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The impact of Industry 4.0 connectivity on the collaboration along Brazilian automotive supply chain

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Abstract. Industry 4.0 presents a new manufacturing model through the intensive use of new technologies in the pursuit of improving processes in the value chain. The use of digital technologies and the application in the industry in general influence the value chain of products, business models and commercial integration, which can improve the competitiveness of companies. This text seeks to understand the importance of data connectivity in the value chain processes of the automotive sector, in order to identify and analyze the relevance of data connectivity between the company, suppliers, customers and partners. The data were collected through a survey applied to professionals in the automotive segment, the observational method and bibliographic research. The results showed that although the use of data to define the business is relevant, investments in digital technologies are insufficient. Data connectivity between companies, suppliers, customers and partners were identified as essential, but it still does not occur as expected.

Keywords: Connectivity, Industry 4.0, Investments, Value Chain, Automotive.

1 Introduction

The concept of Industry 4.0 is seen as a trend towards automation and data exchange during the manufacturing process [1]. The use of new technologies seeks to meet an advanced manufacturing system and the integration of the value chain, transforming the physical, digital and biological pillars, promoting changes that affect the economy as a whole [2].

Technological advances can reconfigure the industrial sector, boosting productivity, modifying business models and skills necessary to add value throughout the value chain operations. Digitalizing and integrating processes vertically, from product development and purchase, to manufacturing, logistics and services.

Industry 4.0 integrates various technologies, enabling smarter and more efficient factories and production models, capable of leveraging growth and economic develop-

ment [3]. In Brazil, the transition to Industry 4.0 can generate new manufacturing models and the evolution of production processes. It is necessary to make investments for the adaptation of infrastructure and qualification of labor [4].

Connectivity, artificial intelligence and flexible automation are considered key technologies for Industry 4.0 [5]. Connectivity creates connections between devices, sensors, machines and software. Regarding the value chain, connectivity optimizes communication with all stakeholders [6].

Considering aspects related to the transition to Industry 4.0, the object of study of this article is: What is the importance of data connectivity in the automotive industry's value chain processes? Aiming to identify and analyze the relevance of data connectivity between the company, suppliers, customers and partners.

2 Literature Review

Industry 4.0 proposes a new manufacturing model through the intensive use of new technologies in the pursuit of improving industrial processes in the value chain [7]. In the context of industrial production, it comprises a variety of cutting-edge technologies characterized by Cyber-Physical systems (CPS) [8]. Cyber-Physical systems are computational and collaborative systems composed of interconnected physical and computational elements [9]. In addition to the interaction between workers and machines [10], CPS also have potential for planning, controlling and organizing production processes and supply chains [11].

Intelligent factories, considered the epicenter of Industry 4.0, operate in a network and show characteristics such as: the vertical integration of production systems; the horizontal integration of networks and the global value chain; engineering in the value chain and acceleration through exponential technologies [12]. The main requirements for the construction of these factories are process control, real-time data and product tracking, setting a new manufacturing standard [13], whose objective is to achieve a higher level of automation, operation, efficiency and productivity [14].

The widespread use of digital technologies and application in industry in general influences the value chain of products, business models and commercial integration. The combination of these new technologies can provide important productivity gains, improving the competitiveness of companies [15].

Industry 4.0 also brings opportunities for the development of new products, in companies and research institutions. On the other hand, the lack of adaptation to the new technological challenges can lead to difficulties in the development of new products, services, innovation and technological models, considering that competitiveness is also supported by cost reduction [16]. Regarding data connectivity, surveys [17] show that 91% of national companies are not connected.

In the conception of Industry 4.0, digitalization in industries has a broader approach, considering new technologies and concepts relevant to the management of the value chain, decentralizing operational decision making through the creation of smart factories [10]. The horizontal integration of the value chain, network production system and

vertical integration and the final digitalization of projects along the value chain are requirements for the implementation of Industry 4.0 supported by emerging technologies, comprising IOT (Internet of Things), networks wireless sensors, big data, cloud-based services, embedded systems and mobile Internet [18].

3 Methods

This article was made using an exploratory, qualitative and quantitative methodology. The collection of primary data occurred through the application of a survey, for professionals in the automotive segment.

The research included 07 questions, based on the professional experience of the authors in the segment. One question designed to qualify the sample (type of company and function) and other 06 questions that asked about the use of data for the definition of the business model, level of data connectivity between the company, suppliers, customers and partners, the collaboration of companies with suppliers, customers and partners, the bottlenecks for the use of new technologies and level of investments.

In the selection of participants, we chose those who exercise leadership functions in the industrial area. The automotive segment was chosen due to its relevance to the Brazilian economy, as it represents 22% of Industrial Gross Domestic Product (GDP) [15]. The companies were selected because they are part of the supply chain of the researched sector. Of the 60 questionnaires sent, 51 were answered and 9 did not justify the absence of an answer.

The surveyed sample was composed of 65% of auto parts companies, 25% of assembly companies and 10% of metallurgical companies, the respondents occupy leadership roles (directors, managers and supervisors). Secondary data were determined by documentary analysis and bibliographic references. The observation method was also used to determine and analyze the results, based on professional experience and the participation of the authors in the segment.

The validity of the research is ensured by the description, by the understanding of the aspects related to connectivity and the adherence of the collected and interpreted data, added to the construction of reality by the participants. Considering that everyone involved has professional experience in the industrial area and that the companies are members of the automotive industry value chain.

4 Result and Discussion

The results obtained are shown by the following figures.

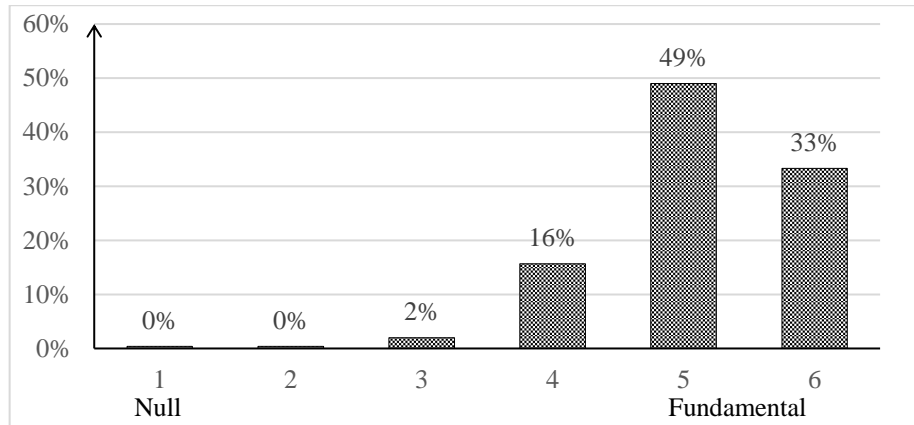


Fig. 1 - Use of data to define the business model (Source: prepared by the authors).

Figure 1 demonstrates the level of importance that the surveyed companies give to the use of data to define the business model. It was used for measuring an intensity scale ranging from 1 (null) to 6 (fundamental). It can be seen that for more than 80% of companies the use of data is fundamental.

The level of data connectivity that currently sets between companies, suppliers, customers and partners is illustrated in Figure 2. It was found that for 94% of the companies surveyed, the level of connectivity established between the members of the value chain is considered low.

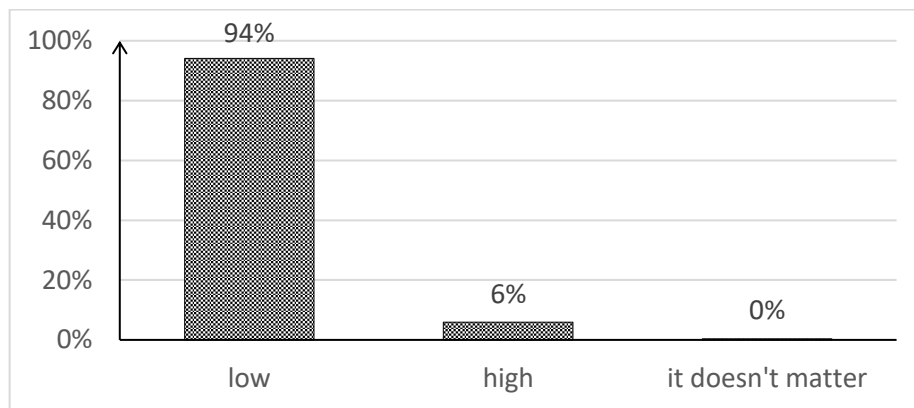


Fig. 2 - Current level of data connectivity between the company, suppliers, customers and partners (Source: prepared by the authors).

Another question raised at the companies surveyed, it was about what would be the expected level of data connectivity between the company, suppliers, customers and partners. The answers to that question are shown in figure 3.

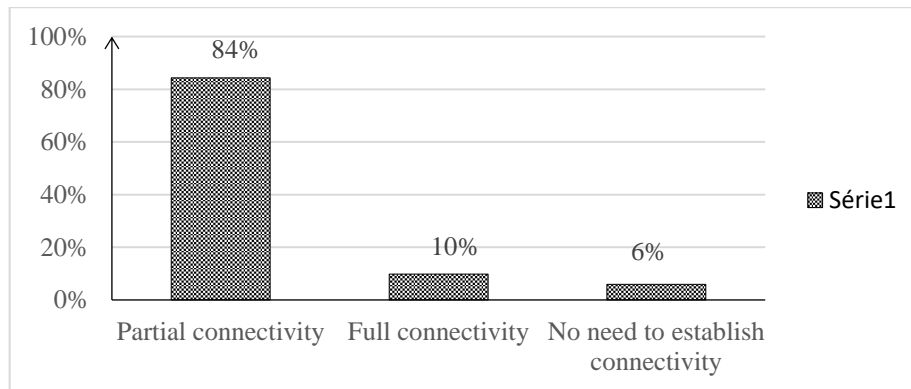


Fig. 3 - Expected level of data connectivity between company, suppliers, customers and partners (Source: prepared by the authors).

Comparing the results presented in Figures 2 and 3 It is observed that the desired level of connectivity by companies is far from what is expected, which indicates that the established connectivity today among value chain components still does not meet the needs of companies.

Figure 4 shows the level of cooperation of companies with suppliers, customers and partners for business development using digital technologies.

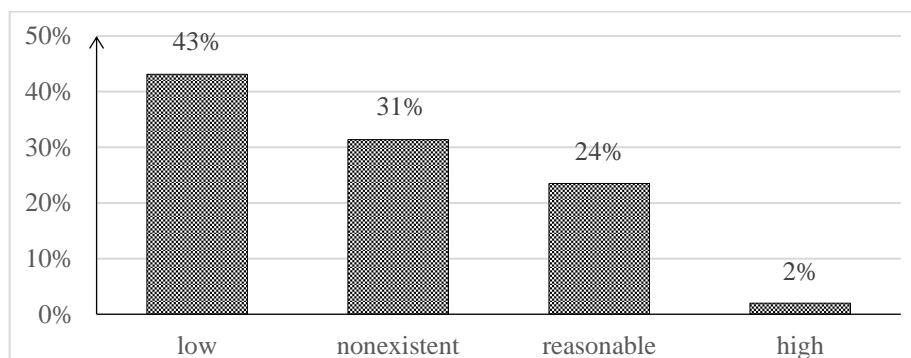


Fig. 4 - Your company's level of collaboration with suppliers, customers and partners for business development using digital technologies (Source: prepared by the authors).

The level of collaboration between members of the value chain for the use of digital technology is pointed out as low and non-existent for 74% of the companies interviewed, which is in line with the situation presented in figures 2 and 3. Although the companies aim to connectivity along the value chain is greater, the scenario set points to a shortage in the use of digital technology in a collaborative way.

The difficulties in using new technologies, according to the companies surveyed, are presented in figure 5.

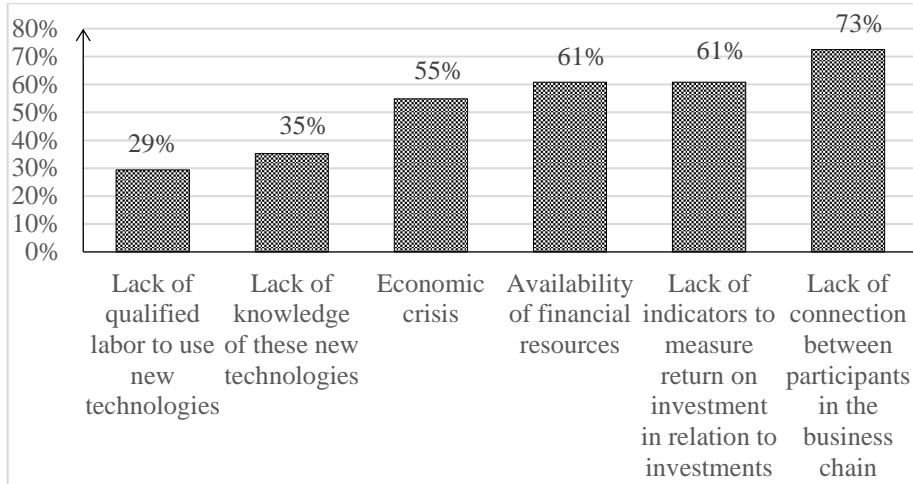


Fig. 5 - Impediments to the use of new technologies (Source: prepared by the authors)

The lack of connection between the participants in the business chain is the most cited impediment to the use of new technologies. Availability of financial resources and indicators to measure the return on investments are also highlighted in a significant way as impediments to the use of new technologies. Economic crisis, lack of knowledge of these technologies and qualified labor are also pointed out, however on a smaller scale.

Figure 6 shows the investment levels for the implementation of technologies related to Industry 4.0 made by companies in the last 2 years and the forecast for the next 5 years.

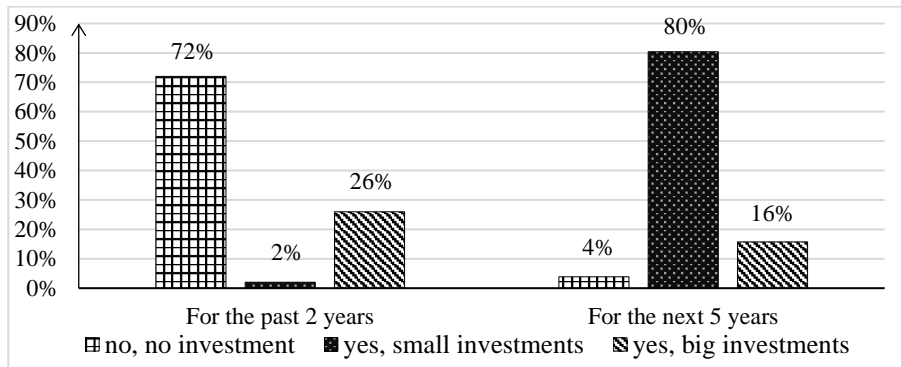


Fig. 6 – Investments levels for the implementation of technologies (Source: prepared by the authors)

The data show that 72% of the companies have not made any investment to implement technologies related to Industry 4.0 in the last 2 years. For the next 5 years, 80% of companies intend to make small investments. In detailing the data, it was found that

the 26% of companies that made high investments in the last 2 years, as well as the 16% that they intend to make in the future correspond only to assembly companies.

5 Conclusion

The aim of this study was to identify and analyze the importance of data connectivity between the company, suppliers, customers and partners. Based on the results obtained, it was found that this issue is paramount for more than 80% of the companies surveyed. The level of connectivity is below expectations, as well as the level of collaboration between members of the value chain for the use of digital technology.

The low collaborative connectivity was identified by the interviewees as the main impediment to the use of new technologies. Other impediments such as available financial resources, indicators to measure the return on investments are also highlighted. Aspects related to the lack of knowledge about new technologies and labor appear as impediments but to a lesser extent. Regarding the level of investments, the data pointed to a low level of investments made and future estimates of small investments.

Research carried out by PWC [19] emphasizes that connectivity between suppliers is necessary, which must communicate integrating all components of the value chain, a situation that is in line with the results obtained by this research.

Considering the level of investments made and to be made by the companies surveyed, it can be said that the impediments to the use of digital technologies tend to continue to occur over the next 5 years.

Technologies related to Industry 4.0 can fundamentally transform industry value chains, production value chains and business models [20]. Bearing in mind that companies point to the lack of connectivity between members of the value chain as a major impediment to the use of digital technologies, the low level of investment made and proposed further aggravates this situation, culminating in greater difficulties for collaborative integration of members of the value chain.

In response to the question proposed in this study, it can be seen that data connectivity in the value chain processes of the automotive sector is relevant, and data connectivity between companies, suppliers, customers and partners proved to be essential for companies surveyed, although connectivity and collaboration between members of the value chain is still not as expected.

Even with great care in carrying out data collection and analysis, this research has limitations, due to the sample size and the complexity of the factors involved. Other answers can be found in different samples and even by the same companies at different times and scenarios. In future articles we suggest comparative studies of the Brazilian case with other countries.

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