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Artificial intelligence and machine learning implementation status on Latam: a systematic literature review

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ABSTRACT

Artificial intelligence (AI) and machine learning (ML) are disruptive technologies nowadays. It is well known that many important organizations use them to improve their productivity and processes, and many new applications are being developed as well. In Latin America, the adoption of new technologies is slower than in other parts of the world, limited by budget and trained personnel. The present research is a systematic literature review (SLR) conducted to analyze the implementation status of AI and ML technologies in Latin America, analyzing the improvements that these technologies bring to organizations. The methodology used in this literature review was PRISMA, a popular method widely used in this type of research. The findings were that the most relevant areas using these types of technologies are education and health, identifying also that their implementation improves operative efficiency, technology innovation, and competitiveness. These findings also demonstrate the lack of efforts in implementation in other business sectors like administration, agriculture, and production, which provides a great opportunity to improve in these areas in the future.

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1. INTRODUCTION

Because of the increment of internet of things (IoT) based on proliferation of new devices like sensors wearable and mobiles capable of gathering a big amount of data [1], relevant data for many types of business like health, eduction and others [2], [3]. the evolution of IoT that include different methods of collect information like rule-base, simulation models, machine learning (ML) and deep learning (DL) models [4] make that the data analysis relevant for increment the efficiency, productivity and for assure the business continuity. These data generation together with the tendency of bring your own device (BYOD) make data recollection easier and help the application of the technology in many areas like education, health [5], costumer applications [6] and others. With these revolutionaries technologies the amount of data increase exponentially from 2016 to 2022 with projections until 2025 [7] (see Figure 1) . the great amount of data nowadays is useful to business and daily life, to make business more efficient and people have a better quality life.

Many technologies were developed in order to take advantage of this get volumen of data as [4] mention ML and DL models which belong to big data, artificial intelligence (AI) and business intelligent technologies are a reference point to made these data useful. Many application of these technologies were identified all over the world specially on Europe, and north America, these application in many business like

analyze meteoritical variance [8], health [9], sustainable power [10], education [11], food [12], and manufacture [13], but little is known about the application of these type of technologies in Latin America, because the low indice of research publications, comparing to north America and Europe and because the application already implemented are just focus in few topics like education and health like this research demonstrate in the nexts sections.

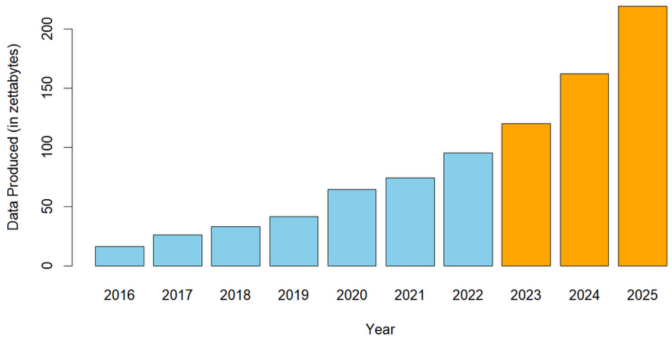

Figure 1. Data produced from 2016 to 2025 [7]

2. METHOD

The main objetive of this systematic literature review (SLR) is identified how AI, ML, business intelligences have been used nowadays on Latin America and identified benefits and future tendencies to motive their massive use. To cover the topics the following main investigation question is set following the method PICO which allow structure the main question to focus on a specific problem.

MQ. In Latin America business, how do the implementation of business intelligence technologies such as AI, ML, and big data, impact decision making, operational efficiency, innovation, and competitiveness?

In Table 1, the PICO components (population or problem, intervention, comparison, and outcomes) are explained for the proposed question.

Table 1. PICO components

Component	Description
P (population or problem)	Deficiency/Gap in the adoption of AI and ML in Latin American companies
I (Intervention)	Implementation of AI and ML technologies.
C (Comparison)	It doesn't apply.
O (Outcomes)	Improvements in decision-making, operational efficiency, innovation, and competitiveness in the market.

For better understanding, the main question was divided into sub-questions, which helps to understand the focus of this investigation.

$SQ1$. What impact has the implementation of this technology on operative efficiency in Latin American business?

$SQ2$. What impact has the implementation of this technology on innovation in Latin American business?

$SQ3$. What impact has the implementation of this technology on competitiveness in Latin American business?

The methodology used to collect, filter, and analyze the information was PRISMA, a methodology widely used for this type of research. In Figure 2, the steps followed are represented, from the initial document search and the multiple filters applied to the final approved research documents. The following section of the document briefly explains the methodology used.

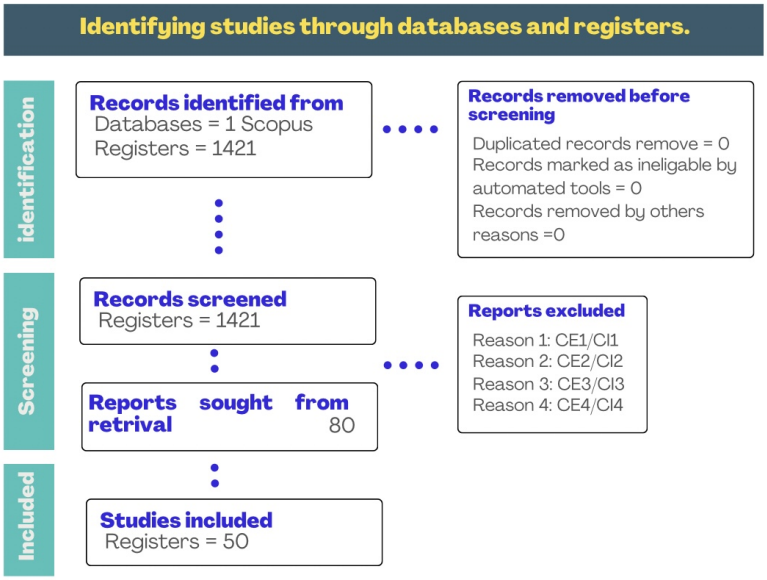

Figure 2. Prisma methodology used in the SLR

For the identification phase, one information database was used. Scopus was selected for two important reasons: the first is that it is one of the most important verified databases for finding research of many types, and the second is its easy accessibility to the research team. A research equation was developed, also analyzing keywords related to the topic of this research, including countries, technology, and the most important issues defined in the different question proposals. This equation is shown in Figure 3, and as a result, 1,421 documents were initially selected.

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(TITLE-ABS-KEY("Artificial Intelligence" OR "Implementation of Artificial Intelligence" OR
"Machine Learning" OR "Machine Learning Implementation" OR "Big Data" OR "Information
Technology" OR "Data analytics") AND AFFILCOUNTRY("Peru" OR "Brazil" OR "Brasil" OR
"Argentina" OR "Chile" OR "Bolivia" OR "Colombia" OR "Ecuador" OR "Costa Rica" OR
"Venezuela" OR "Paraguay" OR "Honduras" OR "Cuba" OR "Haiti" OR "Nicaragua" OR
"Mexico" OR "El Salvador" ) AND TITLE-ABS-KEY("decision-making" OR "decision making" OR
"Efficiency" OR "Innovation" OR "Competitiveness") AND TITLE-ABS-KEY("Education" OR
"Software Development" OR "Warehouse" OR "Sales" OR "Factory" OR "Health"))
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Figure 3. Research equation

After the first documents were selected exclusion and inclusion criteria were defined and applied to the original documents selected. On Table 2 the exclusion and inclusion criteria are shown. After the application of the criteria, the result were 80 documents select for the further analysis. In the last analysis the documents not directed related with ML, AI, and business intelligence wasn't consider because the investigations not implement the technologies directly and as a result 50 final documents were selected.

Table 2. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
CI1 Investigations between 2022 and 2024	CE1 Research that has been carried out prior to 2020
CI2 Implementations made in companies in the education sector, software development, warehouse, sales, manufacturing and health	CE2 Implementations that are not within the education, software development, warehousing, sales, manufacturing and health sectors. In addition, it is not related to the subject
CI3 Original research published in journals	CE3 Research published in conferences or pre-publications
CI4 Research in English and Spanish	CE4 Research that is not in the English and Spanish language

The review and research selection using PRISMA methodology shows on Table 3 the summary by type of business, as it can be notice the major type of business using AI, ML, business intelligence technologies on latin American is education and health.

Table 3. Summary by type of business

Type of business	Research related
Agriculture	[14]
Education	[15]-[32]
Wind power	[33]
Manufacturing	[34], [35]
Energy management	[36]
Marketing	[37]
Animal reproduction	[38]
Health sector	[39]-[55]
Health and logistic	[56]
Environmental sustainability	[57]-[69]
Sales	[60], [61]

3. RESULTS

The papers investigated shows that Brazil , Colombia and Peru are the countries that made the most publications about AI topics between the years 2022 and 2024. In that time the most types of business that implement AI and derivative technologies are the health (19) and education (18) sectors. These sectors focus their concerns mostly on trying to improve student performance and reduce dropouts, as well as improve patient care by using new technology that helps make treatments more efficient. The methodology used for implementation can be seen in Table 4.

Each analyzed study uses a type of investigation that covers a wide range of topics: observational and descriptive studies, this research describes characteristics and specific behaviors without manipulating any variables. AI applications and ML, these applications improve processes and diagnosis for patients, allowing for health monitoring. Research in education, encourages using new technology like ChatGPT and predictive analysis to identify dropout factors and improve education through simulations and recommendation systems. Theoretical and ethical concepts, encourages discussions about AI integration in patient care and education, focusing on ethical and philosophical aspects. Innovation and technological development, these studies improve processes for various businesses, such as industrial, health, and environmental sustainability, through technological innovation, including ML and other computational tools.

Table 4. Methodologies used for implementation

Research type	Application field	Methodologies	Main tools
Descriptive cross-sectional study	General	Observational	Surveys, interviews
Quantitative	Data analysis	Descriptive statistics	Statistical software
Multinational retrospective observational study	Retrospective studies	Cohort analysis	Review of records
Proactive technological research	Technological innovation	Development of prototypes	Engineering design
Original predictive research	Dropping out	Predictive modeling	Statistical analysis, ML

The most utilized theoretical models for implementing these technologies include fuzzy logic and fuzzy rule-based systems for managing decision-making uncertainty. Fuzzy-DEA, which combines fuzzy logic with DEA, assesses uncertain conditions. Variable selection and regression identify significant features in large datasets, extending to data science and AI for predictive modeling in finance, healthcare, and education. ML predominates, enhancing decision-making, and quantitative analysis. Figure 4 outlines these key techniques by priority.

After analyzing the research, several knowledge gaps were identified. Variable selection in regression models needs further exploration for efficiency and accuracy. More studies on postoperative testing and ML for treatment identification are required in health research. Finance lacks research on the causes of payment behavior. In education, investigating school dropout causes with diverse variables and techniques is necessary. Additionally, there's a lack of research on the ethical use of AI tools in education.

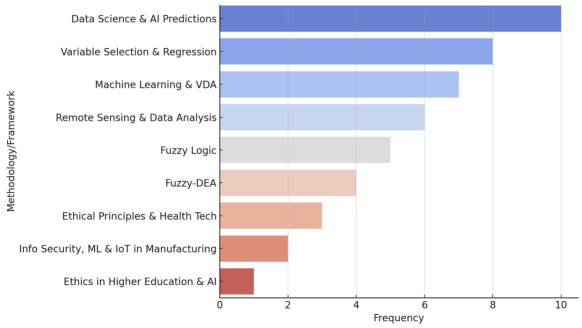

Figure 4. Techniques used on implementations of AI

4. DISCUSSIONS

The major findings are that the implementation of AI and data science techniques in Latin American businesses has significantly contributed to operational efficiency, innovation, and competitiveness. These findings demonstrate the potential to transform various business sectors.

$SQ1$. Findings in operational efficiency: AI and data science improve decision-making in education, health, and administration by enabling faster and more accurate decisions. For example, research [31] improves the creation of educational content to support student learning. In health, [47] improves diagnostic decision-making through the use of AI, and numerous studies support these findings (Table 3), highlighting AI's ability to identify weak processes and promote continuous improvement.

$SQ2$. Findings in innovation: the implementation of new technologies (Figure 4) provides new possibilities in the medical sector with personalized medical treatments (for example, in [51], [47]). In the education sector, it increases academic performance and student retention ([29], [32]). In the agriculture sector, AI models are used in conjunction with drones to monitor crops and ensure high-quality yields [14].

$SQ3$. Findings in competitiveness: the capacity of these technologies to analyze very large databases allows businesses to identify improvement opportunities, optimize operations, and provide new personalized solutions to their clients. The key areas affected are technological innovation [61], business optimization processes [60], decision-making [24], new product development [35], personalized services [60], and market expansion [37]. (For more details, see Table 3).

These findings highlight the transformative potential of AI and data sciences in enhancing operational efficiency and align with the broader scientific consensus on their benefits. They reinforce the importance of adopting these technologies for competitive advantage in Latin American markets. Future work in Latin America should continue implementing AI technologies in health and education, where many improvements have been seen. Additionally, expanding AI use in sectors like agriculture, manufacturing, energy management, and logistics is recommended. These sectors would benefit from increased efficiency, innovation, and competitiveness, as demonstrated by the literature review.

5. CONCLUSION

This SLR is important to demonstrate the actual use of these types of technologies in LATAM. Through this review, there is evidence that the application of these technologies is not widespread in all types of business. While education and health are the sectors with the most significant implementations, there are still business sectors that do not have enough implementations. A lack of knowledge exists as a barrier to investing in this technology in many areas, such as administration, agriculture, and manufacturing. Some may argue that the high cost and complexity of AI implementations deter widespread adoption, but there is evidence that factors like operational efficiency, innovation, and competitiveness improve with the use of these implementations. The review also provides the methodologies and technologies most used to implement these technologies. Additionally, gaps are identified to improve the implementations not only in sectors where they are already used, but there is also motivation to expand to other business sectors.

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