Analysis of the Furniture Industrial Panorama, in Brazil, in Relation to the Adoption of Industry 4.0 Technologies

Dusan Schreiber[1], Alexandre André Feil[2], Cristiane Froehlich[3] & Vilson José Becker[4]

[1] PhD in Managament, Master´s Course in Management, University FEEVALE, Novo Hamburgo, Brazil

[2] PhD in Environmental Quality, Master´s Course in Environmental Sustainable Systems, University UNIVATES, Lajeado, Brazil

[3] PhD in Managament, Master´s Course in Management, University FEEVALE, Novo Hamburgo, Brazil

[4] Graduation Course in Management, University FEEVALE, Novo Hamburgo, Brazil

Correspondence: Dusan Schreiber, Master´s Course in Management, University FEEVALE, Novo Hamburgo, Brazil, ERS-239, 2755 | Novo Hamburgo, RS - CEP 93525-075

Abstract

The furniture industry is a traditional segment, with a global presence, and as in other markets and segments, globalization has contributed to creating an environment of fierce competition between small, medium and large companies. China, the European Union and the United States are the biggest producers and also the biggest consumers of furniture products. Brazil is also included in this market, but with lower production and consumption volumes. The objective of this study is to analyze panorama of the furniture industry in Brazil and abroad, in relation to the adoption of industry 4.0 technologies to foster new working conditions and productivity. In this work, authors opted for the format of reflective theoretical essay, based on the result of systematic review of literature, performed in Scopus, in February, 2023, employing keywords "Furniture manufacturing" and "Industry 4.0", with any other restrictions. Only 47 articles were published in this timeline. Analyzing these articles was evidenced that main obstacles to the adoption of technologies I4.0 is related to the insufficient proofs of the advantages and benefits that these technologies may provide for furniture manufacturing process, lack of the awareness of the employees to enable internalization of knowledge about technologies of 4.0 industry. To accomplish this will be necessary to perform actions to establish collaborative networks, both internal and external, to validate the new organizational practices/ routines, and consolidate its adoption in the manufacturing environment. As conclusion of the study is possible to state that the lack of knowledge of I4.0 technologies and their benefits, by workforce and organizational managers also, lack of financing sources and of government policies to foster adoption of technologies I4.0 are among main obstacles to the adoption of the technologies of industry 4.0. Reducing the distance between universities and industries, investing in R&D, using already available and low-cost technologies and adopting proven and established production methods were also highlighted as premises for I4's technologies and that may to succeed in the furniture segment. I4.0 technologies show the potential to maximize productivity and profitability by reducing lead time, operating costs, increasing quality, flexibility of the operational process, in addition to differentiated design.

Keywords: Furniture manufacturing; Technologies od Industry 4.0; Challenges; Perspectives.

1. Introduction

The furniture industry is a traditional segment, with a global presence, representative in the national scenario with fierce competition. China, the European Union (especially Italy and Germany) and the United States are the largest producers and also the largest consumers of furniture products. Brazil is important player in this market, but with lower production and consumption volumes compared to the aforementioned countries. In relation to the world market, in terms of production, China leads with 39.3% while in Brazil this percentage is only 4.03%. Regarding consumption, China also occupies the first position in the ranking, with 27.85% of the market, while Brazil represents 3.99% (Brainer, 2019). To

compete in this market furniture producers need to maintain low costs, high quality, differentiated design and the ability to customize products. All these aspects may be improved by technologies of Industry 4.0. However, despite the potential benefits mentioned, resulting from the adoption of I4.0, in the furniture manufacturing process, several studies have shown that the operationalization of these technologies, in this productive sector, is still at an early stage, in Brazil (Pagano et al. 2021, Souza & Nunes, 2020, Brainer, 2019, Firjan, 2019, Senai, 2019).

This situation represents a paradox, because this topic is increasingly attracting attention of researchers (Schwab, 2017; Oztemel & Gursev, 2020; Muhuli, Schukla & Abraham, 2019). Studies show up apparent resistance in the adoption of I4.0 in the furniture industry what may be explained by the difficulties evidenced in the industrial environment (Brainer, 2019, Firjan, 2019, Souza & Nunes, 2020). As it is still an emerging topic, researching impacts that the I4.0 may have on the furniture cluster is necessary. As first step of this research is relevant to understand context related to this economic sector, providing information to subsidize planning process, to the implementation of I4.0 in the manufacture of furniture. Furniture manufacture, mainly in Brazil, can be considered an industrial sector with a low level of adoption of new technologies. Most companies that operate in this traditional economic sector, are in transition from the second to the third industrial era (FIRJAN, 2019). Understanding process of the introduction of I4.0 and how this positioning can meet the various niches of the furniture market may be relevant to achieve production versatility and flexibility.

In this perspective, the objective of this research work, a reflexive theoretical essay, is to analyze the scenario of the Brazilian furniture industry, in relation to the adoption of the I4.0. The study was guided by the research question: "What is the current status of adoption of I4.0 in the furniture manufacturing process, abroad and in Brazil?" Therefore, in compliance with the proposed objective, the authors opted for performing integrative review of the scientific literature which consists of an analysis of the most relevant studies on a given subject, in addition to indicating possible gaps in knowledge on that subject. This methodological approach design option is supported by the scientific literature (Polit & Beck, 2006). The details of the research process, with reference to authors who support this methodological option, can be found in the first topic of this work.

The literature review was carried out in February 2023, in the SCOPUS database, which indexes scientific journals with higher impact factors. To carry out the research, the words "Furniture", "Manufacturing" and "Industry 4.0", without restrictions. Only 47 articles were published, from year 2017 to year 2022. 14 articles made available for access only the abstract, 1 article was published only in Chinese version, 1 article was a proposal of construction of an algorithm and 4 articles were exploring other kind of problems. So, this small number of articles published about adoption of technologies 4.0 in manufacturing process of furniture indicate a gap of the scientific literature, justifying more studies about this issue.

The characterization of the furniture market appears in the topic that is presented after. The situation of adoption of I4.0 by organizations in the furniture industry abroad is exposed and analyzed in the following topic. The situation of national companies in the same sector is shown and reflected after, aiming to provide a comparison with furniture industries abroad. In the following topics, the structuring aspects of the adoption of I4.0 are addressed, establishing the relationship with topic about production management. The work ends with final considerations and references to works consulted throughout the study.

2. Method

In order to highlight data on the scenario of adoption of industry 4.0 technologies in the furniture manufacturing process, in Brazil and abroad, the authors opted for carrying out an integrative review of the scientific literature, which aims to analyze the most relevant research on a given topic, highlighting structuring elements for reflection, as well as guidance for the execution of new studies (Benefield, 2003; Polit & Beck, 2006). This method makes it possible to synthesize the results of studies already published on a topic, contributing both to the academy and to organizational managers, offering a critical analysis of the phenomenon, as well as highlighting its most relevant aspects (Broome, 2000).

Among the review methods, the integrative review is the broadest, as it allows the simultaneous inclusion of studies with different approaches and strategies, thus enabling greater independence and reduction of researcher bias (Polit & Beck, 2006). This method also allows the combination of data from scientific literature, from both theoretical and theoretical-empirical works. In this way, it is possible to state that the integrative review can have different purposes, that is, it can be directed towards the definition of concepts, the review of theories or the methodological analysis of the included studies of a particular topic (Benefield, 2003). The variety in the composition of the integrative review sample in conjunction with the multiplicity of purposes of this method results in a complete picture of complex concepts, theories or problems related to the topic under analysis (Broome, 2000).

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restrictions. Only 47 articles were published, from year 2017 to year 2022. 14 articles made available for access only the abstract, 1 article was published only in Chinese version, 1 article was a proposal of construction of an algorithm and 4 articles were exploring other kind of problems. Specifically, 6 articles were published in the year 2022, 5 articles published in the year 2021, 2 articles in the year 2020, 6 articles in the year 2019, 2 articles in the year 2018 and 1 article in the year 2017. So, this small number of articles published about adoption of technologies 4.0 in manufacturing process of furniture indicate a gap of the scientific literature, justifying more studies about this issue.

3. Discussion

3.1 Furniture Market

To understand weaknesses, identify threats and strengths in the furniture market, is considered essential to demonstrate main characteristics of this economic sector. In the furniture production chain, complex panorama emerged, with multiple inputs, such as equipment and machinery, wood (preferably certified), metal, plastics, leather, foam, fabric, as main materials, being extracted, manufactured and sold, to and by, various actors that operate in furniture supply chain, like manufacturers, distributors and retailers (Dalalah et al., 2022). Raw materials are transformed in products with various levels of integration of them, as products made up predominantly from one of them, such as wood, metal, or complex combination of them (Silva, Massote & Lima, 2022). The products are sold to the distributors and retailers, that sale them to the consumers, in domestic market or abroad. Logistic operators provide services to transport raw material or products, from suppliers to distributors, retailers and consumers. All this process requires financing agents and must follow laws and rules that regulate relations between suppliers and consumers, being monitored by government and labor union.

As members of the furniture production chain, in addition to the industries themselves and their suppliers, financial agents and government agencies can be highlighted. According to the FIEP (2017), the link between the productive chain and support sectors is of great importance for the development of the furniture chain. Not only government/corporate relations are mentioned, but also relationship between institutions with apprenticeship systems, unions, both employers and employees.

The furniture manufacturing sector is usually classified according to the raw material most used in the production process. The classification published in 2007, carried out by the National Classification Commission (CONCLA)/Brazilian Institute of Geography and Statistics (IBGE), that manage CNAE (National Classification of Economic Activities) published version 2.0 and presents 4 classifications, with wood, metal, other materials and mattresses (IBGE, 2021). Despite using different materials, as specified in Table 1, the most common input in the furniture or furniture sector is wood. As for the use, the furniture is classified as residential, office and institutional (restaurants, hospitals, auditoriums, cinemas, hotels, schools and others) (Brainer, 2019).

Table 1. Furniture market classification based on raw materials

GROUP	CLASS	SUBCLASS	DESCRIPTION
31	3101-2	3101-2/00	Furniture made predominantly from wood
	3102-1	3102-1/00	Furniture made predominantly from metal
	3103-9	3103-9/00	Furniture made from other materials
	3104-7	3104-7/00	Mattresses production

Source: Adapted from Ibge (2021)

The largest producers and also consumers of furniture in the world are China, the European Union and the United States (Brainer, 2019). Table 2 shows the world scenario of the main players in the furniture sector in 2017 in relation to Brazil, considering production, own consumption, export and import. Regarding the world market, considering production volume, China leads with 39.3% while Brazil has a share of only 4.03%. Regarding consumption, China also occupies the top with 27.85% of the market while Brazil represents 3.99%. It is worth noting that the values in table 1 are expressed in the unit of millions of dollars (US$) (Brainer, 2019).

Table 2. Comparing furniture worldwide market with Brazil

Países	Production	%	Consumption	%	Export	%	Import	%
China	164.358	39,3	117.010	27,85	50.155	32,43	2.807	1,79
European Union	91.535	21,88	87.408	20,81	65.065	42,06	60.938	38,93
USA	51.719	12,37	94.514	22,50	7.344	4,75	50.140	32,03
Brazil	16.854	4,03	16.778	3,99	622	0,4	546	0,3
Other countries	93.749	22,42	104.379	22,85	31.491	20,36	42.120	26,95
Total	418.215	100	420.089	100	154.677	100	156.551	100

Source: Adapted from Brainer (2019)

Also, in Table 2 it is evident that in the European Union countries the relationship between production and consumption results in a surplus of 4.72%. It is worth noting that EU countries export 71.08% of their production, what means 42.06% of total world exports and import 38.93% of the world market for consumption. This surplus is explained by the fact that Germany and Italy are considered the countries where are manufactured products with differentiated design and superior quality, contributing to stimulate the consumption of furniture produced in their territory, being benchmark to other countries. The USA and the European Union are responsible for 70.95% of all imports, with 32.03% destined only for the USA. Brazil exports only 0.4% of world demand.

The IEMI (2021) demonstrate that the sector furniture in 2019 had approximately 19 thousand furniture manufacturers, with approximately 270 thousand people employed directly or indirectly. According to Brainer (2019), in Brazil, 46 furniture clusters were identified in 11 states: Amazonas, Bahia, Ceará, Maranhão, Pernambuco, São Paulo, Espirito Santo, Minas Gerais, Paraná, Santa Catarina and Rio Grande do Sul. Wood represents main raw material in furniture production, which in the South region represents 88.6%, in the Midwest, 86.7%, Southeast, 85.9%, North, 82.0% and in the Northeast, 78.7% (Brainer; 2019). According to Movergs (2020), Rio Grande do Sul is the second largest furniture producer in the country that generated 36,066 direct jobs in 2019. In 2020, the report predicted net revenue of BRL 8.22 billion. In general, a growing market is perceived, where countries such as the United States, China and European Union countries are detached, both in consumption and production, and currently occupy the leading position. However, marketshare of the emerging countries are increasing in importance.

Oztemel and Gursev (2020) state that the furniture production sector has good conditions for the introduction of new technologies, due to a series of factors, with emphasis on: a) the sector's evolution process; b) the continuous transformation of the manufacturing context and demand profile, c) stimulus to the emergence and consolidation of new industrial areas and d) the lag of the technological standard embedded in the current production system, mainly in relation to I4.0 technologies. The authors emphasize that it is essential that the national furniture production sector carries out the technological update of the industrial infrastructure, to become competitive.

3.2 Furniture scenario in relation to the adoption of Industry 4.0 technologies, in other countries

One of the potential markets to be explored by organizations is the export market. However, unlike the local market, the product for export needs a new configuration, highlighting aspects as meeting delivery deadline, adequacy of installed capacity, high level of quality, trust, reputation, among others. Therefore, it is important to carry out a global benchmarking to identify the way to change organizational structure, considering, the embedded technological standard, as is the case of I4.0 technologies to explore opportunities (Bravi, Murmura & Santos, 2022).

According to Souza and Nunes (2020) and Ratnasingam et al. (2019) technologies I4.0 are still considered a new topic, but is increasing becoming very important. With technologies evolving, the trend is to increase integration and not only in manufacturing. To start the process of discussing adoption of these technologies, it is important to have a proper understanding of its characteristics. However, to enable the implementation of I4.0, it is also necessary, in addition to understanding the technologies and their functionalities, that managers have a clear idea of the situation of the organization, and thus, plan and provide appropriate and applicable resources (Oztemel & Gursev, 2020, Schwab, 2017). Souza and Nunes (2020) state that the applications of I4.0 in Brazil are still recent, and because of this, it is considered important to understand and identify its repercussions in the various industrial sectors.

For Ratnasingam et al. (2020) the Malaysian furniture industry faces great difficulties in the process of implementing I4.0, due to the lack of workers with the knowledge and skills necessary to operate the technologies and, secondly, due to the high investment value for its implementation and the maintenance costs. They make suggestions of how to encourage the

qualification of employees in technologies of I4.0 by universities, subsidized by local governments. They understand that with this qualification, it will be possible to increase productivity and reduce dependence on foreign workers, which currently represents 34% of the country's workforce.

In Italy, Pagano et al. (2021), showed through a study that most of industries understand and exploit the technologies of I4.0. The study was carried out in the industrial district of Pesaro, which specializes in furniture production, with companies as the IMAB Group of furniture and Biesse, which is a furniture machinery company. However, in addition to these organizations, other companies from several different branches are in operation in that district, that also adopted most of the technologies of I4.0. Based on this scenario, Pagano et al. (2021) identified important points that should be taken into account by industries that are interested in following the same path: a) the horizon for updating I4.0 in geographic and sectoral terms is not precise; b) knowledge about I4.0 seems fragmented in initiatives and projects coordinated by companies and institutions; c) as knowledge about I4.0 advances, traditional companies cooperate with companies that have more advanced knowledge about I4.0. and d) leading companies are aware of the implementation of I4.0 but do not always have the knowledge to adopt it in the most appropriate format.

3.3 Brazilian scenario in furniture companies in relation to the adoption of industry 4.0 technologies

Understanding the set of requirements that guide the performance of companies in the international market represents a possible direction for companies that focus on the local market. This also applies to the adoption of I4.0. Therefore, knowing the national scenario in relation to I4.0 technologies is important. FIRJAN (2019) states that the adoption of I4.0 technologies represents a trend, a future for companies of all segments and sizes, from micro to large companies. The I4.0 technologies provide the opportunity for national industry to increase competitiveness, transforming industrial production through new processes, products and business models.

The adoption of I4.0 technologies in Brazil began at the plants of automotive factories, such as Mercedes Benz and Fiat. After its adoption, Mercedes Benz obtained an efficiency increase of 15%, a gain in logistical efficiency of 20% and a reduction in the storage of components from 10 days to 3 days (Senai, 2019). But, as highlighted by Sebrae (2019), the national furniture industry consists of companies, which are characterized by traditional manufacturing and a low technological investment. Data show that small and medium-sized companies predominate in the furniture sector, focusing different market niches because they have versatility and productive flexibility.

With the ongoing transformation, several difficulties are encountered for the adoption of I4.0 technologies in Brazil. The first two major problems are the companies' lack of preparation for the implementation of I4.0, and the other is the characteristic fragility of the initial stage, of prior planning. One of the causes of these problems is the great distance between universities and industries, because universities are important spaces of knowledge and innovation (Senai, 2019). Firjan (2019) detaches other problems, such as the lack of qualified workforce, the inefficiency of the country's telecommunication infrastructure, the difficulty in identifying technologies and partners, lack of integration of the IT area with the production area and the absence of appropriate financing sources.

According to Brainer (2019), due to the high number of micro-enterprises in the furniture sector, it is expected that the adoption of I4.0 technologies will face difficulties. In addition, according to data from Firjan (2016), there is a consensus, among specialists, that in Brazil, the industry in general is still in the transition phase from the second industrial revolution for the third which is robotics and programming. This scenario is very challenging to face the adoption of I4.0 technologies.

As evidenced, the national furniture industry still has a low level of investment in new technologies, being in the transition from the second to the third revolution. However, the sector is beginning the adoption of determined new technologies, considered necessary to maintain its competitive position in the market. Among the main obstacles, we highlight the lack of qualified workforce, lack of knowledge of the managers of the companies of the new technologies, investments in infrastructure, what may be caused by perception of lack of availability of sources to finance these projects.

3.4 Implementation of Industry 4.0 technologies

For an effective adoption of I4.0, there are several factors that must converge. I4.0 represents a new industrial revolution that requires well-structured practices and methodologies. This new era requires a high investment to facilitate successful implementation, and thus, it becomes important to assess what should be observed when an organization begins the process of adopting I4.0 technologies.

According to Senai (2019), 4 pillars are needed for the adoption of I4.0 technologies. The first is represented by previously established production methods, such as Lean Manufacturing. That's because when implementing Lean Manufacturing, "companies get to know their deficiencies for improvement before implementing digitalization. Digitizing production

bottlenecks enhances the desired productivity gains with the adoption of new technologies" (Senai, 2019, p.25). The second pillar, according to Firjan (2019), deals with the retraining of the workforce and the managers of companies, because they are considered the central actors in the aforementioned process. Industrial organizations need to know digital technologies and understand their principles. In addition, they need to be able to solve complex problems, understand programming principles, data analysis and decision making. Therefore, it is considered essential to have teams of creative and technically capable professionals, with great leadership and communication skills.

The third pillar for the implementation of I4.0 is the use of already available and low-cost technologies. According to Firjan (2019) technologies such as big data, sensors, cloud computing and IoT are already available and at affordable prices and should serve for the company to initially understand what is happening in its production process. With these technologies it is already possible to increase the availability of equipment and consequently productivity. The fourth and final pillar is represented by investment in Research and Development (R&D). According to Firjan (2019), to innovate is necessary because companies that invest in R&D are more competitive. National manufacturing needs to innovate, through the implementation of smart, flexible, agile and connected factories with their supply chains. To foster partnership between large industries and technology-based startups represent one of the most promising paths in provide creative solutions (FIRJAN, 2019).

Vertical and horizontal integration is also the basis for I4.0 and to enable its implementation is important to develop new forms to handle data until it is transformed into information in order to support decision making. Vertical and horizontal integration can provide several benefits such as agility in decision-making and information flow, process quality, adding value to the customer, generate more accurate information and be less susceptible to errors, with more efficient processes and logistics, what helps to reduce cost and makes organizations more competitive (Oian, 2019, Pederneiras, 2019).

Also, according to information from Firjan (2016), Brazil cope with identical challenges to other countries as presented in a previous topic of this work. Designing smart strategic policies, government incentives, fostering collaboration between entrepreneurs and managers of companies that have a proactive vision and attitude, providing technological development, training qualified professionals at academic and research institutions, are some of the priorities to initiate the process of adopting I4.0 technologies.

3.5 Manufacturing management model to implement Industry 4.0 technologies

It is important that in organizations be an operations management focused on analyzing the past, collecting data that can support decisions with a view to managing the present, planning and directing the future. In this way, the organization will provide needed support to adopt new technologies. Otherwise, several conflicting situations will arise within the production process, which will negatively impact the company's ability to compete in the market, with operational inefficiency and wasting resources.

In this perspective and corroborated by the results of the research coordinated by Slack et al. (2009), production management is considered relevant to the success of organizations, especially those in the industrial sector. As highlighted by Ritzman and Krajewski (2005), Moreira (2009) and Corrêa and Corrêa (2011), it is recommended to set up specific operations and processes to support production and manufacturing management. The focus of production management is to reduce costs, maximize productive capacity, especially through research and application of technological innovations, efficient use of physical resources and a set of capacities and competences, both individual and collective, to achieve the objectives of the organization.

Among production management operations, Ritzman and Krajewski (2005), Slack et al. (2009), Moreira (2009) and Corrêa and Corrêa (2011) highlight production planning, scheduling and control, analysis of work methods, project management and product development, among others. As stated by Slack et al. (2009, p.88) "to design is to conceive the appearance, arrangement and structure of something before building it. In this sense, it is a conceptual exercise. Still, it is an exercise that needs to devise a solution that works in practice". Moreira (2009) also states that the product design development phase is preceded by the stage of generating and filtering ideas, elaboration of the initial product design, in parallel with the economic analysis, prototype testing and final design.

Developing a product requires planning and deep knowledge of the organization's process. According to Moreira (2009), managers must participate in the process of sequencing scripts, defining equipment specifications, training employees, among others, because, according to Corrêa and Corrêa (2011), well-managed and developed projects, at the level of excellence, being innovative and efficient, currently represent a condition for the company to ensure competitive advantage. As stated by Ritzman and Krajewski (2005), it is necessary to design a process that follows a planned protocol, providing sequencing and programming. Thus, it is necessary to develop an adequate model for managing the production chain, managing a significant volume of data and information and sharing them in an agile and accurate way, to minimize

the occurrence of unforeseen and anomalous situations throughout the production process.

For Ritzman and Krajewski (2005), Viana (2006), Moreira (2009) and Slack et al. (2009), planning, sequencing, programming and managing information are functions of the PPCP. This sector has the attribution of planning, both in the short, medium and long term, the manufacturing operations, estimating the necessary resources foreseen in programming of the orders. It consists of generating the production plan, scheduling and defining the production sequencing. After this, set of activities to control the production process. This control is the result of the notes made in production and that generate data that make it possible to compare what has already been done and what still needs to be produced (Ritzman & Krajewski, 2005, Moreira, 2009, Slack et al., 2009).

It is worth to detach the statement of Corrêa and Corrêa (2011) that consider necessary to sequence, schedule and control operations, and if there are deviations, to act to correct the plan, what means that planning is not a guarantee that production will occur as planned. May happen situations that make the projection unfeasible, requiring to plan again. In order to obtain accurate efficiency indicators and Total effective equipment productivity (TEEP), which transmit reliable data, it is necessary that times for carrying out operations in the system reflect the practice. For Mota et al. (2016), timing and its analysis provide a basis for the formation of standard time that define the most appropriate way of working, aligning with the times required for the operation, evaluations of rhythm, movements and tolerances of an operation, what means, the time required to produce an item. Viana (2006, p.43) states that the physical inventory "aims to establish a permanent audit of inventories [...] aiming to guarantee the full reliability and accuracy of the accounting and physical records".

It is worth noting that to enable efficient processes, the layout is important. For Corrêa and Corrêa (2011), the physical arrangement is the way in which the resources needed for production are positioned within the physical space intended for this purpose. Slack et al., 2009) state that there are four types of physical arrangements, namely: a) positional, when the product undergoing processing is stationary and the resources that generate benefit in move, b) functional, which is when similar resources or processes are positioned together, that is, the product goes through its script according to its need, c) cellular, which is when a group of transforming resources is arranged in order to meet certain operations and after this product moves to another group/cells and d) by product, when the product goes through a predefined flow where its operations coincide with the disposition of physical resources.

In this way, by managing operations well, operational efficiency will be maximized and the impact will be perceived by customer both in terms of cost and quality. As stated by Slack et al. (2009), the lower the cost to produce, the lower the cost to the customer. Only then, with the review of internal operational processes, clear definitions of attributions of each operational sector, to achieve the objectives of manufacturing, the adoption of industry 4.0 technologies will be able to offer the expected benefits. Detailed analysis of each operational process will provide data and information about the execution, providing an understanding of the technical feasibility about how to adopt I4.0 technologies, as well as the evaluation of the cost-benefit ratio generated (potential/expected).

4. Conclusion

In view of the fierce competition in the furniture industry, both in the national and international markets, it is relevant to carry out research on alternatives to introduce new technologies in its operating system. In this perspective, the set of technologies of I4.0 stands out due to its potential for organizational competitiveness, which has already been evidenced in other industrial sectors. This was the objective of this study, in theoretical essay, to understand the process of introducing I4.0 technologies in furniture manufacturing.

This study was based on articles and books, with high impact and number of citations worldwide, researching the furniture industry, I4.0 technologies, in international and national scenario, regarding the introduction of I4.0 technologies, and, finally, structuring practices of production management, evidencing difficulties for its adoption. Results evidenced as main obstacles the lack of knowledge of I4.0 technologies and their benefits, by workforce and organizational managers also, lack of financing sources and of government policies to foster adoption of technologies I4.0. Is considered relevant to promote actions to establish collaborative networks, both internal and external, to stimulate adoption of new technologies in the furniture manufacturing environment. Reducing the distance between universities and industries, investing in R&D, using already available and low-cost technologies and adopting proven and established production methods were also highlighted as premises for I4's technologies and that may to succeed in the furniture segment. I4.0 technologies show the potential to maximize productivity and profitability by reducing lead time, operating costs, increasing quality, flexibility of the operational process, in addition to differentiated design.

The national furniture industry has characteristics of a traditional industrial sector, with low level of technological appropriation. But increasing volume production, export and need to cope fierce competition, in national and international

market, may change this situation. To promote this change, will be necessary to change first mind of the managers, to foster greater receptivity to new technologies, especially by managers of larger organizations, which have made significant investments in new technologies, aiming at increasing production and production capacity. Thus, the requalification of the workforce and the management of the companies is essential, to have success in the adoption of new technologies in the operational environment of the industry.

Despite evident limitations of this work, due to the form of a reflective theoretical essay, is offering data and information that are relevant to assess situation at Brazilian furniture companies in relation to the adoption of I4.0 technologies. Represents, also, a relevant contribution to the advancement of knowledge on the subject in question and remains as the suggestion for further study, collect empirical data, with other research strategies and approaches, qualitative and quantitative.

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