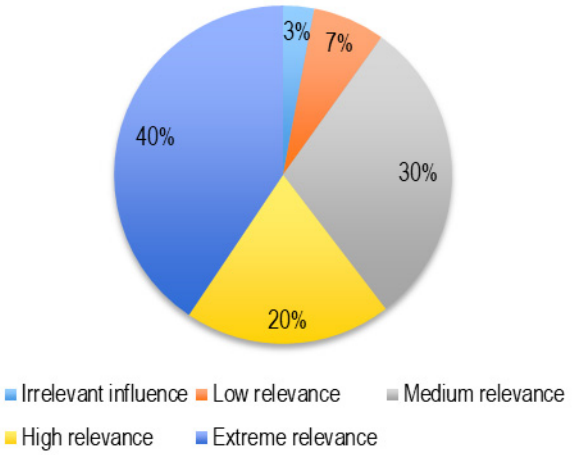

Figure 5: - Group: "Measurement, Evaluation and Performance Measures Method"

Figure 5 indicates that 61% of respondents considered the practices of Performance Measures to be extremely important for the decision-making process in multinational companies. The artifacts of this group are the indicators of liquidity, gross and operating margin, return on investments and equity, operating cash flow, operating and financial leverage, among others. Among the most relevant artifacts, EBTIDA and Net Working Capital stand out, in which 83% and 78% of respondents assigned weight 5, that is, extremely important. EBTIDA, also known as EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization), considers net operating income, less operating costs and expenses, excluding depreciation and amortization. It is a powerful indicator of the company's financial performance, which reflects the revenue-generating potential of the company's activities.

4.2 Global Artifact Analysis

Figure 6 highlights the global relevance of artifacts (clusters) for decision making in market-driven innovation environments in smart companies in Brazil.

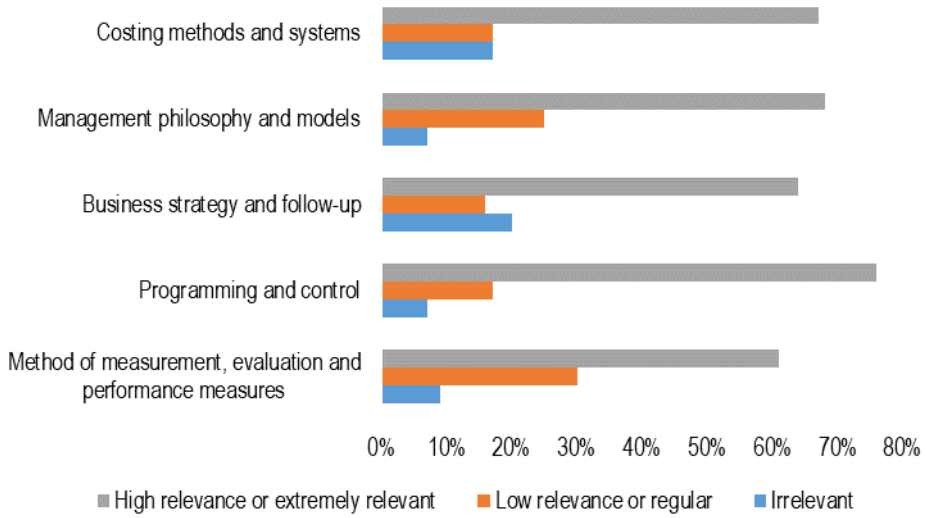

Figure 6: Degree of global influence of groups of artifacts on decision-making performance

It is possible to affirm that all the artifacts highlighted in this study are substantially relevant to the performance of the decision-making process in the multinational companies investigated in this study: Programming and Control (75%); Philosophy and Management Models (68%); Business Strategy and Monitoring (65%); Measurement Methods, Costing Methods (66%); and Performance Assessment and Measures (60%). The "Programming and Control" group should receive greater attention from managers, as it concentrates the main artifacts to assist decision making, such as the types of Budgets (Expenses, Expenses and Capital) and Projected Financial Statements. We also emphasize the importance of Projected Financial Statements as a decision support tool for smart companies. The business simulation, when applied in relation to financial statements, has the main objective of enabling users to visualize the interrelationships of possible actions to be taken, as well as allowing the improvement of the decision-making process through the evaluation and quantification of the impacts of the main decisions business (Fomm, 2004, p.19). In general, the percentages received by the groups did not show much discrepancy, which further confirms the influence of all the artifacts mentioned in this work for the decision-making process in market-driven innovation environments in smart companies in Brazil.

5. CONCLUSIONS

This research aimed to examine the relationship between management accounting artifacts and decision performance in market-driven innovation environments. A conceptual framework was designed and tested in smart multinational companies in Brazil, oriented towards radical technological innovations driven by the market. Through a systematic review, sixty-nine artifacts were identified. For better organization and understanding, five groups were formed: Methods and Costing Systems; Philosophy and Management Models; Business Strategy and Monitoring; Programming and Control; and Methods of Measurement, Evaluation and Performance Measures. Using a scalar judgment matrix, a survey was applied to professionals involved in the decision-making process in smart multinational companies in Brazil. The findings indicated the substantial relevance of Management Accounting artifacts for decision-making performance, with emphasis on the Programming and Control group. This study is a guide for managers in their decision making in market-driven innovation environments, therefore, full of uncertainties and unpredictability, which justifies the better performance of the Programming and Control artifacts group as the most relevant of the study in the production of relevant information for the decision-making process in environments that demand high agility and flexibility in their manufacturing systems. This study presents theoretical contributions because it advances the body of knowledge in the field of management accounting. The research also has limitations, such as the sample scope is limited. Thus, we recommend expanding the sample to other applications, including other respondents. In addition, it would be interesting to guide the application of the research in other multinational corporations in other countries for comparison purposes. Another limitation concerns the practices considered in this study. In future studies, new practices could be included, particularly practices related to non-quantitative performance measurement, such as sustainability metrics.

REFERENCES

Bjornenak, T. (1997) Conventional wisdom and costing practices. *Management Accounting Research*, 8, 367-382.

Bonney, M. (2000) *Reflections on production planning and control (PPC). Revista Gestão & Produção*. 7, 3, 181-207.

Bornia, A.C. (2002) Análise Gerencial de Custos – Aplicação em Empresas Modernas. Porto Alegre: Editora Bookmann.

Delorme, X., Sgarbossa, F., Rabelo, R.J.,Boucher, X. (2021), The *Journal of Intelligent Manufacturing*, Special Issue on Resilient and Sustainable Manufacturing Networks.

Fomm, M.M. (2004) Simulação empresarial: um enfoque voltado para o processo de tomada de decisão. Rio de Janeiro: UniverCidade.

Ghobakhloo, M. and Fathi, M. (2020), "Corporate survival in Industry 4.0 era: the enabling role of lean-digitized manufacturing", *Journal of Manufacturing Technology Management*,31 1, 1-30.

Godoi, M. S, Ferraz, A. C. (2012) Planejamento Tributário e simulação: Estudo e Análise Dos Casos Rexnord Josapar. *Revista de Direito da Fundação Getúlio Vargas*, 8, 359-

380.

Green, F. B.; Amenkhienan, F. E. (1992) *Accounting innovations: a cross sectional survey of manufacturing firms.* Journal of Cost Management for the Manufacturing Industry, spring.

Kaplan, R. S.; Norton, D. P. (1997) A Estratégia em Ação: Balanced Scorecard. Rio de Janeiro: Editora Campus.

Machado, A. C. (1997) Sistema de informações para gestão econômica no comércio varejista: estudo dos principais modelos de decisões envolvidos. Dissertação/ (Mestrado). Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo, São Paulo.

Maher, M. W. (2000) Management Accounting Education at the millennium. Issues in *Accounting Education*, 15, 2, 335-346.

Niewöhner, N., Asmar, L., Röltgen, D., Kühn, A., and Dumitrescu, R. (2020), The impact of the 4th industrial revolution on the design fields of innovation management, 30th CIRP Design 2020 (CIRP Design 2020), Procedia CIRP 91, 43-48.

Ojra, J., Opute, A.P. and Alsolmi, M.M. (2021) Strategic management accounting and performance implications: a literature review and research agenda. *Futur Bus J* 7, 64.

Özcan, E. and Akkaya, B. (2020), The Effect of Industry 4.0 on Accounting in Terms of Business Management, Akkaya, B. (Ed.) *Agile Business Leadership Methods for Industry 4.0*, Emerald Publishing Limited, Bingley, 139-154

Soutes, D. O.; Guerreiro, R.. Uma investigação do uso dos artefatos da contabilidade gerencial por empresas brasileiras. 116f. Dissertação (Mestrado em Ciências Contábeis) – Universidade de São Paulo, São Paulo, 2006.

Spickova, M. and Myskova, R. (2015) Costs Efficiency Evaluation using Life Cycle Costing as Strategic Method, *Procedia Economics and Finance*, 34, 337-343

Vaidya, S., Ambad, S., and Bhosle, S. (2018) Industry 4.0 – A Glimpse, *Procedia Manufacturing*, 20, 233-238

Xu, X., Lu Y., Vogel-Heuser, B., Wang, L. (2021) Industry 4.0 and Industry 5.0—Inception, conception and perception, Journal of Manufacturing Systems, 61, 530-535.

Zdanowicz, J. E. (2004) Fluxo de caixa: uma decisão de planejamento. 10. ed. Porto Alegre: Sagra Luzzatto.

Zühlke, D. (2010), SmartFactory – Towards a factory-of-things, Computer Science, Annu. Ver. Control., 34, 129-138.