

INDUSTRY 4.0: AN ANALYSIS OF INVESTMENT STRATEGIES IN THE INDUSTRIES OF MATO GROSSO

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Abstract: The industries have strategies and investments that need to be aligned with the changes that we are experiencing with the fourth industrial revolution. Research has shown that industries tend to continue investing mainly in the production/manufacturing area. This study aims to survey the strategies with investments made and planned in the areas of industry with a focus on the implementation of industry 4.0 in Mato Grosso. Based on the Research on Maturity Assessment for Industry 4.0, the results indicated that there will be no major changes between the investments already made in the last 2 years in relation to the investments planned for the next 5 years. It is identified that there is a correlation between the implementation strategy, with investments and leadership involvement.

Keywords: Industry 4.0; investments; leadership involvement.

INDÚSTRIA 4.0: UMA ANÁLISE DAS ESTRATÉGIAS DE INVESTIMENTOS NAS INDÚSTRIAS DO MATO GROSSO

Resumo: As indústrias possuem estratégias e investimentos que precisam estar alinhadas com as mudanças que estamos vivenciando com a quarta revolução industrial. A pesquisa mostrou que as indústrias tendem a continuar investindo principalmente na área produção/manufatura. Estudo tem como objetivo o levantamento das estratégias com investimentos nas áreas da indústria com foco na implantação da indústria 4.0 em Mato Grosso. Com base na pesquisa sobre Avaliação de Maturidade para a Indústria 4.0, os resultados indicaram que não haverá grandes alterações entre os investimentos já realizados nos últimos 2 anos em relação aos investimentos planejados para os próximos 5 anos. Identifica-se que existe correlação entre a estratégia de implantação, com investimentos e envolvimento da liderança.

Palavras-chave: Indústria 4.0; investimentos; envolvimento da liderança.

1. INTRODUCTION

The population is experiencing the beginning of a revolution that is essentially changing the way they live, work and relate to one another [1].

The industry, as it is known today, has suffered many changes during the history and has grown based on discoveries and evolutions. It was at the end of the 18th century that steam engines and the use of hydraulic power revolutionized the industry. It was the beginning of the 2nd Revolution [2].

Between the 1950s and the 1970s, called 3rd Industrial Revolution, the digital revolution began to be designed with the propagation and use of semiconductors, computers, automation and robotization within manufacturing lines, with stored information and digitally processed, communications, mobile phones and the Internet [3].

Nowadays, we are in the beginning of the 4th industrial revolution. This new revolution is characterized by the intense use of digital technologies in order to produce new products in an agile way, with a fast response to demand and real-time improvement in manufacturing and the supply chain. Among these technologies, Cyber-Physical Systems (CPS), Internet of Things (IoT), Internet of Services (IoS), advanced robotics, 3D printing, artificial intelligence, Big Data, cloud computing and nanotechnology [1].

The impact of Industry 4.0 is much more than digitization, with a strong focus on innovation, which will force companies to rethink how they manage their business and processes, how they relate to the value chain, how they drive the development of new products and place on the market, fine-tuning marketing and distribution actions [3].

Since the first industrial revolution, the industry has been looking for solutions that aim to increase its performance. These search for solutions drove the progress of several technologies in all areas related to manufacturing [4].

The expression Industry 4.0 first appeared in 2011, in Germany, in Hanover. From this, the interest of several political, academic, scientific, business areas on the subject has increased rapidly, due to the fact that, for the first time, an industrial revolution is being accompanied before becoming real [5].

From this moment on, several companies started to generate solutions for this term Industry 4.0, supported by governments, especially Europeans, mainly German, but by other countries such as the United States, Japan and China, indicating that this new industrial era it is seen as strategic by the great industrial forces [4].

Thus, in addition to Germany, in 2011 the United States announced the Advanced Manufacturing Partnership (AMP), with a national objective to unite industry, universities and the federal government to invest in technologies that will create highly qualified labor for factories, increasing competitiveness [6].

In March 2015 China announced "Made in China 2025", based on the German project called "Industrie 4.0", which is a strategic program to develop the industry, making it more efficient and integrated, aiming to increase the strategic participation of China, at the global level of production [6].

According to German research by Technische Universität Dortmund, in addition to the pillars, six requirements were identified for the implementation of Industry 4.0: Interoperability, Virtualization, Decentralization, Adaptation, Service Orientation and Modularization [6].

The industry is important for the Brazilian economy. According to the [7], Industry results represents 20.9% of Brazil's GDP, but accounts for 70.1% of exports of goods and services, for 72.2% of business investment in research and development and 33% of federal taxes (except social security income). For every R\$ 1.00 produced in Industry, R\$ 2.40 is generated in the Brazilian economy. In the other sectors, the value generated is lower, being R\$ 1.66 in Agriculture and R\$ 1.49 in Commerce and Services. According to data from [8], the State of Mato Grosso has the thirteenth largest GDP in Brazil, with R \$ 112.3 billion. Industry 4.0 is a enabler to improve the current impact of Brazilian industries in the economy.

The state of Mato Grosso is a key player in the Brazilian Midwest region. It reached an industrial GDP of R\$ 17.0 billion, equivalent to 1.4% of the National Industry, and 15.2% is the participation of the industry in the State's GDP in 2017. The main segments and the percentage participation of the sector in the industrial GDP of the State of Mato Grosso, according to IBGE data from 2017, are Construction with 32%, Food with 27.9%, Industrial utilities with 18.6%, Drinks with 4.5% and Petroleum products and biofuels with 3.9%. Together, these sectors represent 86.9% of the State Industry [7].

The objective of the research was to evaluate the investments strategy with a focus on the implantation of industry 4.0 in the companies of Mato Grosso. This article is organized as follows. Section 2 describes the methodology. Section 3 discusses the results observed in the study. Finally, Section 4 presents our conclusions.

2. METHODOLOGY

The methodology used to prepare this article was bibliographic research and quantitative research. Bibliographic research was used to analyze the state of the art on Industry 4.0. Regarding the research with the data to be presented, quantitative research was used to analyze the data of the field research.

The data used in this article were collected from the Assessment of Maturity of Industry 4.0, carried out by SENAI Mato Grosso, with 231 industries from different sectors of the State of Mato Grosso, from April to December 2019.

This maturity assessment was developed as part of a joint research project between the Aeronautical Technological Institute and the National Industrial Learning Service, based on the following maturity models: Maturity model formulated by the National Academy of Science and Engineering (ACATECH), Model VDMA - German Association for the Manufacture of Industrial Machines and Installations and Maturity Model provided by the company PWC.

In this work, the investments made in the last 2 years and the investments planned for the next 5 years within the scope of Strategy and Organization were evaluated, with the following areas of each company being evaluated: Research and Development, Production / Manufacturing, Purchasing, Logistics and sales. Having the

following options: no investment, low investment, medium investment and high investment.

The companies self-assessed where they were asked, as they describe the status of the implementation of their industry 4.0 strategy, referred to in this article as Status 4.0. The alternatives for choosing the status that defines it were: No defined Strategy, Pilot Initiatives in Planning, Strategy in Development, Defined Strategy, Strategy in implementation and Staggered Strategy.

Another question evaluated was about the involvement of the leaders, which is the level of involvement, support and knowledge of the company's leaders (Executive management and senior managers) in relation to Industry 4.0, with four alternatives: Low involvement, Medium - Low, Medium - High, High involvement.

3. RESULTS AND DISCUSSION

The results of the industry 4.0 maturity assessment are presented below. Firstly, it is identified that 70% of the companies interviewed, made some sort of investment focusing on industry 4.0 in the last two years, which shows the importance of this theme for companies.

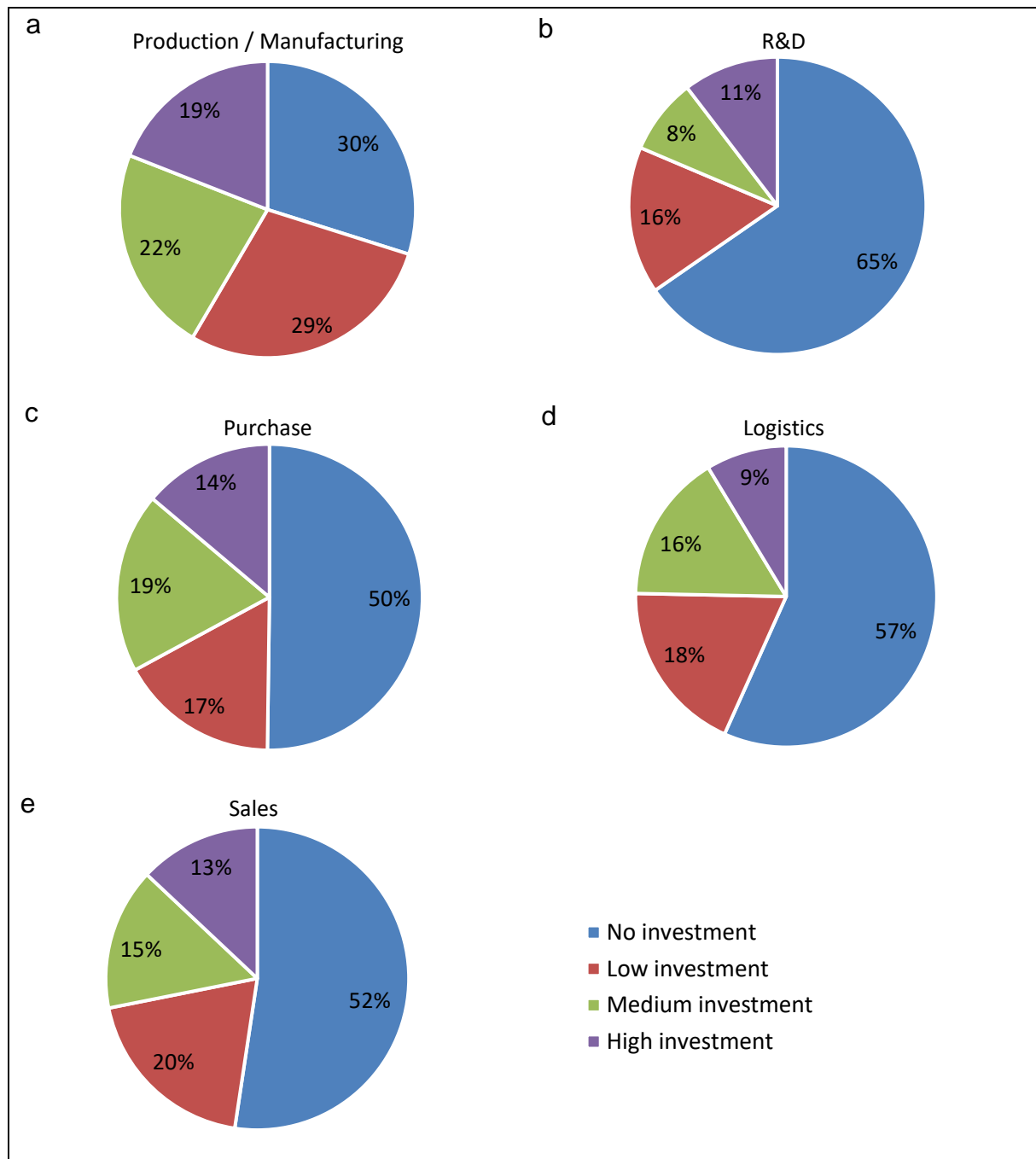
The Production / Manufacturing area, 30% of the companies made no investment, 29% of the companies made little investment, 22% of the companies made a medium investment and 19% of the companies made a high investment (Figure 1a). On the other hand, analyzing the areas of the evaluated companies that received the least investment, it appears that in the Research and Development (R&D) area, 65% of the companies did not make investments in the last 2 years, with only 35% of the industries making some type of investment. investment in this area (Figure 1b).

In the other areas of the companies, being Purchase (Figure 1 c), Logistics (Figure 1d) and Sales (Figure 1e), it is identified that more than 50% of the companies have not made investments in these areas in the last 2 years.

According to the results presented in Figure 2a, it is observed that the priority area for investments aimed at the implementation of industry 4.0, continued to be the Production / Manufacturing area, where 81% of the industries intend to make some type of investment the next 5 years.

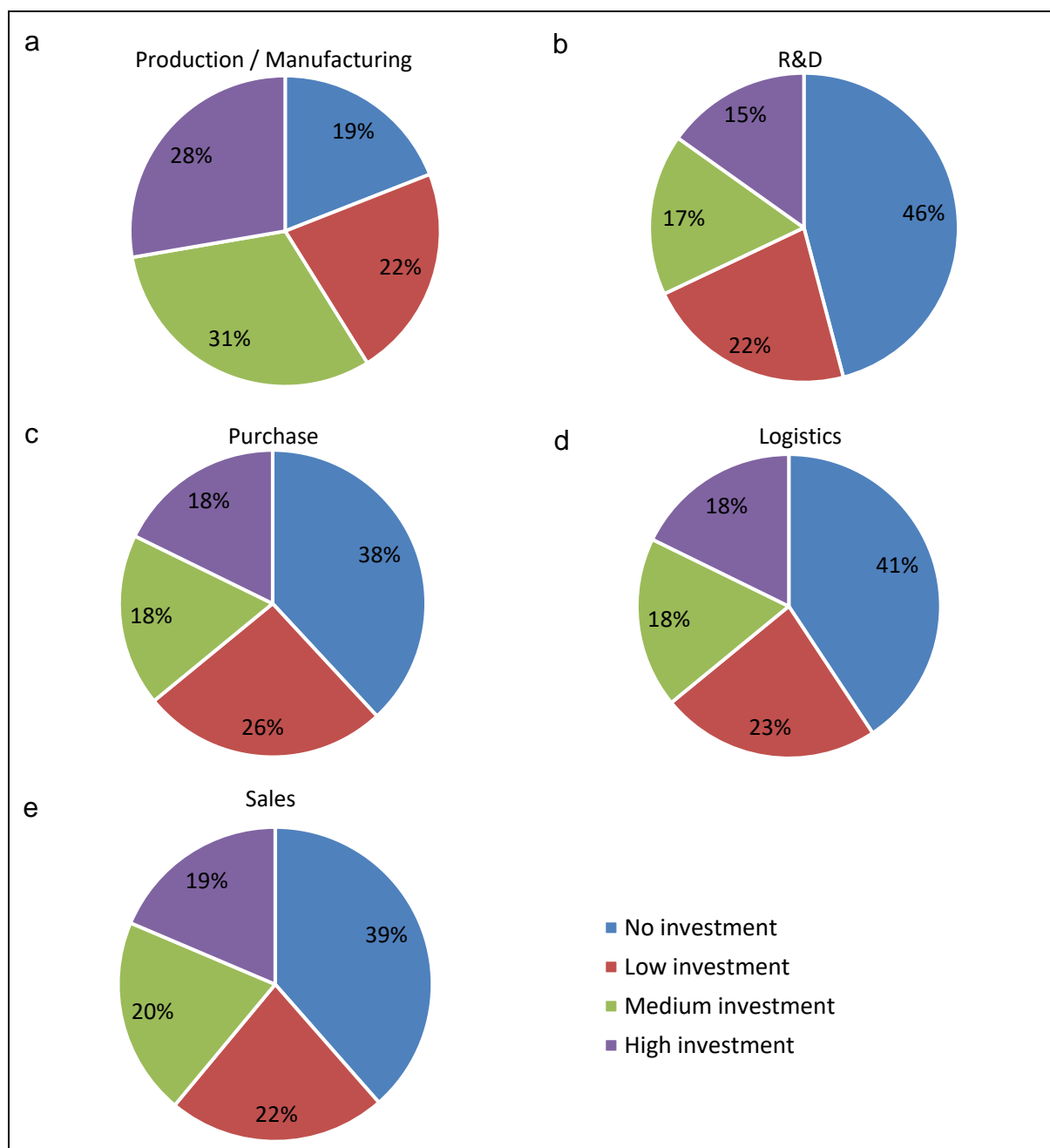
Even so, it can be identified in Figure 2b, that the least priority area still the Research and Development (R&D), with less investment expected in relation to the other areas of the industries, were 46% of the companies didn't plan to invest in the next 5 years. There is an increase of the investment forecast in the other areas of the companies, Purchase (Figure 2c), Logistics (Figure 2d) and Sales (Figure 2e), given that more than 59% of the companies have planned investments in these areas for implementation of industry 4.0 in the next 5 years.

Figure 1 - Investments made in the last 2 years



Source: Authors, 2020.

Figure 2 - Investments planned for the next 5 years

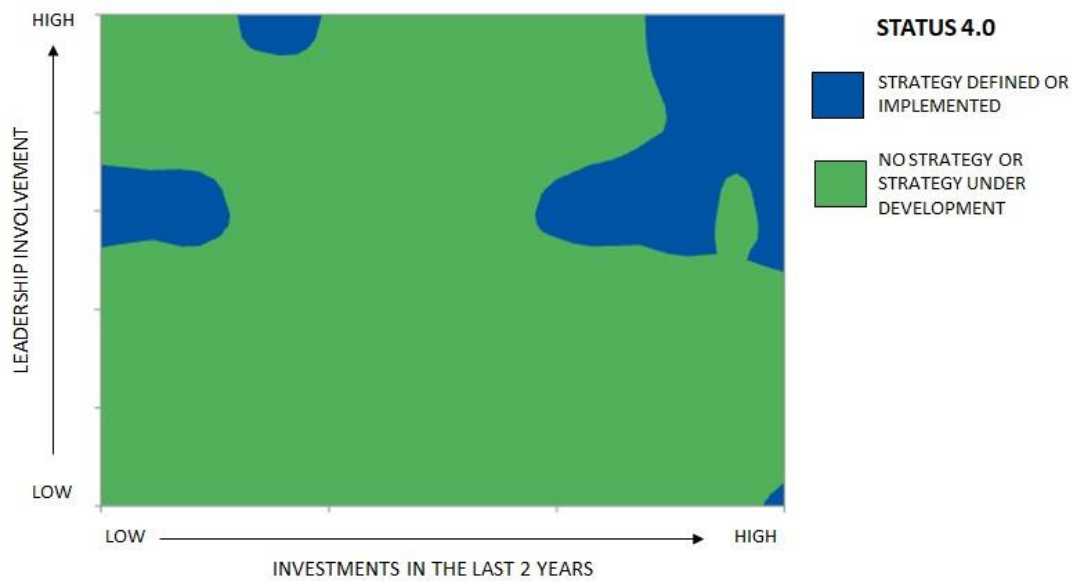


Source: Authors, 2020.

Companies that claim to have a strategy for industry 4.0 defined or implemented have two points in common. Primarily, the high involvement of senior leadership (Executive Management and Managers) is a determining factor in achieving this status. In addition, these companies have generally invested in equipment for industry 4.0 in the past 2 years (Figure 3).

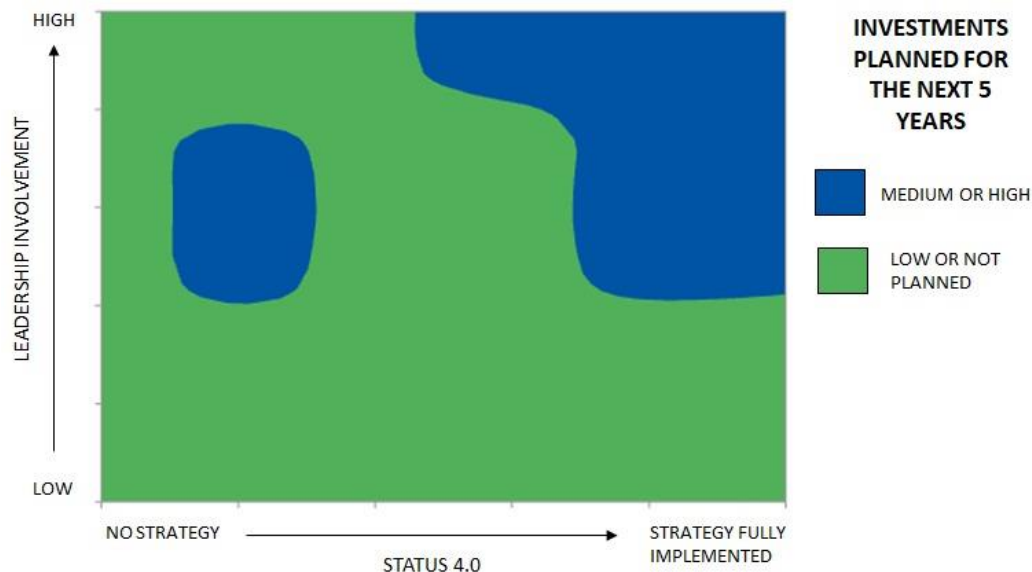
Companies that claim to have high leadership involvement and a defined or implemented strategy for industry 4.0 claim to continue investing to improve their production (Figure 4).

Figure 3 - Leadership involvement x Investments in the last 2 years x Status 4.0



Source: Authors, 2020.

Figure 4 - Leadership involvement x Status 4.0 x Investments in the next 5 last



Source: Authors, 2020.

4. CONCLUSION

Most of the companies concentrated their investments in the production / manufacturing area to implement Industry 4.0. But we emphasize the importance of investments in other areas such as, R&D, Logistics, Purchasing and Sales of the company for the complete implementation of industry 4.0. With this, several companies miss opportunities to stand out in the State and Brazilian scenario, because companies that are implementing industry 4.0, are obtaining positive results.

The companies that are most invested in the implementation of industry 4.0, mostly are those companies, whose leadership is involved and understands the need to evolve its industrial park.

We note that it is important to involve the leadership with the investments planned in all the company's areas in order to implement industry 4.0 in the industries. Most companies focused their investments on the production / manufacturing area for the implementation of Industry 4.0.

The area with the lowest investments made and planned for the implementation of Industry 4.0 is the R&D area. Future works should identify and understand the reasons for choosing investments and differentiating the priorities of these companies between the several evaluated areas.

5. REFERENCES

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