IMPACT OF TECHNOLOGICAL ENABLERS IN THE INDUSTRY AND MANUFACTURING OF SMEs

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ABSTRACT

INTRODUCTION. The fourth industrial revolution is a no return path for the entire business sector. In the EU, 99% of SMEs are negatively impacted by the low technological adoption in their operational and production processes. OBJECTIVE. This Systematic Literature Review presents the results found in studies where the impact of the adoption of emerging technologies in SMEs is analyzed and their main trends are identified. METHOD. Through the systematic search, the selection of studies that include emerging technologies with the exception of DLTs and proposals for management directions for the adoption of DT in companies was made. Studies of DLTs are excluded in the search. RESULTS. Using scientific databases such as Elsevier, Springer link, IEEE among others, 41 related articles (Q1 (55%), Q2 (5%), Q3 (3%)) were found. Taking 87% of works as a reference, it was evidenced that there are still scattered empirical studies, and that proposals predominate in addressing the adoption of DT in SMEs. DISCUSSION AND CONCLUSIONS. It was identified that, within exploratory studies, the technological trend is connectivity, use of internet services and integration of digital technology. This study provides updated information on the trend to explore and exploit digital transformation in companies.

Keywords: Emerging technologies, digital transformation, innovation, SME.
RESUMEN

INTRODUCCIÓN. La cuarta revolución industrial es un camino sin retorno para todo el sector empresarial. En la UE el 99% de las PyMES se ven impactadas negativamente por la escasa adopción tecnológica en sus procesos operativos y productivos. OBJETIVO. La presente Revisión Sistemática de Literatura tiene como objetivo presentar los hallazgos encontrados en estudios donde se analiza el impacto de la adopción de tecnologías emergentes en las PyMES y se identifican sus principales tendencias. MÉTODO. Mediante la búsqueda sistemática se hizo la selección de estudios que incluyan tecnologías emergentes y propuestas de gestión para la adopción de la TD en PyMES. En la búsqueda se excluyen estudios de DLTs. RESULTADOS. Usando BDD científicas como Elsevier, Springer link, IEEE entre otros, se encontró 41 artículos (Q1 (55%), Q2 (5%), Q3 (3%)) relacionados. Tomando el 87% de trabajos como referencia, se evidenció que todavía existen estudios empíricos dispersos, y que predominan las propuestas en el direccionamiento para adopción de la TD en PyMES. DISCUSIÓN Y CONCLUSIONES. Se identificó que la tendencia tecnológica es la conectividad, el uso de servicios de internet e Integración de la tecnología digital. Este estudio aporta información actualizada sobre la tendencia para explorar y explotar la TD en las empresas.

Palabras claves: Tecnologías emergentes, Transformación digital, Innovación tecnológica, PyMES.

RESUMEN

INTRODUÇÃO. A quarta revolução industrial é um caminho sem volta para todo o setor empresarial. Na UE, 99% das PMEs são impactadas negativamente pela baixa adoção tecnológica em seus processos operacionais e produtivos. OBJETIVO. Esta Revisão Sistemática da Literatura tem como objetivo apresentar os achados encontrados em estudos onde se analisa o impacto da adoção de tecnologias emergentes nas PMEs e se identificam suas principais tendências. MÉTODO. Por meio da busca sistemática, foi feita a seleção de estudos que contemplam tecnologias emergentes e propostas de gestão para a adoção de DT em PMEs. Estudos de DLTs são excluídos da pesquisa. RESULTADOS. Utilizando bases de dados científicas como ElSevier, Springer link, IEEE entre outras, foram encontrados 41 artigos relacionados (Q1 (55%), Q2 (5%), Q3 (3%)). Tomando como referência 87% dos trabalhos, evidenciou-se que ainda existem estudos empíricos dispersos, e que predominam propostas para abordar a adoção de TD em PMEs. DISCUSSÃO E CONCLUSÕES. Identificou-se que a tendência tecnológica é a conectividade, o uso de serviços de internet e a integração da tecnologia digital. Este estudo fornece informações atualizadas sobre a tendência de explorar e explorar DT nas empresas.

Palavras-chave: Tecnologias emergentes, transformação digital, inovação, PME.

INTRODUCTION

Developed countries have spent years developing public policies and investing resources for the development of innovation and entrepreneurship, research on the effects on the business sector is abundant in developed countries but scarce in emerging countries [1]. Since the appearance of the COVID 19 pandemic, the adoption of emerging technologies has accelerated and Digital Transformation (DT) has become an imperative for all states, but mainly for emerging countries and even more so for Small
and Medium Enterprises (SMEs). This sector occupies 99% of the business net in the European Union (EU).

The EU has established an agenda whose objective is, on one side, to take advantage of data-based innovation and, on the other side, to exploit the current favorable technological and political context to encourage society to empower itself and accelerate the implementation of these new technologies in its internal processes [2]. Countries like Japan are executing a Society 5.0 plan that tries to use the evolution of Science, Technology and Innovation (STI) to lay the foundations for a new ecosystem that serves for the development of a society based on the human being, in the style of market requirement (Market Pull), reducing the risks of implementing this ecosystem [3].

Currently the technology industry is growing faster than the rest of the economy and hence the importance of digital innovation and the adoption of emerging technologies that enable the development of new digital products and services, business processes or business models. However, the implementation of these technologies are both theoretical and practical challenges for companies, even more so in emerging countries and their SMEs [4], [5].

Currently, there is an environment of traditional economy and digital economy that are in the process of integration, interaction and institutional and organizational adaptation, resulting in a new, more complex ecosystem. From this point of view, the CEPAL (2022), maintains that there are dimensions of digital development which are constantly evolving and that affect the level of society, the productive apparatus, and the state. Consequently, the adoption of DT is a highly dynamic and complex process.

DT goes beyond a simple adoption of technology or digitization of processes; it includes changes in all dimensions of an organization from operational processes and products to changes in business models [5]. The DT will allow the migration of the traditional economy to a digital economy that will satisfy the needs of consumers with intelligent products and services and even with a high degree of personalization [6].

Although DT can be used as a differentiating competition strategy for manufacturing companies in SMEs [7], the form of application and direct effect on production processes, operations and business models remains unclear. In addition, entrepreneurs are also unclear about which technologies to implement or the technological trends to which they could opt.

The exploration and exploitation of emerging technologies such as automation, Cyber-Physical Systems (CPS), the Internet of Things (IoT), sensorization, 3D printing, Big Data and cybersecurity, considered mature in Industry 4.0 (I4.0), are elements that impact within the manufacturing production processes of SMEs. With this background, the purpose of this article was to make a Systematic Literature Review of the experiences in different parts of the world to evaluate and deepen through a qualitative analysis the impact of the implementation of emerging technologies in SMEs and to know the current implementation trends of emerging technologies that can truly create added value to the manufacturing processes of SMEs.
The article is made up of an Introduction section where the context of the article is explained and a Systematic Literature Review (SRL) will be made of cases where the use of emerging technologies for the Digital Transformation (DT) of companies is involved. The Materials and methods section details the process followed for the analysis of the articles. In the results section, the main conclusions found in the studies and future work will be highlighted.

Related jobs

There is recent literature on the impact of the application of emerging technologies in SMEs, however, there has been a pause in the development of these studies due to the appearance of the COVID-19 pandemic. The studies grouped into two large groups are described below.

Routing strategy

Servitization is based on the level of digitization of suppliers and customers. Thus, the different degrees of integration of products and services, basic, intermediate and advanced level, will depend on the operational needs, required capacities, trends in the industry and value generation opportunities that the companies have [8].

For the integration of digital innovations in organizations, there are studies such as the Wiesböck & Hess (2020) where they indicate that innovations can be circumscribed to 3 concentric rings that are: i) technology-driven development and the different categories of implementation of digital innovations in the center; ii) the facilitators of digital innovations in a second ring and; iii) the governance of digital innovations in a third ring.

From a literature review carried out by Zahra et al., (2022), it follows that industry and administration professionals have been able to introduce changes using two basic activities that are the exploration and exploitation of digital technologies, sometimes using only one strategy and other times combining these two strategies. Considering the facilities for innovation, DT can make three key changes: 1) DT promotes the decoupling of form and function, reducing the importance of assets in dependency-power relationships; 2) DT promotes disintermediation, reducing the power of the intermediary in the value chain and giving greater freedom to suppliers of products and services, and finally; 3) Digitization drives generativity, allowing the integration of geographically dispersed markets and creating new ways of creating value [9].

Digital Transformation Strategy

In the case of Grandinetti et al. (2020), an analysis of B2B (Business to Business) companies in Italy was made, considering servitization and PSS (Product-service System) based on IoT, where it was found that <<The "industrializing" business models for servitization based on I4.0 reinforce quality of the relationship when suppliers and customers develop new digital services through functional co-creation >>. However, the study is limited to the analysis of one of the many I4.0 technologies and therefore the effect of other emerging technologies was not analyzed.
In the case of the IoT, Pirola et al. (2020) they argue that digitization and servitization go hand in hand and are complementary. Today, they require digital platforms to establish and manage business ecosystems, enabling flexible collaboration and open innovation for new business models. Within this perspective, the implementation of IoT or Digital Twins (DT, Digital Twins), used as technological enablers of intelligent services and data feedback, can help to generate new functionalities and PSS knowledge exchange throughout the product life cycle. However, one of the main problems is the energy required to implement IoT, for this reason it seeks to develop new policies, standards, security, privacy and technical considerations for a Green IoT [12].

In the investigation of [13] the impact of the IoT in companies is evaluated. It proposes how to convert a manufacturing company into a service-oriented product (Servitization) with theoretical and managerial suggestions using the IoT technological enabler. The research indicates that the sales model is a strategic factor for the digital servitization of companies.

METHODOLOGY

For the present study, a compilation of studies from the last four years was carried out in order to perform a Systematic Literature Review (SLR) but limited to a set of emerging technologies from the I4.0. In order to have rigor, objectivity and transparency in the research process, studies related to the emerging technologies of Automation and Robotics, Internet of Things, Big Data, Data Analytics, Additive or Smart Manufacturing, Cybersecurity and Sensorization have been selected. Likewise, technologies that are not fully developed and that have to do with DLTs, as well as research that is not related to the improvement of manufacturing production in SMEs, are excluded from this review.

The sources of information used for this study range from scientific databases, magazines related to the subject, congresses, books, opinion articles, reports, etc. Finally, the last date of consultations made in the various data sources was made in June 2022.

Research Question

The main objective of this RSL is to cover two research questions: ¿What are the impacts of the emerging technologies of I4.0 on the productive efficiency of companies? What is the current technological trend to evolve traditional companies to the fourth industrial revolution?

To achieve our goal, we searched the main repositories such as: Scopus, Elsevier, Springer link, IEEE, WOS. Journal articles, conference articles, reports, books, scientific articles, research and generic articles were selected using a search string with Boolean operators AND and OR with the following script:
(Digitalization OR Digital) AND ("Innovation" OR Modernization OR cutting edge) AND (Renewal OR transformational OR radical change) AND (Manufacturing OR Produce OR fabrication) AND (ecosystem* OR environ*) AND Servitization

Emerging technologies were included in this research, which are: Internet of Things (IoT); Industrial Internet of Things (IIoT); Smart manufacturing; Additive manufacturing; Sensorization and communication protocols; Automation and industrial robotics; Artificial Intelligence (AI); Big Data and Analysis and; Industrial cybersecurity. Technologies that are not fully mature, such as DLT (Distributed Ledger Technology) and any organizational directive that is not within the scope of the productive and operational performance of companies, were excluded from this review.

This study is structured in four stages: 1) Identification of research questions and creation of the search script; 2) Identification and compilation of articles; 3) Data extraction, classification and typology of results and; 4) Synthesis of results, as can be seen in Figure 1.

Figure 1. Research stages

To carry out the analysis, data extraction and synthesis process, each of the technologies used in each study was identified and classified according to the categorization of the Digital Economy and Society Index (DESI). This avoids the risk of bias in the included studies.
RESULTS

As a result of the search and selection processes, 41 studies were found that served as the basis for this systematic review. The process can be seen in the flow diagram of Figure 2.

Figure 2. Flow diagram

From the result of the review, the following results could be obtained. Table 1 shows the documents that supported the present study. In Table 2 you can see a classification of the different articles selected from the different sources.
| Research Institutions                                                                 | Title                                                                 | Autor (s)                      | Year  | DOI                                                                 | Journal type                                      |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------|-------|----------------------------------------------------------------------|--------------------------------------------------|
| Tampere University, Finland.                                                         | A Survey on Wearable Technology: History, State-of-the-Art and Current Challenges | Aleksandr Ometov              | mar-21| https://doi.org/10.1016/j.comnet.2021.108074                        | Computer Networks                                 |
| Business School, Imperial College, London, UK. Antai College of Economics and Management, Shanghai Jiao Tong University, Shanghai, China. | A systematic literature review of entrepreneurial ecosystems in advanced and emerging economies | Zhe Cao & Xianwei Shi         | feb-20| https://doi.org/10.1007/s11187-020-00326-y                          | Small Business Economics                           |
| Institut Mines-Télécom, France Azad University, North Tehran Branch, Tehran, Iran. University of Technology Sydney, Sydney, Australia. | Application of Internet of Things and artificial intelligence for smart fitness: A survey | Alireza Farrokhi, Reza Farahbakhsh, Javad Rezazadeh, Roberto Minerva | ene-21| https://doi.org/10.1016/j.comnet.2021.107859                        | Computer Networks                                 |
| Department of Entrepreneurship and Management Systems, Faculty of Management, University of Warsaw, Poland. | Automation-driven innovation management? Toward Innovation-Automation-Strategy cycle | Piotr Tomasz Makowski, Yuya Kajijawa | mar-21| https://doi.org/10.1016/j.technfore.2021.120723                     | Technological Forecasting and Social Change       |
| Department of Business Development and Technology Aarhus University Herning, Denmark. | Barriers and Enablers for Digitizing Shop Floor Management Boards | Clausen, P., Mathiasen, J. B., & Nielsen, J. S. | ago-19| https://10.1109/GWS.2018.8686591                                   | 2018 Global Wireless Summit (GWS)                 |
| University of Salento, Italy                                                        | Digital entrepreneurship ecosystem: How digital technologies and collective intelligence are reshaping the entrepreneurial process | Gianluca Elia, Alessandro Margherita, Giuseppina Passiante | oct-19| https://doi.org/10.1016/j.technfore.2019.119791                     | Technological Forecasting and Social Change       |
| Institute for Information Systems and New Media, LMU Munich                        | Digital innovations: Embedding in organizations                       | Florian Wiesböck, Thomas Hess Fabiana Pirola, Xavier Boucher, Stefan Wiesner, Giuditta Pezzotta | ago-19| https://doi.org/10.1007/s12525-019-00364-9                          | Electronic Markets                                |
| University of Bergamo, Department of Management, Information and Production Engineering | Digital technologies in product-service systems: a literature review and a research agenda | Fabiana Pirola, Xavier Boucher, Stefan Wiesner, Giuditta Pezzotta | jul-20| https://doi.org/10.33210/ca.v11i2.394                              | Computers in Industry                            |
Universita LUM Jean Monnet, Casamassima, Italy. University of Salento, Lecce, Italy.

University of Padova, Padova, Italy. University of Salerno, Fisciano, Italy. University of Naples—Parthenope, Napoli, Italy department of Strategy and Management, Paris School of Business, Paris, France. Department of Computer and Information Sciences, Northumbria University, Newcastle Upon Tyne, UK.

European Commission, Joint Research Centre (JRC), Ispra, Italy.

Strategic Management & Entrepreneurship Department, Carlson School of Management, University of Minnesota, Minneapolis, MN, USA.

Technical University of Madrid, Spain.

Ionian Department of Law, Economics and Environment, University of Bari Aldo Moro, Taranto, Italy.

Department of Economics and Management, University of Padua, Italy.

Fostering digital transformation of SMEs: a four levels approach

Antonello Garzoni and Ivano De Tur, Giustina Secundo and Pasquale Del Vecchio Roberto Grandinetti, Maria Vincenza Ciasullo, Marco Paiola, Francesco Schiavone

dic-19

https://doi.org/10.1108/MD-07-2019-0939

Management Decision

Fourth industrial revolution, digital servitization and relationship quality in Italian B2B manufacturing firms. An exploratory study

From serendipity to sustainable green IoT: Technical, industrial and political perspective

From spatial data infrastructures to data spaces—A technological perspective on the evolution of European SDIs

How digital technology promotes entrepreneurship in ecosystems

Innovation ecosystems theory revisited: The case of artificial intelligence in China

Internet of Things and Big Data as enablers for business digitalization strategies

Internet of things technologies, digital servitization and business model innovation in BtoB manufacturing firms

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Management Decision

TQM Journal

Computer Networks

ISPRS International Journal of Geo-Information

Technovation

Telecommunications Policy

Industrial Marketing Management
| Department | Title | Authors | Date | Journal |
|------------|-------|---------|------|---------|
| Department Electrical and Computer Engineering American University of Beirut, Lebanon. | IoT Survey: An SDN and Fog Computing Perspective | Ola Salman | jul-18 | Computer Networks |
| CESE, INESC TEC, Campus da FEUP, Portugal | Providing industry 4.0 technologies: The case of a production technology cluster | Gustavo Dalmarcao, Filipa R. Ramalho, Ana C. Barros, Antonio L. Soares, Raj K. Shankar, Tommy H. Clausen | nov-19 | The Journal of High Technology Management Research |
| Nord University Business School, Division of Innovation and Entrepreneurship, Norway. Department of Industrial-Academic Collaboration, Japan Science and Technology Agency K’s Gobancho, Japan | Scale quickly or fail fast: An inductive study of acceleration | | jul-20 | Technology 
Science, technology and innovation ecosystem transformation toward society 5.0 | | |
| | Science, technology and innovation ecosystem transformation toward society 5.0 | | |
| | Provin | | |
| | ber industry 4.0 technologies: The case of a produ | | |
| | tion technology cluster | | |
| | Scale quickly or fail fast: An inductive study of acceleration | | |
| | | | |
| Northwestern Switzerland | Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective | Alejandro G. Frank, Glaucode H.S. Mendes, Néstor F. Ayala, Antonio Ghezzi | ene-19 | Technological Forecasting and Social Change |
| University of Applied Sciences and Arts Northwestern Switzerland | Strategic action fields of digital transformation: An exploration of the strategic action fields of Swiss SMEs and large enterprises | Marc K. Peter, Corin Kraft and Johan Lindeque | dic-19 | Journal of Strategy and Management |
| International Journal of Advanced Engineering Research and Science (IJAERS) | Systematic Literature Review (SLR) Development of the IoT Industry in the South America Region | Izialber Muniz, Douglas Castro da Silva, Bryan Alexander Saravia | jun-22 | International Journal of Advanced Engineering |
| Eindhoven University of Technology, Department of Industrial Engineering & Innovation Sciences, Eindhoven. The Netherlands School for Environment and Sustainability, University of Michigan. | Technology Forgiveness: Why emerging technologies differ in their resilience to institutional instability | Bonning Roca, Jaime et. Al | ene-21 | Technological Forecasting and Social Change |

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https://doi.org/10.33210/ca.v11i2.394
| Title                                                                 | Authors                                    | Date   | Digital Object Identifier                        | Journal                                      |
|----------------------------------------------------------------------|--------------------------------------------|--------|-------------------------------------------------|----------------------------------------------|
| Technology, entrepreneurship, innovation and social change in digital economics | Steven Si, Jeremy Hall, Roy Suddaby, David Ahlstrom, Jiang Wei | ene-22 | https://doi.org/10.1016/j.technovation.2022.10248 | Technovation                                  |
| The effect of digitalization on business performance: An applied study of KIBS | Samuel Ribeiro-Navarrete, Maria Orero-Blat | dic-20 | https://doi.org/10.1016/j.jbusres.2020.12.065   | Journal of Business Research                 |
| The Examination of the Corporate Organization and Implementation of Industry 4.0 in a High Value | Julian Rueb | nov-20 | 978-1-7281-7037-4 | 2020 IEEE International Conference on Engineering, |
| The process of business model innovation driven by IoT: Exploring the case of incumbent SMEs | Paiola M., Agostini, L., Grandinetti, R., Nosella, A. | mar-22 | https://doi.org/10.1016/j.indmarman.2022.03.006 | Industrial Marketing Management             |
| The Shenzhen ecosystem: What it means for the western world | Mokter Hossain | ene-22 | https://doi.org/10.1016/j.techsoc.2022.101919 | Technology in Society                        |
| The strategic impacts of Intelligent Automation for knowledge and service work: An interdisciplinary review | Crispin Coombs, Donald Hislop, Stanimira K. Taneva, Sarah Barnard | feb-20 | https://doi.org/10.1016/j.jisis.2020.101600 | Journal of Strategic Information Systems    |
| Transformational shifts through digital servitization | Bård Tronvoll et al. | feb-20 | https://doi.org/10.1016/j.indmarman.2020.02.005 | Industrial Marketing Management              |
| Transforming provider-customer relationships in digital servitization: A relational view on digitalization | Anmar Kamalaldina, Lina Lindea, David Sjödina, Vinit Parida | ago-20 | https://doi.org/10.1016/j.indmarman.2020.02.004 | Industrial Marketing Management              |
| Value Creation and Value Capture Alignment in Business Model Innovation: A Process | David Sjödī, Vinit Parida, Marin | jul-20 | 10.1111/jpim.12516 | Journal of Product Innovation Management     |

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**Table 2.** Data sources.

| Publisher                      | Journal name                                      | SJR | Article number | Percentage | Representation |
|--------------------------------|---------------------------------------------------|-----|----------------|------------|----------------|
| Blackwell Publishing Ltd.      | Information Systems Journal                       | Q1  | 1              | 2%         |                |
|                                | Journal of Product Innovation Management          | Q1  | 1              | 2%         |                |
| CEADE-Polytechnic University of Madrid | Management and Organization                      | Q3  | 1              | 2%         |                |
| CELAC                          | Economic Commission for Latin America and the Caribbean (CELAC) | 1   | 2%             |            |                |
| Complutense Editions           | Social Mediations                                 | 1   | 2%             |            |                |
| Elsevier                       | International Journal of Production Research      | Q1  | 1              | 2%         |                |
|                                | International Review of Financial Analysis        | Q1  | 1              | 2%         |                |
|                                | Journal of Business Research                      | Q1  | 1              | 2%         |                |
|                                | The Journal of High Technology Management Research| Q1  | 1              | 2%         |                |
| Elsevier B.V.                  | Computer Networks                                 | Q1  | 5              | 9%         |                |
|                                | Computers in Industry                             | Q1  | 1              | 2%         |                |
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Morillo-Aguilar. Impact of technological enablers in the industry and manufacturing of SMEs. July - December 2022

https://doi.org/10.33210/ca.v11i2.394
While in Table 3 you can see the type of documents reviewed according to the research questions.

**Table 3.** Type of document

| Document type          | Article number | Percentage | Representation |
|------------------------|----------------|------------|----------------|
| Journal article        | 36             | 52%        |                |
| Report                 | 11             | 16%        |               |
| Book                   | 8              | 12%        |               |
| Generic                | 8              | 12%        |               |
| Conference procedures  | 5              | 7%         |               |
| magazine article       | 1              | 1%         |               |

The analysis of the present investigation was made by the classification of the articles investigated in two parts. On one hand, the documents that propose innovative strategies to explore and exploit emerging technologies in such a way as to increase the performance of their production processes that we will call Digital Transformation Management Scheme (DTMS); and on the other hand, the studies that illustrate various results showing the impacts of adopting emerging technologies that we will call Application cases of technology enablers for digital transformation, as can be seen in Figure 3.

**Figure 3.** Classification of studies

Within the studies where technological enablers were applied for the exploration and exploitation of digital transformation, the Digital Economy and Society Index (DESI)

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categorization was used where the five subcategories were used to characterize the studies and identify the trends of the studies, according to Figure 4.

![Figure 4. Categorization of studies according to DESI](image)

Furthermore, it was found that after making a systematic review of qualitative empirical evidence that identifies comprehensive information on the implementation of DT in manufacturing companies, the studies carried out in a high-value manufacturing company in Germany allowed us to identify three key factors: 1) The creation of a central department for the DT; 2) the election of a CDO (Chief Digital Officer) and; 3) corporate openness for cooperation as cultural change. Lean Management has been discovered as a major enabler for I4.0 adoption [14].

In a study carried out in Portugal, it can be seen that instructional instability negatively influences the adoption of emerging technologies for the manufacturing sector. A theory was even developed about an organization's resistance to early adoption of a new technology due to institutional instability and also due to technology immaturity [15].

In another study carried out in Sweden by Sjödin et al. (2020), an analysis and study were made of two successful and four unsuccessful cases of implementing new business models when moving from selling products to selling services, guaranteeing performance results of products and services. According to Sjödin et al. (2020), he maintains that « This form of business model innovation requires a profound, although little known, change in the way of creating, delivering and capturing value».

In a study of a shipping company to evaluate the digitalization process that it has carried out in more than 11 years, it was possible to demonstrate the steps that the company took to migrate and update services to digital services. In order for manufacturing companies to direct and evolve their businesses towards servitization, it requires not only the implementation of technological enablers, but also three interconnected changes: (1) from planning to discovery, (2) from scarcity to abundance,
and (3) from hierarchy to association. First, top management must develop and promote a clear, shared, and compelling vision for both the company and the entire network. Second, digital servitization requires radically different knowledge and skills. Third, replicated and (re)distributed at marginal cost, new datasets enable novel services and ultimately enhance competitive advantage. These strategic changes are necessary to ensure the success of digital servitization [17].

In a study carried out by Sestino et al., (2020), it is clearly indicated that the adoption of IoT and Big Data generates an amount of disorganized knowledge and that therefore companies should always analyze and evaluate the impact of these technologies. The same must be applied considering a strategic framework because otherwise it can be counterproductive for the company.

In another study carried out in Germany in 199 companies, it shows the benefits of digitization in the innovation process with the incorporation and support of an Innovation Management Software (IMS – Innovation Management Software), which improves efficiency in New Product Development (NPD - New Product Development). However, in the same study it is concluded that the consulting services complementary to the implementation of IMS have a negative influence due to an issue of decision-making capacity in the Innovation Management [19]. Endres (2022), argue in their study of German companies that « Innovation managers prefer less sophisticated and easy-to-use digital solutions without the need for more sophisticated services such as consulting, training and customer support or customization».

In a study carried out in companies in the community of Valencia-Spain, it was analyzed how information systems affect business performance in the services sector, factors such as the age and gender of the manager and the size of the company. It was intended to know how the digitization of Knowledge-Intensive Business Services (KIBS) contributes to performance. It is concluded from the study that the use and updating of social networks for corporate purposes, as well as a high level of training in digital tools, regardless of the gender and age of the manager, can obtain good results for the company [20].

In this study, an analysis was carried out in different companies in Portugal, a cluster of 10 companies, where the adoption of technologies from I4.0 was evaluated. In them, it was found that the opportunities for improvement are in efficiency, flexibility, productivity, cybersecurity, quality of products and services, and decision processes based on data analysis [21].

In a study carried out in a cluster of Chinese A-Share companies, it is evident that there is an indirect relationship between the digitization of the manufacturing industry and investment in corporate innovation. Manufacturing companies can implement DT as a differentiating competition strategy while, at the same time, the possibility of generating a cost-competitive strategy is inhibited. Thus, companies with greater viability have a greater incentive to innovate, regardless of the scale of operation, ownership or productivity [7].
Finally, according to Jafari-Sadeghi et al., (2021), a study carried out in companies from 28 EU countries during the period from 2009 to 2015 shows how DT was applied and three basic elements of this application were identified: 1) Technological preparation; 2) Technological exploration and; 3) Technological exploitation.

**DISCUSSION AND CONCLUSIONS**

Of the studies reviewed for the present investigation, it was found that most of them propose a DTMS, while few studies with explicit results of improved processes in companies are still evident, as can be seen in Figure 3. The investigation shows that most of the companies that have adopted technological enablers are characterized by having connectivity, use of internet services and Integration of digital technology, but they do not specify in what areas and in what way they have adopted it.

It can also be observed that most companies are interested in adopting IoT and IIoT as the main technology enablers. In studies such as: [2], [10], [18], [23], [24], it is identified that companies are taking into account Big Data and Data Analysis data collection and processing systems as tools to improve production systems and also migrate or evolve business models, leading them to a servitization process, which is the current business trend. However, the studies show new technologies in a general way, but they do not show which is the most effective or popular.

Of the studies reviewed, the positive effects of the adoption of technology are evident, however, they are limited to showing the effects qualitatively and with conclusions that are more business-oriented. Evidence of the impacts of DT on production processes in a diffuse way generates uncertainty for other companies about how to explore and exploit new technologies, according to what was reviewed in the studies.

It is concluded from the research that the studies in companies that have adopted emerging technologies, the results of said adoptions are qualitative; and that the impacts are positive in the improvement of its productive and operational processes. In addition, the technology adopted depends on the line of business and depends a lot on the technologies explored and adopted for each case. Finally, it is clear that the technological trends are IoT and Big Data as well as data analysis.

It can also be concluded that more research and development is required in the companies themselves to measure all production parameters and thus be able to analyze, evaluate and improve production processes with the adoption of new technologies. This research is limited to the analysis of emerging technologies declared in the methodology.

This article allows generating relevant information for future research. More quantitative research is needed to show the results of adopting promising new emerging technologies such as robotics and the digital twin to improve manufacturing processes.
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No potential conflict of interest was reported by the author(s).

CONTRIBUTION OF THE ARTICLE TO THE LINE OF RESEARCH
This study aims to contribute to the analysis of productivity when new emerging technologies are adopted. This phenomenon is little studied and opens a huge field of research to identify how to explore and exploit new Industry 4.0 technologies in manufacturing companies.

CONTRIBUTION STATEMENT OF EACH AUTHOR
Researcher Kleber Morillo did the literature review and tabulated the results of the study as well as identified and classified the technologies used in the studies.

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