

ISSN: 2602-8506 Vol. 8 No.3, pp.118–137, July – September 2024

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Tecnologías emergentes para las PYMES en los cantones Sigchos y Latacunga

Emerging technologies for SMEsin the Sigchos and Latacunga cantons

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> Scientific and Technological Research Article Sent: 05/09/2024 Revised: 11/06/2024 Accepted: 25/07/2024 Published:20/08/2024 DOI:https://doi.org/10.33262/visionariodigital.v8i3.3133





Financial Performance



Palabras clave: Tecnologías, emergentes, PYMES, innovación, productividad, conocimiento

Resumen

Introducción: las tecnologías emergentes han tenido un impacto significativo en las pequeñas y medianas empresas (PYMES). Con el avance de estas tecnologías, se han diseñado herramientas que han optimizado varios procesos con la finalidad de mejorar la productividad y competitividad de las empresas. Objetivo: el objetivo central de esta investigación fue identificar el conocimiento de tecnologías emergentes en las Pymes de los cantones Sigchos y Latacunga. Metodología: esta investigación utilizó un enfoque cuantitativo de carácter descriptivo y corte transversal. Se empleó la encuesta como técnica de investigación, aplicando un cuestionario con escala Likert a 46 trabajadores de 6 PYMES seleccionadas. Resultados: el estudio reveló que el 84.78% de los encuestados están más al conocimiento con los asistentes virtuales, mientras que, en otras tecnologías, como la ciberseguridad (6.52%), es mucho más restringido. El 69.57% de los encuestados considera que no tiene los conocimientos adecuados para utilizar tecnologías emergentes debido a la falta de capacitación, recursos económicos y conectividad. El 54.35% de los encuestados tiene una imparcialidad sobre los beneficios de implementar servicios en la nube, indicando la falta de claridad sobre los beneficios de estas tecnologías. El 65.22% de los encuestados está de acuerdo en que existe una buena comunicación interna en sus empresas, lo que significa una relación abierta y comprensible. Conclusiones: se concluye que las tecnologías emergentes son una alternativa viable para la innovación en las PYMES, pero aún existen brechas significativas en conocimiento y aplicación. La fuerte cultura de comunicación interna puede ser un recurso valioso para impulsar la adopción tecnológica. Área de estudio general: Administración y Economía. Área de estudio específica: Tecnologías emergentes en las PYMES. Tipo de estudio: Artículo Original.

Keywords: Technologies, Emerging, SMEs, Innovation, Productivity, Knowledge

Abstract

Introduction:Emerging technologies have had a significant impact on small and medium-sized enterprises (SMEs). With the advancement of these technologies, tools have been designed that have optimized various processes to improve the productivity and competitiveness of companies. Objective: The





main objective of this research was to identify the knowledge of emerging technologies in SMEs in the Sigchos and Latacunga cantons. Methodology: this research used a quantitative approach with a descriptive and cross-sectional nature. The survey was used as a research technique, applying a questionnaire with a Likert scale to 46 workers from 6 selected SMEs. Results: the study revealed that 84.78% of respondents are more familiar with virtual assistants, while knowledge of other technologies, such as cybersecurity (6.52%), is much more limited. 69.57% of respondents consider that they do not have adequate knowledge to use emerging technologies due to lack of training, economic resources, and connectivity. 54.35% of respondents are impartial about the benefits of implementing cloud services, indicating a lack of clarity about the benefits of these technologies. 65.22% of respondents agree that there is good internal communication in their companies, which suggests an open and understandable relationship. Conclusions: It is concluded that emerging technologies are a viable alternative for innovation in SMEs, but there are still significant gaps in knowledge and application. The strong culture of internal communication can be a valuable resource to drive technological adoption. General study area: Administration and Economics. Specific study area: Emerging technologies in SMEs.

Introduction

At the beginning of the 21st century, there has been the greatest evidence of unprecedented technological growth. Today's society is surrounded by electronic devices that have allowed companies and organizations that are dedicated to the purchase and sale of products, provision of goods and services to grow and innovate, especially. Digital transformation is a disruptive innovation process in SMEs (Small and Medium Enterprises), and threatens their very existence. The traditional business model of SMEs is challenged by the pressure of digitalization imposed by competitors on the one hand and by changes in marketing habits on the other (Del Do et al., 2023, p. 205).

Emerging technologies can help solve some challenges by facilitating immediate access to information, improving citizen services, taking advantage of interoperability between different entities and generating efficiency gains in procedures and services in organizations. The accelerated growth of technology has generated a change in the way





SMEs conduct business, interact with customers and manage their operations. This change, however, is not without its challenges, and it is crucial to address them to ensure the success of digital transformation (Lujanet al., 2023).

Organizational productivity is at the heart of all technological advances, "new emerging technologies help organizations march at the pace of customer needs, this allows organizations to be more competitive and optimize their processes" (Berdugo, 2022). In the current era, organizations seek to be competitive by implementing technology in their processes. This will allow for greater effectiveness and efficiency in their products and services, advertising, marketing, customer service and, above all, new business opportunities.

The introduction of emerging technologies in organizations seeks to support the objectives of increasing business productivity, providing solutions and transforming large amounts of information into useful knowledge for decision-making."Technologies have been making available to companies new and better ways of carrying out their operations, allowing them to redefine businesses, so that users perceive new forms of value in the products and services offered" (Moreno & Valencia, 2019). There needs to be profound changes in organizations and they need to conceive a global market impregnated with technology. This dynamic will allow them to be on the same competitive level as the rest of the organizations and the supply and demand of products and services will be equitable, in this way greater sustainability in the market would be achieved.

"Microenterprises in Ecuador represent 90.78%, and they stand out for the economic contribution and employment that each of them generates by using different technologies that help them to be more productive for the benefit of society and to achieve their objectives" (Rodríguez et al., 2019). Organizations seek innovation and modernization of operational and management processes, increase the efficiency of products or services, and establish new business opportunities through the introduction of new technologies.

It is often evident that emerging technologies are no longer just a concept, but have become a viable alternative for companies, especially for entrepreneurs, because they allow for innovative processes from the organization, control, management, operations, decision-making and above all the continuity and permanence of the business. With the above, the central objective of the research was to identify whether SMEs in the cantons of Sigchos and Latacunga are familiar with emerging technology.

This research will focus on 4 emerging technologies, which are the following: Artificial Intelligence, cybersecurity, virtual assistants and decision making. These emerging technologies were taken as a reference since they are the most well-known and widely accepted ones. They also offer SMEs a series of significant advantages that can improve their operational efficiency, competitiveness, and ability to adapt in a constantly evolving





market. Implementing these technologies not only helps SMEs stay relevant and competitive, but also drives innovation, sustainability, and long-term growth.

SMEs in the province of Cotopaxi

The province of Cotopaxi, located in the central region of the Ecuadorian highlands, belongs to planning zone 3 and is made up of 7 cantons and 45 urban and rural parishes. The population projection for 2020 is 488,716 inhabitants. Cotopaxi contributed 1.88% of the national Gross Domestic Product (GDP), with a value of USD \$ 9,558,915.70 for 2018 and a GDP per capita of USD \$ 4,984.10. Additionally, during 2020 it presents a gross added value of USD \$ 1,793,901 and an intermediate consumption of USD \$ 1,157 (Flores-Cevallos et al., 2023).

In the province of Cotopaxi there are 563 small and medium-sized companies that are currently active, each of them dedicated to different activities such as agricultural, industrial and service production, in addition to having productive chains focused on their territorial characteristics, a predominantly young population and active indigenous social organizations. However, it presents a notable weakness in its productive structure and in its business network due to the limited investment between the public and private sectors in the area, as well as the inadequate prioritization of key and strategic productive sectors. In reality, the lack of structure and the lack of knowledge of emerging technologies in the province lead to the wasted business opportunities, greater vulnerability to market externalities and a high percentage of underemployment.

The generation of technologies

The first generation of technology, the telegraph, brought changes in logistics and communications, making human relations easier and not limited by geographical borders, the second generation of technology, the telephone, allowed local and global communications to be democratized, brought citizens closer to the State and gave rise to new value-added services such as fax, thus promoting the development of human and organizational relations, the third generation of technology began with the democratization of the Internet, especially through the use of telephone lines (dial-up telephone or internet), which opened up the digitalization of information services and content, the fourth generation, with the arrival of mobile and smart devices, people accessing different technologies through the same device, content and services. This generation has marked the beginning of the era of the digital world, the fifth generation thrives thanks to digitalization and the use of emerging technologies and digital transformation in organizations, the new generation not only allows a deep use of data but also, the transformation of processes, culture, people and technology. This entire set of actions significantly benefits the gradual growth of organizations.





Emerging Technologies (ET) promote innovations whose future goal is to change the way of living and producing in SMEs by providing greater ease when performing tasks, or making them safer (Labanda et al., 2021). It can be said that emerging technologies are technological innovations that are in constant stages of development and adoption, but that have the potential to transform organizations, improve operational efficiency, opening up new opportunities to the market. It can also be said that "Emerging technologies are facilitating greater efficiency in data-driven decision-making, virtual and personalized customer service, which is essential for the competitiveness and sustainability of local businesses" (Aguirre, 2023).

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Figure1

Emerging Technologies

Source: Latin American and Caribbean Electronic Government Network (GEALC Network, 2021)

The importance of emerging technologies has been recognized for their potential to generate revolutionary transformations in society and create profound effects through the innovations they generate. Several examples of these technologies are immersed in processes that have changed the way companies perceive life, including: artificial intelligence, cloud computing, cybersecurity, virtual assistants, smart sensors, 3D printing, among others.

Importance of emerging technologies for SMEs

The (TE) "aincreases performance and usefulness, with its contributions in administrative control, technology management, employee or product registration" (Ramos-Rivadeneira & Jiménez-Toledo, 2023). In addition, new digital technologies have arrived to solve problems through innovative systems that adapt to the needs of each organization, with



minimal effort and in a short time, which will make companies simpler, more efficient and more effective. Its use is important since this generates competitive advantages over their rivals, allowing them to expand further in the market and improving the customer experience through (AI) through which preferences can be personalized to meet customer needs.

Artificial intelligence

"AI is a tool that allows a wide variety of functions to be carried out, from managing communication to presenting business reports, doing so more quickly and efficiently" (Chávez, 2021, p. 23). This technological tool allows many processes to be automated and simplified, improve productivity, make the right decisions and be more competitive.

On the other hand, "artificial intelligence brings a significant improvement in productivity, thus driving economic growth, helping to mitigate errors, reduce costs, gather and collect data efficiently" (Castillo et al., 2021, p. 36). In organizations, employees can focus on strategic and creative activities, with the aim of improving efficiency and productivity. It can be used in different areas such as data analysis, marketing, customer service, among others.

(AI) is oriented towards a comprehensive approach that involves working in three areas or aspects at the same time: business transformation, improvement in decision-making and modernization of systems and processes (Tenés, 2023).Artificial intelligence (AI) is transforming the way businesses operate. It enables the automation of processes, analysis of large amounts of data, and improvement of customer experience. Some key benefits of its application in the business sector include:

- ✓ Process automation: (AI) enables the automation of routine and repetitive tasks, freeing up employees to focus on higher value-added activities.
- ✓ **Data analysis**: Companies can take advantage of (AI) to analyze large volumes of information and obtain valuable data for decision making
- ✓ Customer Experience: Significantly improves customer experience by providing immediate and accurate personalized responses
- ✓ Reduction of human errors: By automating processes, AI can minimize human errors, therefore, this will increase accuracy.

Cybersecurity

It is a set of technologies, processes and practices designed to protect networks and data from cyber attacks, damage or unauthorized access, which is why 89% of companies say that improving their digital security would strengthen the trust and loyalty of their customers (Galiana, 2023). The use of this technology will help minimize attacks, theft of confidential information, avoid the risk of being exposed to extortion of users or



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interrupting normal business processes, cybersecurity provides confidence to customers and the organization.

It is worth noting that it is essential to use strong and different passwords for each account, avoiding using ineffective or repeated passwords that allow unauthorized access. Whenever possible, use password managers and activate multifactor authentication. Keeping all systems and software updated with the latest security patches is also crucial to reduce equipment vulnerabilities. Another necessary practice is to make permanent data backups, as it allows recovery from incidents such as cyberattacks or failures.

Virtual Assistants

"Virtual assistants are known as the set of computer programs, which are capable of interacting conversations of 98% with the users of a site or service in their own language" (Rubio et al., 2022, p. 89). This allows them to save on equipment and supplies, they do not need to provide a physical space, since the assistant works remotely allowing to provide the best attention to customers. On the other hand, Trujillo et al. (2023) mention that "they are software applications to understand human needs by responding as if they were a person, helping to answer questions or provide solutions."So the purpose of a virtual assistant is to answer customer questions and concerns, This technologyIt helps you to always be connected, allowing you to increase productivity, build customer loyalty and reduce costs.

According to the authors Torres & Cruz (2020), they state that virtual assistants have generated a positive impact of 47%, providing a substantial improvement in companies that do not have sufficient staff or resources to serve their customers. This tool allows them to be available 24 hours a day, providing an immediate response, reducing customer waiting time and meeting their needs. The implementation of virtual assistants has allowed organizations to handle 80% of multiple queries simultaneously and serve customers at any time, which is crucial in a dynamic and ever-changing business environment (Lauria, 2022).

Decision making and data analysis

Decision-making at the managerial level is a very important factor to take into account in strategic direction because it significantly helps organizations to achieve their objectives and goals (López et al., 2020). Based on the above, decision-making allows to identify the business strengths and opportunities in an organization, especially to responsibly assume the threats and uncertainties of a changing market such as the one currently observed.

On the other hand, a research study on the digital competence of university students carried out in different European universities showed that 50% of the decisions taken led





to a failure in organizational performance, so making quality decisions is important to avoid these failures" (López et al., 2020, p. 398). For this reason,Decision making is essential to achieve the productivity of SMEs, which has been established as a multidimensional factor, therefore, the quality of decisions plays an important role in the productivity of an organization.based on the analysis and understanding of the factors that influence decision making, executed by managers.

Methodology

The methodology used in the research has a quantitative approach since it allows obtaining numerical data, representation of tables and figures with percentages which allows us to quantify the level of knowledge and adoption of emerging technologies in the selected SMEs, thus allowing an objective comparison between different companies and technologies.Quantitative research is a research method in which mathematical and statistical analysis tools are used to describe, explain and predict phenomena through numerical data." (Babativa, 2017, p. 33). From cdescriptive character since it focuses on detailing and classifying the characteristics of what is being studied, without seeking to understand the underlying causes of the same,besidesfocuses on providing an accurate representation of the observed and cutting factstransversal because the data were taken at a single moment of the research.

The survey was used as a research technique and the questionnaire was used as an instrument. It is developed with a Likert scale and consists of 22 questions with five response options, which are as follows: (totally agree, agree, neutral, disagree, totally disagree). The instrument was developed and validated by the judgment of experts in the ICT area. The questionnaire was applied in 2024 to all workers in each of the SMEs, from general managers and other collaborators.

The population under study comprises 6 small and medium-sized companies that have knowledge of emerging technologies, specifically in the areas of cybersecurity, virtual assistants, artificial intelligence and decision-making. Non-probabilistic convenience sampling was used to select the sample.

Non-probability convenience sampling allows for the selection of accessible cases that agree to be included in the study. This technique is based on the convenient accessibility and proximity of the subjects for the researcher, recognizing that not all individuals in the population have the same probability of being selected (Otzen & Manterola, 2017).

The SMEs selected for the application of the survey were; Vinos De Mortiño, El Ultimo Inca, Queso Andino San Miguelito, Planta Procesadora Chochos Chugchilan, Asociación Flor de Caña, Textiles Cotopaxi, these companies were chosen for the application of the questionnaire since they are the best known due to the product they offer, despite the fact





that they use machines with advanced technology, they are characterized by still preserving the artisanal production process while maintaining the cultures and traditions of the locality. It is important to mention that this has allowed them to become better known in the market nationally and internationally.

The population and sample that took part in the research corresponds to the personnel working in SMEs from the general managers and their collaborators of the cantons of Sigchos and Latacunga in the province of Cotopaxi. Table 1 is shown below, with the names of the companies and the number of people working in each one of them.

Population and sample

Table 1

SMEs from the canton	ns of Sigchos	s and Latacunga
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Names of SMEs	Number of People Working
Wines from Mortiño The Last Inca	24
San Miguelito Andean Cheese	4
Chugchilan Chochos Processing Plant	10
Cane Flower Association	6
Cotopaxi Textiles	2
Total	46

Note: Population surveyed in the 6 SMEs of the cantons of Sigchos and Latacunga in the province of Cotopaxi.

Results

Using the data obtained in the research, those questions that had the greatest relevance and scope with respect to emerging technologies for SMEs were adopted. After conducting an analysis, the following results were obtained.

Table 2

Do you feel that you have the appropriate knowledge to use emerging technologies?

Alternative	Frequency	Percentage
Totally agree	3	6.52%
ОК	5	10.87%
Neutral	6	13.04%
In Disagreement	22	47.83%
Totally disagree	10	21.74%
Total	46	100.00%

Note: Table 2 expresses the level of knowledge appropriate for the use of emerging technologies



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In table 2The majority of respondents (69.57%) disagree or strongly disagree with the statement that they do not have adequate knowledge to use emerging technologies. This may arise from various factors such as; Lack of training and continuing education on emerging technologies, the speed with which technologies advance is notorious, therefore it can cause current knowledge to become obsolete quickly, there may be complexity of the (TE) since it requires a significant time to learn about technologies, some may even require advanced technical knowledge that not all individuals possess, in addition, in the case of the SMEs surveyed, they do not have the necessary financial resources to invest in the training and tools required, the lack of access to the necessary technological tools and resources is a barrier, since in some regions internet connectivity and access to modern devices are scarce since most companies are located in rural areas, that is why the perception and attitude of the collaborators tends to have resistance to change, especially if they feel that new technologies are unnecessary for their current job, in addition the lack of confidence in their own abilities to learn and use new technologies can influence the responses.

Table 3

	Virtual		Cyber		Decision		Artificial	
Alternative	Assistants	%	security	%	making	%	intelligence	%
Totally								
agree	39	84.78%	0	0.00%	0	0.00%	0	0.00%
OK	7	15.22%	2	4.35%	7	15.22%	1	2.17%
Neutral	0	0.00%	4	8.70%	0	0.00%	0	0.00%
Disagree	0	0.00%	40	86.96%	1	2.17%	42	91.30%
Totally								
disagree	0	0.00%	0	0.00%	38	82.61%	3	6.52%
TOTAL	46	100.0%	46	100.0%	46	100.0%	46	100.0%

Are you familiar with these emerging technologies?

Note: Table 3 shows the number of people who are familiar with the emerging technologies detailed.

In table 3, it can be observed that the (84.78%), a significant majority of respondents stated that they totally agree with having knowledge about virtual assistants, this shows a high level of familiarity and possibly an active use of these tools in their work environment in SMEs, while (86.96%) mentioned that they totally disagree with knowing about cybersecurity, this low percentage may be due to the lack of knowledge of these tools, lack of capital prevents SMEs from acquiring and implementing advanced technological solutions, (82.91%) stated that they totally disagree with cybersecurity, they consider it an unnecessary tool, that is, they still resist the change of the digital age, (91.30%), that is, the majority are totally unaware of (AI) and the benefits it brings to their companies, in general, the majority of respondents showed fear of change, complexity or interrupting established business processes.









?Do you consider it necessary to manage digital information in your company?

Note: Figure 2 shows whether you consider it necessary to manage digital information in your company.

In Figure 2 it can be observed that the general perception of the respondents is predominantly negative towards the statement evaluated on (65.22%) mentioned that the management of digital information in their companies is unnecessary since they are not familiar with digital information, the lack of training to use these tools efficiently, low economic resources that limit them from being in courses that help them generate knowledge and the benefits they have, it is also important to mention that The transition from a paper-based information management system to a digital one can seem complex and overwhelming, which discourages companies and their employees from adopting it as part of their daily work, while (6.52%) of respondents have a positive perception since this will allow them to save paper, keep information safer, free from any incident to which it is exposed and, above all, make it available to everyone at any time.





Figure 3





Note: Figure 3 shows whether you believe that implementing cloud services could improve document management in your company.

As can be seen in the data provided in Figure 3, the majority of respondents show a high proportion of neutral responses (54.35%) and stated that there is a lack of clarity or certainty about the benefits of implementing cloud services and how it could contribute to the company's document management. This indicates that respondents are not trained on the benefits and methodologies for implementing cloud services. This can also be influenced by varied experiences, since they are not familiar with these services and this generates fear in some employees, leading them to adopt a neutral stance. In addition, the lack of financial resources is one of the factors that does not allow them to acquire a reliable and secure cloud service for document management.

Table 4

Alternative	Frequency	Percentage
Totally agree	11	23.91%
ОК	30	65.22%
Neutral	5	10.87%
In Disagreement	0	0.00%

Is there good communication between coworkers in your company?





Table 4

Is there good communication between coworkers in your company? (continued)

Alternative	Frequency	Percentage
Totally disagree	0	0.00%
Total	46	100.00%

Note: Table 4 shows that there is good communication between coworkers in the company.

LTable 4 shows the following results, the majority of respondents (65.22%) agree that there is good communication between coworkers in the company, that means that there isaopen communication between managers and their collaborators thereforeIt leads to a positive perception among employees but one should not overlook the constant training in communication skills so that they can be more productive, leaders who encourage communication and constant feedback since this can contribute to a positive vision, in addition, those surveyed mentioned that they hold regular meetings, integrations and events that give them the opportunity to exchange ideas in order to improve communication, always maintaining an environment of respect and mutual trust, finally, they carry out integration activities where all collaborators take part in any recreational activity that the company carries out in order to combat stress, improve interpersonal relationships and communication between employees.

Discussion

Regarding the results of the research, they were compared with the study developed by León(2020)On "Technological trends with the greatest impact in Ecuador for the year 2020", where it mentions the influence of emerging technologies, specifically virtual assistants, 49% of respondents would choose to incorporate this tool and taking advantage of these technologies will require time and interest to obtain tangible benefits so that companies can incorporate it in the short term. In relation to this research, the (84.78%) of respondents claim active use of virtual assistants.

There is no doubt that both results are different in the 2 investigations with different percentages on the use of emerging technologies. Deducing that the management of these technological tools brings opportunities that are linked to the development of new skills and competencies that are demanded in a labor market driven by technology, where companies seek professionals with skills in programming, data analysis, problem solving and critical thinking, among others. These technological advances force everyone, especially managers and their collaborators, to be prepared and trained in the technologies that are updated daily and thus be able to provide better customer service and improve the productivity of the company.



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It was also compared with the results of the research developed by Camacho et al. (2023), where it states the reasons for the high incidence of non-implementation of technologies, which are due to the lack of qualified personnel in 43% and the lack of knowledge of the tools in 33%. Something similar happens in the SMEs investigated, with a percentage of (69.57%) since there is little knowledge of emerging technologies and they consider them unnecessary for their work, this indicates that there is resistance or fear of change.

In light of this, it is suggested that they should strengthen several aspects such as offering incentives to managers and collaborators to complete training courses in emerging technologies, providing them with bonuses, recognition or promotions since this will motivate them to continue acquiring new knowledge, establishing a business culture that values and encourages innovation and continuous learning and establishing alliances with other SMEs to share knowledge, experiences and best practices in the implementation of emerging technologies.

Future research could explore the relationship between the adoption of emerging technologies and the financial performance of SMEs, as well as examine the most effective strategies to overcome the adoption barriers identified in this study.

Conclusions

- Emerging technologies describe a feasible alternative for innovation in SMEs, especially for entrepreneurs. 84.78% of respondents are aware of virtual assistants, which demonstrates the enormous potential in the implementation of these technologies. However, there is still significant lack of knowledge in other areas such as cybersecurity and artificial intelligence, where knowledge is limited (86.96% respectively are unaware of these technologies), which indicates the need for specific training programs.
- Organizational productivity is positioned as the central axis of technological progress for SMEs. Although 69.57% of respondents believe they do not have sufficient knowledge to use new technologies, they implicitly recognize their potential to increase competitiveness and optimize processes. This finding highlights the importance of adopting technology implementation strategies to address known barriers.
- The research reveals and shows that the SMEs surveyed have strong internal communication, with 65.22% of respondents confirming that there is good communication between colleagues. Good internal communication can be a valuable resource to overcome the resistance to change observed in some areas of technology. This positive aspect can serve as a boost to promote cooperation and knowledge sharing necessary for digital transformation.





• 54.35% of respondents consider the benefits of adopting a cloud service for document management. This means that there is an opportunity to understand the specific benefits of these technologies. Combined with the fact that 65.22% of respondents consider digital information management unnecessary, there is a clear need to develop strategies to demonstrate that digitalisation is very efficient and helps SMEs to be competitive in the digital age.

Conflict of Interest

There is no conflict of interest in relation to the submitted article.

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ISSN: 2602-8506 Vol. 8 No.3, pp.118–137, July – September 2024

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