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ORIGINAL

Big Data and Artificial Inteligence in small and medium-sized companies in the province of Córdoba

Big Data e Inteligencia Artificial en pequeñas y medianas empresas de la provincia de Córdoba

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ABSTRACT

Technology behaves in disruptive ways. As the word implies, it abruptly disrupts the way people's lives unfold, mainly the life of organizations. The main objective of this research work was to know whether SMEs in the province of Córdoba, Argentina know the need and the type of adaptation of the organizational system necessary to develop competitively in this 4th. Industrial Revolution, by incorporating Big Data technology and Artificial Intelligence according to the management elements required for this adaptation. The research had a descriptive scope and was carried out through a qualitative approach with a non-experimental cross-sectional design, through semi-structured interviews. The results showed that organizations are already implementing these tools or are considering doing so in the future as they perceive that these are of great help to obtain better results. As a result of this research, we can conclude that this technology is already a reality and companies must adapt to it to survive in this increasingly competitive and competent market.

Keywords: Technology; SMEs; Organisational Adaptation; Big Data; Artificial Intelligence; Artificial Intelligence.

RESUMEN

La tecnología se comporta de manera disruptiva. Como la palabra lo indica, rompe bruscamente la manera en la que se desenvuelve la vida de las personas, principalmente la vida de las organizaciones. El presente trabajo de investigación tuvo como objetivo principal conocer si las PyMEs de la provincia de Córdoba, Argentina conocen la necesidad y el tipo de adaptación del sistema organizacional necesario para desarrollarse competitivamente en esta 4ta. revolución industrial, al incorporar tecnología big data e inteligencia artificial según los elementos de gestión que requiere esa adaptación. La investigación tuvo un alcance descriptivo y fue realizada mediante un enfoque de tipo cualitativo con diseño no experimental transversal, mediante entrevistas semi estructuradas. Los resultados arrojaron que las organizaciones ya estan implementando estas herramientas o este considerando hacerlo en un futuro ya que perciben que estas son de gran ayuda para obtener mejores resultados. A raíz de esta investigación, podemos llegar a la conclusión que esta tecnología ya es una realidad y las empresas deben adaptarse a ella para lograr subsistir en este mercado cada vez más competitivo y competente.

Palabras clave: Tecnología; PyMEs; Adaptación Organizacional; Big Data; Inteligencia Artificial.

INTRODUCTION

In the context of the Fourth Industrial Revolution, digital technologies such as Big Data and Artificial

Intelligence (AI) are profoundly transforming business models, decision-making, and business competitiveness globally.[1,2,3,4] This new paradigm requires organizations, regardless of their size or industry, to adapt to an increasingly dynamic, digitized, and data-driven environment.[5,6,7] In this context, small and medium-sized enterprises (SMEs) face a double challenge: on the one hand, they must recognize the opportunities offered by these disruptive technologies, and on the other hand, they must overcome structural and economic barriers to implement them effectively.[8,9,10]

The present research aims to investigate whether SMEs in the province of Córdoba, Argentina, recognize the need to adapt their organizational systems to incorporate Big Data and Artificial Intelligence tools as part of their competitive strategy. This work aims to determine the level of knowledge and utilization of these technologies, the sectors in which they are applied, the benefits achieved, as well as the barriers and challenges faced by companies that have not yet adopted them. Additionally, it examines whether organizational size is perceived as a decisive factor in the decision to implement technology.

The study employed a qualitative approach with a non-experimental design and a descriptive scope. The sample was intentionally selected to include both companies that have already incorporated Big Data and AI into their processes, as well as those that have not yet done so, thereby allowing for comparative analysis and a more comprehensive view of the phenomenon. Through semi-structured interviews with executives and managers, primary data were collected to complement a previous documentary review on the subject.

This work is particularly relevant in a context where digital transformation is not only a competitive advantage but an essential condition for business survival. Understanding how SMEs in Córdoba are responding to these changes allows not only to diagnose the current state of digitalization in the region but also to offer concrete recommendations to facilitate their transition to a more efficient management model based on data and with the capacity to adapt to the new technological scenario.

METHOD

Design

This research was descriptive in scope and employed a qualitative approach with a non-experimental, cross-sectional design. It focused on finding out whether SMEs in the province of Córdoba, Argentina, recognize the importance of adapting their systems to take advantage of new technologies and be competitive. The current level of technology incorporation in Cordoba's SMEs was taken into account, and the analysis was divided into companies that implement these technologies and those that have not yet done so.

The context in which we intend to study these characteristics is the Argentine territory, specifically in small and medium-sized companies in the province of Córdoba, but intentionally selected according to the characteristics required by the research objectives.

To fulfill the first objective, the starting point was documentary research on theoretical issues related to the central topics, as well as research with empirical information on this reality. Then, based on the results obtained and through the use of primary sources, the truth about the companies was established, progressing from the general to the particular to achieve the other specific objectives.

Participants

For the research, the population consisted of small and medium-sized companies in the province of Córdoba, Argentina. The sample is non-probabilistic and intentional. The participants are composed of directors and managers from both companies that have the potential to utilize Big Data technology and those that have effectively incorporated this technology, each of whom will answer specially formulated interview questionnaires.

Collection instruments

For the documentary part, the collection instruments were content cards, bibliographic and demographic cards, and the registration of electronic pages.

For the primary source collection part, the collection instrument used was a semi-structured interview administered through indirect questionnaires by a specialist. This type of interview is ideal for obtaining descriptions and information about the person's ideas, beliefs, and conceptions of reality, which we aim to analyze.[11] In addition, these interviews are characterized by being part of a script (a tentative list of topics and questions) in which the issues related to the theme of the study are pointed out. During the interview development, questions are posed without adhering to the previously established sequence, allowing for unforeseen yet pertinent questions to be asked. The script outlines the necessary information to achieve the stated objectives.[12]

The formulation of the questionnaires was carried out in consideration of the results of the documentary research.

Data analysis

The data to be analyzed were qualitative in nature. The procedure for data analysis was as follows: Obtaining the information through documentary search and questionnaires; capturing, transcribing, and ordering the information through the collection of original material and the interviews through the electronic record of the interviews; then continued with the coding of the information grouping according to categories, concepts pre-selected by the researcher and culminated with the integration of the information through the analysis and categorization of the information collected about the scope of the proposed objectives.

RESULTS

This section presents the findings obtained from analyzing the data collected in interviews conducted with 10 small and medium-sized companies in the province of Córdoba to answer the question posed in this research. The companies interviewed belong to a diverse range of sectors, including agriculture, retail, steel, media, logistics, and finance.

Regarding the profile of the interviewees, the age range is between 23 and 54 years old, and most of them hold managerial positions.

The first specific objective was to determine whether small and medium-sized companies in the province of Córdoba have implemented Big Data and/or Artificial Intelligence tools in their daily processes. The interviews showed that 60 % of them currently apply these tools.

The second specific objective of this research was to identify in which areas they are applied and what functions they fulfill. The areas in which companies utilize these tools are as follows:

- Marketing
- Sales and Marketing
- Purchasing
- Administration

As a result of the information obtained, we were able to detect that the Marketing area is the most commonly chosen area for implementing this technology, with 6 out of 6 (100 %) companies deciding to apply this technology in this area. Then, in the Sales area, it is used by 5 out of 6 (83,3 %). In the Purchasing area, it is used by 3/6 (50 %) of companies, and in the Administration area, it is used by only 2/6 (33,3 %) of companies.

The third specific objective focused on companies that do not use this type of tool and sought to determine if they are aware of the current need to apply this technology to adapt and achieve satisfactory development in the 4th Industrial Revolution. Of the four companies that do not currently use these tools, 3 out of 4 (75 %) believe that applying this technology can generate a benefit for the company. The remaining 6 (100 %) companies that use Big Data and Artificial Intelligence agreed that applying these tools generated an advantage for them.

The fourth specific objective sought to investigate the reason why companies do not apply Big Data and Artificial Intelligence. The causes identified were the following:

- Costs
- Industry
- Present of the organization.

Of the companies that currently do not utilize this technology, three-quarters (75 %) cited the high costs involved in applying it as a reason. 1/4 (25 %) claimed that the industry in which the company operates is not the most suitable for using these tools. Finally, 1/4 (25 %) believe that their organization is not ready to make a change of this nature at this time because it is in a restructuring process. Complementing this objective, a question was asked to determine whether these companies were considering applying Big Data and/or Artificial Intelligence in the short or medium term. Seventy-five percent of the participants responded that it was not in the organization's plans to do so within the proposed timeframe.

The fifth specific objective of the research aimed to determine whether the application of Big Data and Artificial Intelligence had yielded satisfactory results. 100 % of the participants agreed that the results they obtained after applying this technology were entirely positive, yielding better results than in the past.

The sixth specific objective pursued by this research focused on identifying the most significant challenge detected by participants when applying Big Data and Artificial Intelligence for the first time in their companies. It is pertinent to name and explain the named challenges:

- Training of personnel: 50 % agreed that the biggest challenge they faced was to get their presented to them was getting their staff to adapt to the organizational change, bringing as a consequence a radical change in the way they perform in their jobs, forcing them to learn new tools and more sophisticated than the ones they used in the past.
- Utility of data: 33,3 % agreed that the challenge that took the most effort to overcome was to

correctly apply Big Data and Artificial Intelligence tools because they were unable to find a use for the data obtained and, therefore, did not perceive a benefit.

- Restructuring the business: 16,6 % named as the biggest challenge to restructure the way they the way they carried out their activities because these tools provided them with data suggesting that how they carried out their operations was not the most efficient.

Finally, the seventh specific objective focused on whether the participants believed that the size of the organization was a determining factor when opting for the implementation of Big Data and/or Artificial Intelligence. The results obtained were that 6/10 (60 %) participants believe that the size of the organization is a determining aspect when deciding whether to apply some of these tools. Among the answers obtained, the costs to be incurred by the organizations were cited as a justification, and the need for personnel with the capacity to manage this technology correctly was also a recurring response. The remaining 4/10 (40 %) participants consider that the size of the company is not a determining factor in applying these tools since any company, regardless of size, can apply Big Data and/or Artificial Intelligence, but remarking that small and medium companies do not use in most cases very sophisticated software as it would be in the case of large companies and thus apply it in more basic processes. To add more information to achieve the objective, a question was asked to determine if the closest competitors were currently using these tools. The results obtained were that 4/10 (40 %) answered that their competition is using Big Data and/or Artificial Intelligence.

DISCUSSION

The general objective of this research was to determine whether SMEs in the province of Córdoba, Argentina, are aware of the need for any organizational system adaptation necessary to develop competitively in the 4th Industrial Revolution by incorporating Big Data and Artificial Intelligence technology. To achieve this task, an analysis of the data obtained from the interviews conducted and data acquired from other sources was conducted. SMEs in the province of Cordoba are aware of the need to incorporate this type of disruptive technology in their daily operations and the implications of making this decision.

The first specific objective was to determine whether SMEs utilized Big Data and Artificial Intelligence tools. It is essential to recognize that the companies providing information for this research belong to a diverse range of sectors. The data showed that 60 % of the companies interviewed use these tools, although with varying degrees of intensity and functionality. This technology can be applied to most processes within an organization, and these data allow us to understand that SMEs are aware of this information. In the case of the SMEs that do not use these tools, they were also aware of their use.

Continuing with the second specific objective, which consisted of identifying in which areas and functions SMEs use Big Data and Artificial Intelligence, it was recognized that the Marketing area was mentioned by 100 % of the participants because applying these tools in this area implies costs and a much lower difficulty than the application in areas where it is mandatory to use paid software and trained personnel to manage them. The sales area is also very popular, being used by 83,3 %, and this is because applying Big Data and Artificial Intelligence in this area generates data that are of vital importance for SMEs; this is not the case for the administration area (33,3 %) since applying these tools in the operations of companies of this size does not justify its implementation because it does not generate great benefits as in the other areas.

The third specific objective was to determine whether companies that do not implement this technology were aware of the current need for adaptation to develop competitively. 100 % stated that they are aware of the advantages that these tools provide and the need to adapt to these changes. They are all aware of the advantages of applying these tools and the consequences of not adapting to these changes.

The fourth objective is closely related to the one mentioned above and was based on determining the causes of the non-application of Big Data and Artificial Intelligence in their companies. The causes mentioned were very similar, but the most repeated was that the industry in which they are immersed is not compatible with this technology.[12,13] Beyond the fact that the participants agreed on this point, the reality differs because, as shown in this research, these tools can be applied in any scenario; what does vary is the degree of impact they have and in the case of the participants who claimed incompatibility, it can be agreed that they belong to sectors where the advantages offered by this technology are not currently of great importance and have more costs than benefits.

The fifth objective aimed to determine whether SMEs that utilize Big Data and Artificial Intelligence derive benefits from applying these tools. We can confirm that all companies agreed that there were positive changes in their organizations after implementing this technology. The main change they glimpsed was understanding more deeply which practices were correct and which needed modification to generate more efficient processes. The great advantage of these tools is the thousands of vital data points that allow us to have a more accurate view of our business rather than operating based solely on our experience and intuition.

The sixth objective was to identify the biggest challenges companies faced in implementing this technology

in their daily operations. Fifty percent agreed that adapting their personnel was the most critical aspect of this transformation. When using this type of technology, companies are forced to modify a large number of processes and the way their personnel are accustomed to working. This causes some resistance to change among employees, as they feel a certain degree of uncertainty due to the changes and increased complexity in their jobs. In some cases, SMEs are obliged to hire personnel trained to handle this data, and the difficulty lies in the small number of human resources available to fill these types of positions at present.[14,15] The other great challenge faced by SMEs that decide to venture into this technology is to make sense of the large amount of data extracted with these tools. It is useless to have thousands of data points that have no value. It is essential to know what to analyze and how to interpret it to derive the most benefit from it.[16,17]

Finally, the last objective was to know the opinion of SMEs on whether the size of the organization is a determining factor in the application of Big Data and Artificial Intelligence tools. The data obtained show that 60 % believe size is a determining factor when deciding whether to apply this technology. This was mainly based on the fact that there is a belief that high costs must be incurred to use Big Data in organizations. The reality is not black and white; it is possible to use this technology without incurring fees, or these can be almost zero in areas such as marketing, where most of the tools are free to use. Still, suppose you want to venture into areas where obtaining data involves having a larger budget due to the sophistication of the elements to be acquired. In that case, size can be a determining factor. As for the size per se, this is not an obstacle because any organization, regardless of the number of employees and the magnitude of their processes, can freely apply Big Data and Artificial Intelligence tools, as they all generate vast amounts of data that allow for making decisions based on these.

CONCLUSIONS

Thanks to the data collected and the research conducted, we can conclude that SMEs in the province of Córdoba, Argentina, are aware of the significant changes occurring in the way the business world conducts its daily operations as a result of the implementation of Big Data and Artificial Intelligence tools. Hence, a large number of companies have already adapted their organizations to this change. In contrast, those who have not done so yet need time to cope with these changes, but it is always worth keeping in mind that this change is very beneficial and necessary for their future survival.

Soon, these technologies will become an obligation if we want to remain competitive. Obtaining vast amounts of data that clarify many unknowns and challenge long-held prejudices prevalent in most companies, which often stem from traditional working methods, enables us to uncover the vast potential for improvements in our operations that can be easily exploited, thereby achieving a competitive advantage.

Uncertainties are always present in a business, and this is especially true for small or medium-sized companies, where a wrong step can be the end of it. That is why, today, a large number of SMEs are reluctant to take the steps to reap the benefits and, more importantly, to assume the responsibilities involved in applying these disruptive technologies.

For future research, it is advisable to conduct a study with a larger number of samples, preferably involving SMEs from a particular industry, as the implementation of Big Data and Artificial Intelligence depends mainly on this.

Additionally, it is recommended to delve deeper into topics related to cybersecurity, as the benefits of these tools also bring risks that should be avoided. We handle a significant amount of sensitive data that must be safeguarded in the most secure manner possible.

The fourth industrial revolution is already an integral part of our daily activities. The data generated daily is growing exponentially. This data is of incalculable value, which is why it must be utilized as soon as possible and always responsibly.

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