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The Use of Artificial Intelligence in Small Businesses in the City of Guayaquil.

Uso de la inteligencia artificial en microempresas comerciales de la Ciudad de Guayaquil.

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Abstract.
Digital transformation has driven the integration of technologies such as artificial intelligence (AI) in the business environment, creating new opportunities to enhance management efficiency and competitiveness in microenterprises. The objective of this study was to analyze the adoption of artificial intelligence in microenterprises within the commercial sector of the Pedro Carbo Concepción urban parish, Guayaquil. A quantitative, descriptive, and cross-sectional non-experimental design was applied. Data were collected through surveys administered to 40 microentrepreneurs using a structured Likert-scale questionnaire. Statistical analysis included descriptive and inferential techniques, such as Cronbach's alpha for reliability assessment and one-sample t-tests, complemented by the evaluation of dimensions related to perceived benefits, operational efficiency, adoption intention, and contextual barriers. The results indicated a favorable perception of the benefits of artificial intelligence and its impact on operational efficiency, which was reflected in a positive disposition toward its adoption. Additionally, adoption intention was found to be influenced by the perceived value of technological benefits and process optimization. However, contextual and knowledge-related barriers were not perceived consistently, showing a limited effect on overall perceptions. It was concluded that perceived benefits and operational efficiency significantly drive the adoption of artificial intelligence, highlighting the need to strengthen training and technological access strategies in microenterprises.

Keywords.
Artificial Intelligence, Microenterprise, Commercial Sector, Business Environment, Urban Parish.

Resumen.
La transformación digital ha impulsado la incorporación de tecnologías como la inteligencia artificial en el ámbito empresarial, generando nuevas oportunidades de mejora en la gestión y competitividad de las microempresas. El objetivo del estudio fue analizar la adopción de la inteligencia artificial en microempresas del sector comercial en la parroquia urbana Pedro Carbo Concepción, Guayaquil. Se empleó un enfoque cuantitativo, de tipo descriptivo y diseño no experimental de corte transversal. La información se recolectó mediante encuestas aplicadas a 40 microempresarios, utilizando un cuestionario estructurado con escala Likert. Los datos fueron analizados mediante técnicas estadísticas descriptivas e inferenciales, incluyendo el cálculo de fiabilidad con alfa de Cronbach y pruebas t para una muestra, complementadas con el análisis de dimensiones relacionadas con beneficios, eficiencia operativa, intención de adopción y barreras contextuales. Los resultados evidenciaron una percepción favorable hacia los beneficios de la inteligencia artificial y su impacto en la eficiencia operativa, lo que se reflejó en una disposición positiva hacia su adopción. Asimismo, se identificó que la intención de adopción se encuentra influenciada por la valoración de los beneficios y la optimización de procesos. Sin embargo, las barreras relacionadas con el contexto y el conocimiento no se manifestaron de manera uniforme, mostrando un efecto limitado en la percepción general. Se concluyó que la percepción de beneficios y eficiencia impulsa la adopción de la inteligencia artificial, sugiriendo la necesidad de fortalecer estrategias de capacitación y acceso tecnológico en microempresas.

Palabras clave.
Inteligencia Artificial, Microempresa, Sector Comercial, Ámbito Empresarial, Parroquia Urbana.

1.- Introduction

Digital transformation has established itself as one of the main drivers of change in production and organizational systems globally, generating new forms of management, interaction and value creation in companies. In this context, the incorporation of emerging technologies, particularly artificial intelligence (AI), has made it possible to redefine business processes through the use of advanced algorithms capable of analyzing data, automating tasks, and supporting decision-making. Indeed, AI has gone from being an experimental technology to becoming a strategic component in business competitiveness, facilitating the optimization of resources, the anticipation of trends and the continuous improvement of operational processes. Various international studies show a growing adoption of these technologies in

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Vol. 08 / Nº 02
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organizations of different sizes, which reflects their relevance in the contemporary digital economy.[1]

In emerging economies, digital transformation poses both significant opportunities and challenges. In Latin America, micro, small and medium-sized enterprises represent the core of the productive fabric, contributing substantially to employment and economic development. However, these organizations face structural limitations that hinder the incorporation of advanced technologies such as artificial intelligence, including restricted access to financing, the technological knowledge gap, and limited digital infrastructure. Despite these difficulties, the adoption of digital technologies is emerging as an essential condition to improve productivity, strengthen competitiveness and guarantee business sustainability in increasingly dynamic environments. In this sense, the analysis of the incorporation of artificial intelligence in this business segment is a topic of high scientific and practical relevance. [2]

In the specific context of Ecuador, and particularly in the city of Guayaquil, microenterprises play a fundamental role within the local economic system, being responsible for a significant proportion of commercial activity and job creation. However, their level of digitalization is still in their infancy, limiting their ability to take full advantage of the benefits offered by emerging technologies. Although initiatives aimed at promoting innovation and the use of digital tools have been promoted in recent years, barriers related to knowledge, accessibility and the perception of the value of artificial intelligence persist. Consequently, there is a need to understand not only the level of adoption of these technologies, but also the factors that influence their acceptance and use within microenterprises.

From a scientific and technical perspective, the central problem lies in the limited understanding of the determinants that explain the adoption of artificial intelligence in microenterprises in the commercial sector, especially in specific local contexts such as the urban parish of Pedro Carbo Concepción. Although the literature has extensively addressed technological adoption in large organizations, there is a gap in the analysis of these processes in microenterprises, where structural, cultural, and economic conditions generate particular dynamics. In this sense, it is necessary to develop research that integrates variables such as perceived benefits, operational efficiency, adoption intention and contextual barriers, allowing to build a comprehensive vision of the phenomenon.

In response to this need, the present study aims to analyze the use of artificial intelligence in microenterprises in the commercial sector of the urban parish Pedro Carbo Concepción, in the city of Guayaquil, through a quantitative approach based on the identification of key factors that affect its adoption. Through a field study, it seeks to establish a baseline that allows understanding the level of knowledge, perception and disposition of microentrepreneurs in the face of artificial intelligence, thus contributing to the development of strategies aimed at promoting digital transformation in this business segment. In this way, the research is positioned as a relevant contribution to interdisciplinary knowledge in the areas of engineering, business management and technological innovation.

1.1. Artificial intelligence and its application in the business environment.

Artificial intelligence has established itself as one of the most influential technologies in contemporary digital transformation, allowing computer systems to simulate cognitive capabilities of human beings, such as learning, reasoning and decision-making. In general terms, it is understood as the set of techniques and algorithms designed to process large volumes of data, identify patterns and generate answers or predictions autonomously. Its evolution has been closely linked to the development of computer science, statistics and data science, which has allowed its applications to be progressively expanded in various economic and productive sectors.[3]

In the business field, artificial intelligence has acquired strategic relevance, offering tools that contribute to improving operational efficiency, optimizing resources and strengthening the competitive capacity of organizations. Its implementation has extended to multiple areas, such as process automation, predictive analytics, inventory management, and data-driven decision-making. These applications allow companies to reduce errors, minimize costs and accelerate processes, facilitating more effective management in highly dynamic and competitive environments. In this context, artificial intelligence not only acts as a technological support, but as a key element in the redefinition of business models.[4]

However, the adoption of artificial intelligence in the business environment, especially in microenterprises, presents challenges associated with access to technological resources, the level of knowledge and the ability to adapt organizationally. Despite the potential benefits, many organizations are still in the early stages of incorporating these technologies, which shows the existence of gaps in terms of training and access. Consequently, the analysis of artificial intelligence in the business context not only involves understanding its operation and applications, but also evaluating the factors that facilitate or limit its adoption, as well as its impact on the sustainability and growth of companies.[5]

1.2. Models of technological adoption.

Technology adoption models constitute a fundamental theoretical framework to understand the factors that influence the acceptance and use of new technologies within organizations. These theoretical approaches seek to explain the behavior of individuals in the face of the incorporation of innovations, considering cognitive, attitudinal and contextual variables. Among the most relevant models is the Technology Acceptance Model (TAM), proposed by Davis, which states that the adoption of a technology depends

Vol. 08 / Nº 02
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mainly on perceived utility and perceived ease of use. These factors determine the user's attitude and, consequently, their intention to use, becoming a widely used reference in studies related to the implementation of technological systems in organizational contexts.[6]

Subsequently, the evolution of these models gave rise to more integrative approaches, such as the Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. This model broadens the perspective of TAM by incorporating new elements such as social influence and enabling conditions, recognizing that technological adoption does not depend only on individual perceptions, but also on the environment in which users operate. In this sense, the adoption of technologies such as artificial intelligence in the business environment is influenced both by the perception of benefits and by structural factors, such as access to resources, level of training and organizational support.[7]

In the context of microenterprises, technological adoption models acquire particular relevance, as they allow us to analyse the dynamics that condition the incorporation of innovative tools in environments with limited resources. The application of models such as TAM and UTAUT facilitates the identification of key factors that explain the intention to adopt, such as the perception of utility, expected operational efficiency and existing barriers. In this way, these models not only contribute to understanding user behavior, but also support the design of strategies aimed at promoting the effective adoption of emerging technologies, such as artificial intelligence, in the business sector.[8]

1.3. Benefits and operational efficiency of AI.

Artificial intelligence has established itself as a key tool for generating value in the business environment, mainly due to its ability to transform data into useful information for decision-making. Among the most relevant benefits associated with its implementation are the improvement of competitiveness, the reduction of errors and the optimization of resources, aspects that directly contribute to the strengthening of organizational performance. The ability to analyze large volumes of information in real-time allows companies to anticipate scenarios, identify opportunities, and minimize risks, which translates into sustainable strategic advantages in highly dynamic environments.[9]

In relation to operational efficiency, artificial intelligence plays a decisive role in facilitating the automation of processes and the continuous improvement of internal operations. The incorporation of intelligent systems makes it possible to reduce execution times, eliminate repetitive tasks and increase accuracy in key activities such as administrative management, resource planning and inventory control. In this way, artificial intelligence not only increases productivity, but also frees up time for business leaders to focus on strategic functions, favoring more efficient and results-oriented management.[10]

However, the impact of artificial intelligence on business profits and operational efficiency does not depend exclusively on the technology itself, but also on the ability of organizations to properly integrate it into their processes. In the case of microenterprises, this process can be conditioned by factors such as the level of knowledge, the availability of resources and the willingness to change. Therefore, although artificial intelligence offers a high potential to optimize management and improve business performance, its effective use requires an adequate articulation between technology, human skills and organizational strategies.[11]

1.4. Intention to adopt technology.

The intention of technological adoption is defined as the willingness or willingness of individuals and organizations to incorporate and use new technological tools in their activities. From the approach of technological acceptance models, this intention constitutes the main antecedent of the actual behavior of use, since it reflects the conscious decision to adopt an innovation. In this sense, the intention to adopt does not arise in isolation, but is influenced by cognitive and attitudinal factors such as the perception of usefulness, trust in technology and the valuation of expected benefits.[12]

In the business context, the intention to adopt acquires strategic relevance, since it determines the ability of organizations to adapt to dynamic and highly competitive environments. In particular, the adoption of technologies such as artificial intelligence implies not only a technical decision, but also an organizational commitment that involves investment, training, and change in work processes. Therefore, the predisposition to adopt these technologies is often associated with the perception that their implementation will generate substantial improvements in efficiency, decision-making, and business competitiveness.[13]

In the case of microenterprises, the intention to adopt technology is conditioned by various structural and contextual factors, such as the availability of resources, the level of knowledge and the perception of risk. Despite these limitations, evidence suggests that when microentrepreneurs recognize the potential value of emerging technologies, their willingness to invest and train for their implementation increases. Consequently, the intention to adopt is configured as a key element in the digital transformation process, since it represents the bridge between the perception of benefits and the effective incorporation of technology in business management.[14]

1.5. Barriers and context of adoption in microenterprises.

The adoption of technologies such as artificial intelligence in microenterprises does not take place in a homogeneous environment, but is conditioned by a set of structural factors that can facilitate or limit its implementation. Among the main barriers are a lack of technical knowledge, poor training in digital tools, and limited understanding of the benefits associated with these technologies. These constraints create uncertainty for decision-makers, reducing the likelihood of

Vol. 08 / Nº 02
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investment in innovative solutions and delaying digital transformation processes in this business segment.[15]

In this context, the environment in which microenterprises operate plays a determining role in technological adoption. Factors such as access to technological infrastructure, the level of connectivity, the availability of financing, and institutional support have a direct impact on the ability of organizations to incorporate tools based on artificial intelligence. In emerging economies, where microenterprises predominate, these conditions tend to be more restrictive, which amplifies digital divides and limits the integration of advanced technologies into production and administrative processes.[16]

However, the perception of barriers is not uniform among microentrepreneurs, as it depends on variables such as previous experience, educational level and degree of familiarity with technology. In some cases, a lack of access or knowledge is combined with a perception of complexity or risk, reinforcing resistance to change. However, when these barriers are addressed through training strategies, technical support and provision of resources, it is possible to generate more favorable conditions for technological adoption. Consequently, the analysis of the context and barriers not only allows us to identify limitations, but also to guide actions that promote the effective incorporation of artificial intelligence in microenterprises.[17]

1.6. Relationship between study variables (conceptual model).

The relationship between the variables of the study is based on the models of technological adoption, which state that adoption behavior is not an isolated process, but the result of the interaction of various perceptual and contextual factors. In this sense, the intention to adopt artificial intelligence is configured as the central variable of the model, influenced by the perception of benefits and operational efficiency that individuals associate with technology. When microentrepreneurs identify that artificial intelligence contributes to improving competitiveness, optimizing processes and facilitating decision-making, their willingness to incorporate it into their business activities increases.[13]

Likewise, operational efficiency plays an important role within the conceptual model, acting as a factor that reinforces the perception of the usefulness of the technology. The idea that artificial intelligence saves time, reduces errors, and improves resource management has a positive effect on the valuation of benefits, which in turn affects adoption intent. In this way, a complementary relationship is established between operational efficiency and perceived benefits, since both dimensions contribute to consolidating a favorable perception towards the use of artificial intelligence within the business environment.[3][18]

On the other hand, variables related to context and adoption barriers introduce a moderating element into the model, influencing the intensity with which benefits and efficiency impact adoption intent. Factors such as the level of knowledge, technological accessibility, and the availability of resources can facilitate or limit this process, generating variations in the willingness of microentrepreneurs to adopt technology. Consequently, the relationship between variables should not be understood in a linear way, but as an interdependent system in which positive factors drive adoption, while barriers can attenuate or hinder its materialization in the business environment.[10]

2.- Materials and methods.

The research was quantitative, descriptive in scope, and the design was cross-sectional, non-experimental, since data collection was at a single moment or point in time. The population under study was made up of microenterprises in the commercial sector located in the urban parish of Pedro Carbo Concepción, Guayaquil. The information was taken from the directory of the Superintendence of Company, Securities and Insurance which registered 279 microenterprises in the commercial sector in the parish object of the investigation, the selection criterion was that the companies remain active until the year 2025, another of the criteria that was considered was that these microenterprises do not have more than ten collaborators under dependency, and its sales do not exceed one hundred thousand dollars per year. For the study, non-probabilistic convenience sampling was considered. This decision was taken due to the limitations derived from the insecurity that the country is going through, which could compromise the integrity and willingness of microentrepreneurs. [19]

The data collection technique was the survey and the instrument was the questionnaire itself that was designed in the Google Forms application, this questionnaire had 17 questions which were validated by experts, ensuring its reliability. The questionnaire was addressed to managers or managers of microenterprises. As for the data collection process, it was carried out in three working days, managing to survey 14 microentrepreneurs on the first day, on the second day there were 18 respondents and on the third day 8 more were achieved. In this way, it was possible to survey a total of 40 microentrepreneurs. The data processing was carried out using the SPSS v.22 software, which allowed the corresponding analysis to be carried out for the presentation and interpretation of the results.[20]

3.- Results.

The results obtained not only reveal a current panorama of the use of Artificial Intelligence in Microenterprises, but also offer a valuable perspective to drive an effective transformation that translates into sustainable competitive advantages. The relevant findings of the research are presented below:

Table 1.- Summary of case processing

		N	%
Cases	Valid	40	100,0

Vol. 08 / Nº 02
e – ISSN: 3028-8533
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	Excluded [from]	0	0,0
	Total	40	100,0

a. Elimination by list is based on all procedural variables.

Table 1 shows the summary of the processing of the cases used in the statistical analysis. It is evident that the entire sample (N = 40) was considered valid, with no excluded records, which guarantees the completeness of the data set. This aspect is methodologically relevant, since it indicates the absence of missing values in the variables analyzed under the list elimination procedure, strengthening the consistency of the subsequent analysis and avoiding biases derived from the loss of information.

Table 2.- Reliability statistics

Cronbach's alpha	N of elements
0,953	17

Table 2 presents the reliability statistics of the instrument, showing a Cronbach's alpha value of 0.953 for a total of 17 elements. This coefficient indicates an excellent level of internal consistency, suggesting that the questionnaire items are highly correlated with each other and consistently measure the overall construct associated with the use of artificial intelligence in microenterprises.
Overall, the results of both tables allow us to affirm that the instrument used has a high psychometric quality, supported both by the integrity of the data and by the high reliability of the questionnaire. This implies that the measurements made are stable and consistent, providing a solid basis for the development of subsequent statistical analyses, as well as for the interpretation of the dimensions evaluated in the study.

Likewise, the high value of Cronbach's alpha observed in Table 2 suggests a strong homogeneity between the items, which can be interpreted as an adequate operationalization of the phenomenon studied. However, from a more advanced methodological perspective, such high levels of reliability could also indicate some redundancy between items, an aspect that could be explored in future analyses using techniques such as factor analysis.

In summary, Tables 1 and 2 show that the study has complete data and a highly reliable instrument, which supports the internal validity of the results obtained and strengthens the credibility of the conclusions derived from the statistical analysis.

Dimension 1: Benefits of AI; questions: P2, P3, P6, P9, P11, P14

Table 3.- Reliability statistics

Cronbach's alpha	N of elements
0,911	6

Table 3 presents the reliability statistics corresponding to the Benefits of AI dimension, made up of six items (P2, P3, P6, P9, P11 and P14). The value of Cronbach's alpha obtained (α = 0.911) shows excellent internal consistency, which allows us to affirm that the elements that make up this dimension maintain a high degree of homogeneity and coherently measure the same construct. This result provides methodological soundness to the analysis, as it supports the reliability of the dimension as a valid measure of the perception of the strategic and operational value of artificial intelligence in the microenterprises studied.

Descriptive statistics

Table 4. Descriptive Statistics of the Benefits of AI Dimension

AI Benefits	N	Minimum	Maximum	Media	Standard deviation
	40	1,00	4,83	3,7750	1,02778

Table 4, corresponding to the descriptive statistics of the dimension, shows that the AI Benefits variable has a mean of 3.7750, with a standard deviation of 1.02778, within a range of values ranging from 1.00 to 4.83. These results allow us to identify a favorable overall assessment of the benefits associated with the use of artificial intelligence, given that the mean is clearly above the theoretical midpoint of the Likert scale used. Likewise, the standard deviation indicates a moderate dispersion of responses, suggesting that while there is an overall positive trend, there is also some variability in the intensity with which respondents perceive these benefits.

Table 5.- Statistics on the distribution of the AI Benefits dimension

AI Benefits	N	Asymmetry		Curtosis	
	Statistician	Statistician	Standard Error	Statistician	Standard Error
	40	-1,413	0,374	0,985	0,733

Table 5 delves into the shape of the distribution of the Beneficios_IA dimension using the coefficients of asymmetry and kurtosis. The asymmetry value of -1.413 reveals a left-leaning distribution, implying a higher concentration of responses at the high levels of the scale. In other words, there is evidence of a marked tendency for participants to positively value the benefits of artificial intelligence. On the other hand, kurtosis of 0.985 indicates a relatively concentrated distribution, with a moderate accumulation of responses around the top of the scale. Together, both indicators reinforce the idea that the perception of the benefits of AI is not only favorable on average, but also consistent in its positive orientation.

T-test

Table 6.- Statistics for a sample

AI Benefits	N	Media	Standard deviation	Standard Error Mean

Vol. 08 / Nº 02
e – ISSN: 3028-8533
ISSN – L: 3028-8533

	40	3,7750	1,02778	0,16251

Table 6 complements this evidence by reintroducing the basic statistics required for the t-test for a sample. It confirms that the mean of the dimension is 3.7750, with a standard deviation of 1.02778 and a standard error of the mean of 0.16251. This last indicator shows that the estimation of the mean presents an adequate level of precision, which strengthens confidence in the results obtained for this dimension.

Table 7.- Test for a sample

AI Benefits	Test Value = 3					
	t	Good luck	Sig. (bilateral)	Mean difference	95% difference confidence interval	
					Bottom	Superior
	4,769	39	0,000	0,77500	0,4463	1,1037

Table 7 shows the results of the t-test for a sample, performed using the neutral point of the scale (3) as the test value. The statistics obtained (t = 4.769; df = 39; p = 0.000) indicate that the observed mean of the AI Benefits dimension is significantly higher than the neutral value, which allows us to reject the hypothesis of indifference or neutrality in the perception of the respondents. The mean difference of 0.77500 confirms that the positive assessment is not casual or marginal, but statistically relevant. Similarly, the 95% confidence interval for the difference, between 0.4463 and 1.1037, remains completely above zero, which reaffirms the robustness of the result and supports the conclusion that microentrepreneurs perceive real and significant benefits in the use of artificial intelligence.

In an integrated manner, Tables 3, 4, 5, 6 and 7 allow us to argue that the Benefits of AI dimension has a statistically sound structure, both from the psychometric and descriptive and inferential point of view. The high reliability of the construct, together with a mean above the neutral point, a biased distribution towards positive valuations and a statistically significant difference with respect to the theoretical reference value, show that the microentrepreneurs analysed clearly recognise the strategic and operational potential of artificial intelligence to improve competitiveness, optimise resources, reduce errors and strengthen business management.

In analytical terms, these findings allow us to conclude that the perception of the benefits of artificial intelligence constitutes a favorably positioned dimension within the group studied, which suggests the existence of a positive attitudinal basis for future processes of technological adoption. This result is especially relevant, as it indicates that, even though there may be structural or knowledge barriers, the recognition of the value of AI is already present in a considerable proportion of respondents.

Dimension 2: Operational efficiency; questions P1, P7, P8, P10

Table 8.- Reliability statistics

Cronbach's alpha	N of elements
0,832	4

Table 8 presents the reliability statistics corresponding to the Operational Efficiency dimension, composed of four items (P1, P7, P8 and P10). The value of Cronbach's alpha obtained (α = 0.832) shows a high internal consistency, which indicates that the items included maintain an adequate correlation with each other and coherently measure the construct associated with process optimization and decision-making through the use of artificial intelligence. This result allows us to consider the dimension as statistically reliable for analysis and interpretation.

Descriptive statistics

Table 9. Descriptive statistics of the Operational Efficiency dimension

Operational Efficiency	N	Minimum	Maximum	Media	Standard deviation
	40	1,25	5,00	3,9062	1,09440

Table 9, relating to the descriptive statistics, shows that the Operational Efficiency variable has a mean of 3.9062 and a standard deviation of 1.09440, with values ranging from 1.25 to 5.00. The average obtained, located above the midpoint of the scale (3), shows an overall positive perception regarding the impact of artificial intelligence on improving operational efficiency. On the other hand, the standard deviation reflects a moderate dispersion of the responses, which suggests the coexistence of diverse assessments, although with a predominance of favorable perceptions.

Table 10. Statistics on the distribution of the Operational Efficiency dimension

Operational Efficiency	N	Asymmetry		Curtosis	
	Statistician	Statistician	Standard Error	Statistician	Standard Error
	40	-1,239	0,374	0,508	0,733

Table 10 allows us to delve into the shape of the distribution of the variable using the coefficients of asymmetry and kurtosis. The asymmetry value of -1.239 indicates a left-leaning distribution, implying a higher concentration of responses at the high levels of the scale. This confirms the tendency of respondents to perceive the impact of artificial intelligence on operational efficiency favorably. As for kurtosis, the value of 0.508 suggests a slightly concentrated distribution, although relatively close to a normal distribution, which supports the stability of the data's behavior.

T-test

INQUIDE
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Journal of Science and Engineering
Vol. 08 / Nº 02
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ISSN – L: 3028-8533

Table 11.- Statistics for a sample

	N	Media	Standard deviation	Standard Error Mean
Operational Efficiency	40	3,9063	1,09440	0,17304

Table 11 presents the statistics required for the t-test of a sample, confirming the mean of the dimension (3.9063), as well as its standard deviation (1.09440) and the standard error of the mean (0.17304). This last indicator shows adequate precision in the estimation of the mean, which is relevant for the inferential interpretation of the results.

Table 12.- Test for a sample

	Test Value = 3					
	t	Good luck	Sig. (bilateral)	Mean difference	95% difference confidence interval	
					Bottom	Superior
Operational Efficiency	5,237	39	0,000	0,90625	0,5562	1,2563

The results in Table 12 correspond to the t-test for a sample, performed using the neutral point of the scale (3) as a reference value. The statistic obtained (t = 5.237; df = 39; p = 0.000) indicates that the observed mean is significantly higher than the reference value, which allows us to reject the hypothesis of neutrality in the perception of operational efficiency. The mean difference of 0.90625 shows a considerable positive deviation from the midpoint. Likewise, the 95% confidence interval for the difference, between 0.5562 and 1.2563, remains completely above zero, which reinforces the statistical strength of the result obtained.

In an integrated manner, Tables 8, 9, 10, 11 and 12 show that the Operational Efficiency dimension presents a statistically consistent behavior, supported by an adequate reliability of the instrument, an average above the neutral point, a biased distribution towards positive valuations and a statistically significant difference with respect to the reference value. Taken together, these results allow us to affirm that microentrepreneurs perceive favorably the impact of artificial intelligence on process optimization, time savings, improved decision-making and inventory management.

From an analytical perspective, these findings suggest that operational efficiency is one of the areas where artificial intelligence is best valued by respondents, which could be interpreted as a key factor in driving its adoption in the context of microenterprises. The consistency between the descriptive and inferential indicators reinforces the evidence that this dimension is positioned as a relevant element within the analysis model developed in the research.

Dimension 3: Intention to adopt, questions: P4, P15, P16, P17

Table 13.- Reliability statistics

Cronbach's alpha	N of elements
0,914	4

Table 13 presents the reliability statistics of the Intention to adopt dimension, composed of four items. The value of Cronbach's alpha obtained (α = 0.914) shows excellent internal consistency, which indicates that the items that make up this dimension are highly correlated and coherently measure the willingness of microentrepreneurs to adopt tools based on artificial intelligence. This result supports the robustness of the construct and guarantees the reliability of the measurements made.

Table 14. Descriptive statistics of the AI adoption intent dimension

	N	Minimum	Maximum	Media	Standard deviation
Intent to Adopt	40	1,00	5,00	3,7813	1,04112

Table 14 shows the descriptive statistics of the dimension, where it is observed that the variable Intention to adopt has a mean of 3.7813 and a standard deviation of 1.04112, within a range between 1.00 and 5.00. These results show that the intention to adopt artificial intelligence is above the midpoint of the scale, reflecting a favorable predisposition on the part of respondents towards the implementation of this type of technology. The standard deviation suggests a moderate dispersion, evidencing the existence of variability in the responses, although with a predominance of positive assessments.

Table 15. AI Adoption Intent Distribution Statistics

	N	Asymmetry		Curtosis	
Intent to Adopt	Statistician	Statistician	Standard Error	Statistician	Standard Error
	40	-0,900	0,374	-0,129	0,733

Table 15 analyzes the characteristics of the distribution of the variable using the coefficients of asymmetry and kurtosis. The asymmetry of -0.900 indicates a left-leaning distribution, implying that a significant proportion of respondents tend to be in the upper categories of the scale, reflecting a favorable disposition towards AI adoption. Regarding kurtosis, the value of -0.129 suggests a relatively close to normal distribution, with a slight tendency to disperse, indicating a moderate variability in responses without extreme concentrations.

T-test

Table 16.- Statistics for a sample

	N	Media	Standard deviation	Standard Error Mean
Intent to Adopt	40	3,7813	1,04112	0,16462

Table 16 presents the statistics necessary for the t-test of a sample, where it is confirmed that the mean of the dimension is 3.7813, with a standard deviation of 1.04112 and a standard error of the mean of 0.16462. This last value shows an adequate level of precision in the estimation of the average, which allows the results to be considered as statistically reliable.

Table 17.- Test for a sample

Intent to Adopt	Test Value = 3					
	t	Good luck	Sig. (bilateral)	Mean difference	95% difference confidence interval	
					Bottom	Superior
	4,746	39	0,000	0,78125	0,4483	1,1142

Table 17 shows the results of the t-test for a sample, taking the neutral point of the Likert scale as a reference value (3). The statistic obtained (t = 4.746; df = 39; p = 0.000) indicates that the observed mean is significantly higher than the reference value, which allows us to reject the hypothesis of neutrality in the intention to adopt. The mean difference of 0.78125 shows a relevant positive deviation from the midpoint. Likewise, the 95% confidence interval for the difference, between 0.4483 and 1.1142, remains completely above zero, confirming the statistical strength of the result.

In an integrated manner, Tables 13, 14, 15, 16 and 17 show that the AI Adoption Intent dimension presents a statistically consistent and favorable behavior. The high reliability of the construct, together with a mean above the neutral point, a distribution with a tendency towards high values and a statistically significant difference with respect to the reference value, allow us to conclude that microentrepreneurs show a positive predisposition towards the adoption of technologies based on artificial intelligence.

In analytical terms, these results suggest that, beyond the perception of benefits or efficiency, there is a concrete willingness of respondents to invest, train and adopt technological tools, which is a key element for the effective implementation of artificial intelligence in the field of microenterprises. This finding acquires special relevance within the study model, as it shows that the acceptance of technology is not limited to the perceptual plane, but is projected towards the behavioral intention of adoption.

Dimension 4: Context/barriers; Questions: P5, P12, P13

Table 18.- Reliability statistics

Cronbach's alpha	N of elements
0,343	3

Table 18 presents the reliability statistics corresponding to the "Context / barriers" dimension, made up of three items (P5, P12 and P13). The value of Cronbach's alpha obtained (α = 0.343) shows a low internal consistency, which indicates a weak correlation between the items that make up this dimension. This result suggests that the elements included are not homogeneously measuring a single construct, and may reflect the coexistence of different conceptual factors, such as the level of knowledge, the perception of accessibility, and the identification of limitations. From a methodological point of view, this finding indicates that the dimension should be interpreted with caution, since its low reliability limits the internal robustness of the construct.

Descriptive statistics

Table 19. Descriptive statistics of the dimension Context and barriers

Background Barriers	N	Minimum	Maximum	Media	Standard deviation
	40	2,00	4,33	3,0917	0,59909

Table 19 presents the descriptive statistics of the variable "Context barriers". A mean of 3.0917 is observed, slightly higher than the neutral point of the scale (3), with a standard deviation of 0.59909. These values indicate that the perception of context and barriers is at a level close to neutrality, with relatively low variability among respondents. The range of responses, between 2.00 and 4.33, suggests the absence of extreme assessments, evidencing a moderate and relatively homogeneous perception regarding the factors that condition the adoption of artificial intelligence.

Table 20. Statistics on the distribution of the dimension Context and barriers

Context barriers	N	Asymmetry		Curtosis	
	Statistician	Statistician	Standard Error	Statistician	Standard Error
	40	-0,241	0,374	-0,779	0,733

Table 20 delves into the shape of the distribution of the variable using the coefficients of asymmetry and kurtosis. The skewness value of -0.241 indicates a slightly left-leaning distribution, suggesting a slight trend towards valuations above the midpoint, although without a marked concentration. On the other hand, kurtosis of -0.779 reflects a flatter distribution compared to normal, indicating a moderate dispersion of responses without significant accumulations around a specific point. Taken together, these indicators confirm that the variable presents a relatively balanced behavior, without pronounced biases in the perception of the respondents.

T-test

Table 21.- Statistics for a sample

Context barriers	N	Media	Standard deviation	Standard Error Mean
	40	3,0917	0,59909	0,09472

Vol. 08 / Nº 02
e – ISSN: 3028-8533
ISSN – L: 3028-8533

Table 21 presents the statistics required for the t-test of a sample, which confirms a mean of 3.0917, a standard deviation of 0.59909 and a standard error of the mean of 0.09472. This last value indicates adequate accuracy in the estimation of the mean, allowing an inferential evaluation to be made with a reasonable level of confidence.

Table 22.- Test for a sample

Context barriers	Test Value = 3					
	t	Good luck	Sig. (bilateral)	Mean difference	95% difference confidence interval	
					Bottom	Superior
	0,968	39	0,339	0,09167	-0,0999	0,2833

The results in Table 22 correspond to the t-test for a sample, taking the neutral point of the scale (3) as a reference value. The statistic obtained (t = 0.968; df = 39; p = 0.339) indicates that there is no statistically significant difference between the observed mean and the reference value. In this sense, it is not possible to reject the hypothesis of neutrality in the perception of context and barriers. The mean difference of 0.09167 is small, and the 95% confidence interval between -0.0999 and 0.2833 includes zero, reinforcing the absence of statistically significant evidence.

In an integrated manner, Tables 18, 19, 20, 21 and 22 show that the "Context / barriers" dimension presents a different behavior than that observed in the dimensions previously analyzed. The low reliability of the construct, together with a mean close to the neutral point and the absence of statistical significance in the t-test, indicate that there is no clearly defined perception regarding the conditions that facilitate or limit the adoption of artificial intelligence. Likewise, the relatively balanced distribution of the data suggests that the opinions of microentrepreneurs are dispersed and do not converge in a consistent position.

In analytical terms, these results allow us to interpret that the context and the barriers associated with artificial intelligence are not a factor clearly perceived or homogeneously evaluated by the respondents. This situation could be explained by differences in the level of knowledge, access to technological resources or previous experiences with digital tools, which generates diverse perceptions and makes it difficult to consolidate a uniform construct. Consequently, this dimension is presented as a less defined element within the analysis model, which suggests the need to deepen its measurement or conceptually redefine its components in future research.

4.- Discussion

4.1. Interpretation of the results

The results of the study show that the dimensions associated with the perceived benefits, operational efficiency and intention to adopt artificial intelligence show a consistent and favorable behavior within the analyzed group, which allows us to infer the existence of a positive attitudinal basis towards the incorporation of these technologies in microenterprises. This finding is aligned with the postulates of the Technology Acceptance Model (TAM), which establishes that perceived utility is a determining factor in the intention of technological adoption. In this sense, evidence suggests that microentrepreneurs clearly recognize the strategic and operational value of artificial intelligence, which translates into a favorable predisposition towards its implementation.[21][22]

Likewise, the operational efficiency dimension reinforces the previous interpretation, by demonstrating that respondents perceive that artificial intelligence contributes to optimizing processes, reducing times and improving business management. This result confirms what Davenport and Ronanki pointed out, who indicate that the application of solutions based on artificial intelligence allows for increased organizational productivity through automation and advanced data analysis. Consequently, operational efficiency not only acts as a perceived benefit, but also as an element that strengthens the perception of usefulness of the technology, consolidating its influence on the intention of adoption.[23][24]

On the other hand, the dimension of intention to adopt reflects that the acceptance of artificial intelligence is not limited to the cognitive level, but is projected towards a specific behavioral disposition. This finding is especially relevant, as it shows that microentrepreneurs not only recognize the potential benefits, but also express interest in investing, training, and adopting these technologies. In theoretical terms, this result is in agreement with the UTAUT model, which postulates that the intention of use is influenced by both the performance expectation and the facilitating conditions.[25]

In contrast, the dimension related to context and barriers presents a differentiated behavior, characterized by low internal consistency and a perception close to the neutral point. This result suggests that the factors associated with knowledge, accessibility, and structural limitations are not perceived homogeneously by the respondents. From an analytical perspective, this indicates that adoption barriers are not a clearly defined factor within the group studied, which could be due to individual differences in terms of experience, access to resources, or level of familiarity with the technology. Consequently, while profits and efficiency drive adoption, barriers do not emerge as a dominant element in the collective perception.

4.2. Comparison with previous studies

The findings obtained in the present study show a high coherence with the previously developed literature on the adoption of emerging technologies in the business environment. In particular, the positive relationship between perceived benefits and adoption intent has been widely documented in studies based on the TAM model, where perceived utility is established as the main predictor of

Vol. 08 / Nº 02
e – ISSN: 3028-8533
ISSN – L: 3028-8533

technological acceptance. In this sense, the results obtained reinforce the empirical validity of this model in microenterprise contexts, especially in emerging economy environments.[21][26]

Similarly, the influence of operational efficiency on technology adoption coincides with recent studies highlighting the role of artificial intelligence in optimizing business processes. Research such as that of the McKinsey Global Institute indicates that companies that implement solutions based on artificial intelligence achieve significant improvements in productivity and decision-making. In this sense, the results obtained not only confirm these trends, but also provide empirical evidence from the specific context of microenterprises, a segment less explored in the literature.[27]

However, divergences are identified in relation to the role of adoption barriers. While several studies highlight the lack of knowledge and resources as significant obstacles to the implementation of digital technologies, in this study these barriers are not manifested in a forceful or homogeneous way. This difference suggests that, in the context analyzed, the perception of benefits could be compensating or attenuating the influence of structural limitations, which constitutes a relevant contribution to the understanding of the processes of technological adoption in microenterprises.[28][29]

4.3. Theoretical and practical implications

From a theoretical point of view, the results of the study contribute to strengthening technology adoption models by showing that the relationship between perceived benefits, operational efficiency, and adoption intent remains consistent in microenterprise contexts. In particular, the applicability of the TAM model is expanded by incorporating operational efficiency as a complementary dimension that reinforces the perception of utility. Likewise, evidence is provided that suggests that barriers do not always act as determining factors, which invites us to reconsider their relative weight within traditional models of technological adoption.

In practical terms, the findings have direct implications for business management and the design of digital transformation strategies. Evidence of a favorable perception towards artificial intelligence suggests the existence of an environment conducive to the implementation of technological solutions in microenterprises. In this sense, training and technical support programs could be developed aimed at consolidating this positive predisposition, facilitating the transition to more digitized management models. Likewise, the identification of operational efficiency as a key factor allows adoption strategies to be focused on practical applications that generate visible results in the short term.

Additionally, from an applied perspective, the results open the possibility of promoting technology transfer schemes adapted to the needs of microenterprises, considering their structure and limitations. This could include the development of accessible AI tools, low-cost platforms, and financing programs that facilitate investment in technology. Consequently, the study not only contributes to academic knowledge, but also offers guidelines for the effective implementation of artificial intelligence in the business sector.

4.4. Limitations and future projections

Despite the contributions made, the study has some limitations that must be considered when interpreting the results. First, the sample size, composed of 40 microentrepreneurs, limits the ability to generalize the findings to broader populations. Likewise, the use of non-probabilistic convenience sampling restricts the representativeness of the results, which could introduce biases associated with the selection of participants.

Secondly, limitations related to the measurement of the context and barriers dimension are identified, which presented a low internal consistency. This result suggests the need to redefine or expand the items used to more accurately capture the conditions that affect technology adoption. From a methodological approach, future research could incorporate factor analysis to validate the structure of the constructs and improve the psychometric quality of the instrument.

Finally, future lines of research are proposed aimed at deepening the analysis of the adoption of artificial intelligence in microenterprises. Among them, the need to expand the sample size, incorporate additional variables such as organizational culture or technological leadership, and develop longitudinal studies that allow analyzing the evolution of adoption over time stands out. It is also pertinent to explore the real impact of artificial intelligence on business performance, moving from perception to objective measurement of results, which would contribute to strengthening the link between academic research and practical application.

5.- Conclusion.

5.1. Synthesis of findings

The results of the study show that the microenterprises analyzed present a favorable perception of artificial intelligence, particularly with regard to its ability to generate strategic benefits and improve operational efficiency. These dimensions are consolidated as key factors in the understanding of the phenomenon studied, reflecting that microentrepreneurs not only recognize the potential value of these technologies, but also identify their applicability in the optimization of internal processes and in the improvement of decision-making. In this sense, the objectives set out in the research are met in a coherent manner, as it is possible to identify the main elements that influence the valuation of artificial intelligence in the business environment.

Vol. 08 / Nº 02
e – ISSN: 3028-8533
ISSN – L: 3028-8533

Likewise, it is observed that the intention to adopt technology is manifested as a favorable dimension within the analyzed group, which suggests that there is a concrete predisposition towards the incorporation of tools based on artificial intelligence. This finding is particularly relevant, as it evidences a transition from perception to potential action, which reinforces the coherence between the results obtained and the methodological approach adopted. On the other hand, the dimension related to the context and barriers does not present a defined behavior, which indicates that these factors are not perceived in a homogeneous way, reflecting the diversity of structural conditions existing in microenterprises.

5.2. Scientific and technical contributions

From a scientific point of view, the study provides empirical evidence that strengthens the understanding of the processes of adoption of artificial intelligence in microenterprises, a context that has been relatively little explored in the literature. In particular, it is evident that the dimensions of perceived benefits and operational efficiency act as determining elements in the intention of technological adoption, which contributes to validate and expand existing models of technological acceptance, such as TAM and UTAUT, in smaller-scale business contexts. In this way, the study not only confirms previous theoretical postulates, but also contextualizes them in specific economic realities.

In technical terms, the research presents a relevant methodological contribution by structuring an analysis model based on clearly defined dimensions and evaluated by instruments with adequate internal consistency. This approach allows a more systematic approach to the study of the adoption of artificial intelligence, facilitating its replicability in other contexts. Likewise, the integration of descriptive and inferential analyses provides robustness to the results, allowing a deeper interpretation of the phenomenon studied and contributing to the generation of applicable knowledge in the field of engineering and business management.

5.3. Theoretical implications and practical applications

On a theoretical level, the results of the study reinforce the validity of technology adoption models by showing that the perception of benefits and operational efficiency are key factors for the acceptance of artificial intelligence. This evidence suggests the need to consider these elements as central dimensions in future conceptual models, especially in microenterprise environments. Likewise, the limited definition of adoption barriers raises the possibility of reviewing their treatment in the literature, proposing more specific approaches that allow for a more accurate capture of the diversity of contextual conditions.

From a practical perspective, the findings of the study offer relevant implications for business management and the design of digital transformation strategies. The existence of a favorable predisposition towards artificial intelligence suggests that microenterprises could benefit from programs aimed at strengthening technological training and facilitating access to digital tools. In this sense, opportunities are identified to promote innovation processes through the implementation of solutions adapted to the needs of this business segment, as well as to promote support policies that reduce existing technological gaps. Similarly, the results can serve as a basis for the development of technology transfer initiatives that contribute to improving the competitiveness and sustainability of microenterprises.

5.4. Projections and lines of future research

Despite the contributions made, the study highlights the need to deepen the analysis of the adoption of artificial intelligence in microenterprises. In this sense, future research could expand the sample size and use probabilistic sampling designs to improve the representativeness of the results. It is also suggested to incorporate additional variables related to organizational, cultural, and technological aspects, in order to enrich the analysis model and capture in a more comprehensive way the factors that influence technological adoption.

Similarly, it is recommended to develop longitudinal studies that allow analyzing the evolution of the adoption of artificial intelligence over time, as well as исследования that integrate mixed methods to complement the quantitative perspective with qualitative evidence. Finally, it is pertinent to explore the real impact of artificial intelligence on business performance, shifting the focus from perception to the objective measurement of results, which would strengthen the link between scientific research and its practical application in the business environment.

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Vol. 08 / Nº 02
e – ISSN: 3028-8533
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8.- Appendix.

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9.- References.

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Vol. 08 / Nº 02
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