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Scientific articles

Estudio bibliométrico sobre organizaciones inteligentes desde la perspectiva de la Educación Superior

Bibliometric study on intelligent organizations from the perspective of Higher Education

Estudo bibliométrico sobre organizações inteligentes na perspectiva do Ensino Superior

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Resumen

El objetivo del presente estudio fue analizar los resultados de una revisión bibliométrica sobre el concepto de organizaciones inteligentes desde las aportaciones de Instituciones de Educación Superior. La metodología empleada implicó un estudio de enfoque cuantitativo, exploratorio y de alcance transversal con la iniciativa de conocer el estado actual de las investigaciones sobre organizaciones inteligentes en el ámbito de la educación superior. Los principales resultados muestran que, de 1981 a 2023, se identifican 36 artículos con respecto a las organizaciones inteligentes, los principales exponentes son Lyan y Schwaninger; la Universidad de Negocios de Singapur destaca con mayores publicaciones sobre el tema; Estados Unidos de Norteamérica es el país con mayor participación al respecto. Los documentos académicos que más se publican sobre organizaciones inteligentes son los artículos científicos con un 43.1% y las áreas que mayor relación presentan son; ciencias computaciones, 24.2%, administración, 19.5% e ingeniería, 13.5%. Se concluye que, desde la perspectiva de las IES como organizaciones inteligentes deben considerar los siguientes elementos: gestionar el talento humano para el desarrollo de la creatividad e innovación, valorar la libertad entre los colaboradores, implementación de tecnología, fomentar el aprendizaje a través de la inversión en capacitación, generar una cultura que fomente el trabajo individual, en equipo y grupal, así como establecer alianzas estratégicas con los diversos sectores empresariales.

Palabras claves: organizaciones inteligentes, educación superior, conocimiento, aprendizaje, análisis bibliométrico.

Abstract

The aim of this study was to analyze the results of a bibliometric review on the concept of intelligent organizations from the contributions of Higher Education Institutions (HEIs). The methodology involved a quantitative, exploratory, and cross-sectional study with the purpose of understanding the current state of research on intelligent organizations in the field of HEIs. The main results show that, from 1981 to 2023, 36 articles regarding intelligent organizations were identified. The main exponents are Lyan and Schwaninger, and the Singapore Business University stands out with most publications on this subject. The United States of America is the country with the highest participation. 43.1% of published academic documents on intelligent organizations are scientific articles, and the most related areas are computer science, 24.2%, administration, 19.5% and engineering, 13.5%. It´s concluded that, from the

perspective of HEIs as intelligent organizations, the following elements should be taken into account: to manage human talent in order to develop of creativity and innovation, to value freedom among collaborators, implementation of technology, fostering learning through investment in training, and generating a culture that promotes individual, team and group work, as well as establishing strategic alliances with diversity of business sectors.

Keywords: intelligent organizations, higher education, knowledge, learning, bibliometric analysis.

Resumo

O objetivo deste estudo foi analisar os resultados de uma revisão bibliométrica sobre o conceito de organizações inteligentes a partir das contribuições das Instituições de Ensino Superior. A metodologia utilizada envolveu um estudo de abordagem quantitativa, exploratória e transversal com a iniciativa de conhecer o estado atual da pesquisa sobre organizações inteligentes na área do ensino superior. Os principais resultados mostram que, de 1981 a 2023, são identificados 36 artigos sobre organizações inteligentes, os principais expoentes são Lyan e Schwaninger, a Singapore Business University destaca-se com as maiores publicações sobre o tema, os Estados Unidos da América são o país com maior participação nesse sentido. Os documentos acadêmicos que mais são publicados sobre organizações inteligentes são artigos científicos com 43,1% e as áreas que apresentam maior relacionamento são; ciência da computação, 24,2%, administração, 19,5% e engenharia, 13,5%. Conclui-se que, na perspectiva das IES como organizações inteligentes, estas devem considerar os seguintes elementos: Gerir o talento humano para o desenvolvimento da criatividade e da inovação, valorizar a liberdade entre os colaboradores, a implementação da tecnologia, promover a aprendizagem através do investimento na formação, gerando uma cultura que incentiva o trabalho individual, em equipe e em grupo, além de estabelecer alianças estratégicas com diversos setores empresariais.

Palavras-chave: organizações inteligentes, ensino superior, conhecimento, aprendizagem, análise bibliométrica.

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Introduction

Nowadays, learning and knowledge are an indispensable part of the functioning of organizations, especially considering the disruptive changes in the environment (Guerrero *et al.*, 2020). As a result of the COVID-19 pandemic, a global phenomenon that affected many sectors such as the business sector, traditional procedures within organizations have had to abruptly adapt in response to the needs of the environment and the market, in aspects such as communication, teamwork and customer service (Amado *et al.*, 2022).

The speed of the revolution in the fields of science, technology, digitalization and the innovation economy demands that organizations use hard and soft skills (Vázquez-González *et al.*, 2022), as well as efficient management skills that respond to the challenges of the environment (Licorish The learning and knowledge of collaborators in *organizations* are indispensable resources to appreciate in order to promote the generation of creative and innovative ideas, which have originality, respond and provide solutions to the demands of a globalized, dynamic and changing world. The nature of organizations is not to remain static because they are living entities in constant interaction that cannot resist change, on the contrary, challenges must be transformed into opportunities that represent a bridge towards the generation of learning about political, social, cultural, marketing and economic phenomena that arise as a result of globalization (Mokeddem , 2020). Thus, in the face of the so-called liquid modernity (Bauman, 2005) characterized by consumerism, capitalism and an emerging economy, the solidarity of collaborators is required to face the vulnerability of the existing reality.

To be considered an intelligent organization , it must be innovative, transforming and modifying internal structures, and it must also consider the learning, experiences and knowledge that collaborators can contribute to enrich collaborative work (Kolbjørnsrud , 2024). Investment in science and technology that drive innovation and development is the beginning that sets the tone for organizations to be considered intelligent, which also favors their sustainability in the market.

The post-COVID-19 pandemic context, with geopolitical issues such as the war between Russia and Ukraine that generates global effects, demands that organizations be alert to changes in the environment that affect business and market decisions. The rapid evolution of technology has impacted the knowledge and learning of the business world in such a way

that businesses demand that their decision makers adapt to new processes, in addition to having a holistic vision that considers the risk and vulnerability that companies face every day (Sokolov *et al.,* 2022). In addition, leaders must possess critical, analytical and reflective thinking that prepares them to understand the phenomenon of the existing reality.

In this sense, the intelligent organization seeks to ensure that, in a sustainable way, all its members are learning and developing their potential (León *et al.,* 2003). Therefore, considering that the business world is going through a critical moment in the face of the need to address the various problems of the internal and external environment, it is necessary to contribute with studies related to the topic of intelligent organizations, to strengthen the existing theory and formulate proposals that promote the emergence of innovative and intelligent organizations. The objective of this research is to analyze the concept of intelligent organizations, based on the bibliometric review, from the contributions of Higher Education Institutions (HEIs). As a contribution to the conceptualization of intelligent organizations, the following definition is proposed:

> An intelligent organization is an organization that is willing to learn in order to generate knowledge, that allows for the promotion of decision-making, future prediction of the context, appreciation of the talent of its collaborators, adaptation to change, effective communication, which, together with technology, allows for an innovative transformation of a company's processes. An intelligent organization generates a business culture characterized by loyalty, commitment and teamwork of its collaborators.

Overview of the concept of Intelligent Organizations

In an agile, diverse and complex environment, organizations face multiple situations from those related to health to the economy, for this reason, intelligent organizations require analytical and reflective thinking on the part of their members that allows them to act and solve intricate problems, this approach is the beginning towards understanding the term intelligent organizations.

The contributions of Larrota-Castro (2012) consider that an intelligent organization is a constitution of various elements existing in the organization governed by a culture, to respond to a problem or achieve a goal. Likewise, Hsieh (2011) recognizes that the intelligent organization optimizes the knowledge of its collaborators in order to generate environments where new knowledge is developed. In the same vein, Suchar (2015) analyzes that learning

and knowledge are an indispensable part of the progress of an organization to face the demands of a competitive environment.

For Noboa-González (2019), in the environment where an organization develops, there cannot be order without the prevalence of disorder, vulnerability, complex environments and an uncertain future. That is why intelligent organizations require open, flexible and dynamic thinking that allows them to respond to emerging situations; it lies in rethinking and redesigning organizational processes derived from changes in the environment.

With another vision, León *et al.* (2003) consider that intelligent organizations are living systems, according to the studies of the German biologist Bertalanffy (1989), who pointed out that the intelligence of organizations requires strategic, reflective, critical and creative thinking about the reality of the world that allows the creation of knowledge aimed at solving existing problems. Similarly, Fierro-Moreno (2021) considers that intelligent organizations require strategic agility to manage change in the event of an emergency that guarantees their survival, considering as a basis the studies of the contingency theory of Lawrence and Lorsch (1968). The accelerated evolution of the business world forces organizations to generate new processes, products, services, ways of working, look for new options for distribution channels, production, storage, sales, marketing, among others, to satisfy the new needs of the current market.

In this way, the competencies, skills and abilities of collaborators are essential to generate creative and original ideas that impact the solution of internal and external problems of the organization, through strategies that guarantee the employability, growth, development and survival of organizations in the face of contingencies such as the COVID-19 health emergency. In this sense, the most valuable resource of organizations are people; social interaction allows them to be observed as a living entity, through their capabilities and knowledge about the world, applying them in order to achieve organizational objectives. In this scenario, learning constitutes a competitive advantage for intelligent organizations, because it leads to the creation of value, the design of strategies, innovation and, therefore, profitability (Seminario-Córdoba and Seminario Córdoba, 2020).

The International Competitiveness Index (ICI) indicates that the ten most competitive countries worldwide are: Denmark, Norway, Switzerland, Sweden, the Netherlands, South Korea, Japan, Ireland, Finland, and Australia, which stand out for aspects such as the increase in Gross Domestic Product (GDP), decreased unemployment, trade openness, and the

protection of natural areas; while they show a decline in inflation rates, women in the paid economy, perception of corruption, healthy finances, and external debt (International Competitiveness Index [ICI], 2023). It should be noted that in global terms, Mexico occupies position number 37 in the ICI; the results obtained in this index are detailed in Table 1.

Table 1. Mexico's results in the ICI.

Advances		It was maintained		Recoil	
Aspect	Ranking position	Aspect	Ranking position	Aspect	Ranking position
Society	35	Environment	36	Economy	34
Government	26	Political system	35	Right	41
Factor market	16	Precursors	39		
International relations	38				
Innovation	29				

Source: Prepared by the authors, with information from IMCO (2023)

Based on the results of the ICI, it can be seen that Mexico is a country that needs to strengthen its competitiveness, which is why companies need to include elements that allow them to increase their competitive advantages.

In terms of innovation, the ten most innovative countries are: Switzerland, the United States, Sweden, the United Kingdom, the Netherlands, the Republic of Korea, Singapore, Germany, Finland and Denmark. In this ranking, Mexico occupies position 58 out of 132 economies in the world (Global Innovation Index). [WOPI], 2023). The study points out that the most prominent countries in science and technology are Tokyo, Hong Kong, China, the Republic of Korea, and the United States. According to these international rankings, the countries' areas of opportunity are found precisely in the topics related to artificial intelligence and automation, because companies lack mechanisms for the adoption of these processes. According to the above, the smart organizations component would allow organizations to adopt elements that streamline their traditional processes and thus impact the generation of competitive advantages.

Organizational learning and knowledge management as a catalyst

The generation of resources in any entity is intrinsically linked to the learning capacity exhibited by its collaborators. This capacity is nourished by accumulated experiences, as well as by the essential skills and competencies required to effectively address the challenges that arise in the organizational context. According to Castellanos-Rivero and Escott -Mota (2021), in the organizational field there is a disruption in innovation as a consequence of the effects caused by the COVID-19 pandemic, and the following challenges are identified: virtual collaboration, emotional health, internet of things, industry 5.0, digitalization, robotics, artificial intelligence, e-commerce and remote work. In this sense, learning and knowledge must be profitable for organizations, so learning and technology must become a dynamic and agile process.

According to Prieto-Lee *et al.* (2021), learning is the sum of the efforts of collaborators, the contributions that organizations make, and is the result of motivation, the organizational climate and culture, the opportunity provided for the development of work skills, and the investment of economic resources to achieve competitiveness against existing competition. For Marcano-Durán and Cirera -Bianco (2021), organizations that learn are intelligent because they adopt the promotion of learning, encourage the generation of knowledge, both individual and collective, to face the uncertainty generated in the context; that is, they have the opportunity to process information for the common good as a first step to understand the trends in their environment. Based on the above, the concept of organizational learning is analyzed, which has been approached from the proposal of various authors, who proposed models with specific characteristics, which are summarized in Table 2.

Table 2. Main models of organizational learning

Senge (1990)	Huber (1991)	Crossan *et al.* (1999)
Personal domain	The acquisition of knowledge	Intuition
Mental models	The distribution of information	The interpretation
Building a shared vision	Interpretation of information	Integration
Team learning	Organizational memory	The institutionalization of knowledge
Systems thinking		

Source: Prepared by the authors with information from López-Zapata et al. (2012)

According to Senge (1990), the learning organization is willing to generate new knowledge, to adapt the context to ensure its survival, to encourage interaction between collaborators to achieve the desired results and to encourage learning among collaborators. For Huber (1991) learning is the result of the modification in the behavior of collaborators to process existing information of the organization, while Crossan (1992) believes that learning is the result of the modification in the behavior of collaborators to process existing information of the organization. *et al.* (1999) distinguish learning from individual, team and group perspectives. These models aim to explain how organizations learn through characteristics and attributes that make them unique in a context. Table 3 shows the approaches to organizational learning.

Table 3. Approaches to organizational learning

Resource-based approach Penrose, (1959), Wernerfelt (1984)	Intellectual capital theory Edvinsson (1997)	Theory of dynamic capabilities Teece , Pisano and Shuen (1997)	Knowledge management Nonaka and Takeuchi (1995)	Absorption capacity Cohen and Levinthal (1990)	Ambidextrous organization Raisch and Birkinshaw (2008); Simsek (2009).
Learning in organizations and the resources they possess must become the competitive advantage	Organizations have two types of resources: tangible and intangible, where learning is a valuable element to strengthen intellectual capital.	These are the skills to take advantage of the context that allows organizations to be competitive.	They believe that employees must socialize to enrich and transform their knowledge, which allows for the generation of new knowledge.	It is the acquisition of new knowledge external to the organization.	Organizations need to have flexible on the one hand and efficient in promoting learning among employees on the other.

Source: Prepared by the authors with information from López-Zapata *et al.* (2012)

The six approaches related to organizational learning aim to understand the manifestation of employee learning in a business context internally and externally, as well as its construction and transformation, so that organizations can optimize their resources and face the challenges of a globalized environment. Villasana-Arreguín *et al.* (2021) state that knowledge management in organizations is considered an asset, a resource, a strategy for

application and exchange with the outside world, to maximize the potential and capacity of organizations.

Knowledge is a symbol of progress and economic development, because it is considered a business asset to provide emerging solutions to the demands and needs of the current context. Thus, learning and knowledge are catalysts in organizations that consider that they are intelligent. Likewise, learning and knowledge are multidisciplinary and seek to provide a deeper understanding of how individuals acquire and use information. This knowledge has practical applications in the improvement of educational methods, professional training and the development of cognitive skills throughout life.

The intelligent organization and HEIs

HEIs have also suffered the effects of globalization, from market changes and most recently the COVID-19 pandemic. In this sense, HEIs demand to restructure their traditional processes, so that they have an early vision of the various scenarios that arise, such as contingencies and vulnerable situations. This perspective will allow adaptation to change and put resilience and other capabilities into practice.

Schwarzman 's perspective (2001), HEIs are considered an economic enterprise because they carry out organizational activities: they use and take advantage of their resources, implement technologies, have laboratories and infrastructure to encourage learning in students, all aimed at achieving quality in education (Clara-Zafra and Vega-Zárate, 2021). In addition, they carry out the administrative management of the organization, which implies operating as an open system in constant interaction with their interest groups, so that they coexist and achieve objectives through socialization. Also, through the terminal efficiency of students, a kind of merchandise is offered to the market, to satisfy the current and potential demands of the work context. There is an academic-business link with the various productive sectors, to share experiences and knowledge that provide the opportunity to form strategic alliances. HEIs perceive competition in their context and make great efforts to exceed customer expectations. For this reason, HEIs can be considered as business organizations, but at the same time as intelligent organizations that attend to and adapt to the needs of the environment, as has been the case with the incorporation of diversity and inclusion policies, gender equity, to mention some examples (Sánchez-Leyva *et al.*, 2021).

For Blanchart (2023), intelligent organizations promote the following aspects: the human factor, process reengineering, business diagnosis, organizational change, culture,

training, resources and institutional synergy. The above implies that an intelligent organization is a generator of knowledge, flexibility, connection, feedback, learning, quality, service, effective and affective communication; this requires the design of institutional policies and the development of competencies and skills oriented to the organizational strategy. According to Valecillos and Quintero (2007), organizations refuse innovation because they maintain a traditional approach, lack knowledge, but also maintain an ambiguous culture and alien to the reality of the current context, for this they require streamlining learning and knowledge that provides the opportunity to result in the commitment of employees. As well as promoting organizational growth and development, so that, in the face of vulnerability, risk or threat, the organization perceives an opportunity in the face of events.

According to Chávez-Hernández and Torres-Sanabria (2012), smart organizations make decisions, analyze data and take advantage of the knowledge generated by employees to create value in educational services and processes, so that these characteristics become a competitive advantage and a viable path to innovation. Schwaninger 's perspective (2019) places HEIs at the center of the current context and recognizes that they face challenges from a dynamic, complex and uncertain environment. Smart HEIs require adaptation to the environment, generating learning through organizational governance where there is a mix of science, technology and management,

Briceño and Yraima (2021) analyze that HEIs are intelligent educational organizations, because they make a contribution to the development of the environment through the academic and professional training of critical and reflective citizens who promote a spirit of freedom. The characteristics of intelligent organizations pointed out by Alnuaimi are also configured in them. *et al* . (2021, as cited in Céspedes-Gallegos *et al.,* 2022) because they know how to learn, they use the collective knowledge of collaborators and transform it into results, as well as understand the dynamics generated in the context.

The contributions of Navarrete-de la O and Sánchez-Valdés (2022) refer to the fact that organizations must be conceived as an open system, which offers the possibility of opening up learning and knowledge through competitive models. An organization is considered intelligent when its interest lies in leaving its traditional scheme and chooses to establish changes in the mission, vision, values, decision-making, adapts to the new demands of the context, guarantees the promotion of learning and the generation of knowledge, values

freedom and flexibility to face the challenges of a chaotic and complex environment, as well as integrates value in the creation of products and services.

Today, HEIs are the entities responsible for training professionals who are agents of change in organizations, with the bold knowledge to face the demands of the dynamic and changing environment. Thus, HEI leaders who adopt intelligent elements will be innovating in their institutional activities, they will have a vision based on creativity and innovation, sustainability and diversity to manage dynamic and modern companies to leave behind the traditional paradigms that burden organizations in the way they generate products, services and processes for society (Otero *et al.*, 2022). Considering the main activity carried out by HEIs in relation to providing educational services, leaders must establish mechanisms that allow the exploitation of the capacities of collaborators in such a way that talent is enhanced in order to transcend traditional processes in the field of education towards innovative and technological processes that are typical of an intelligent educational organization (Sánchez-Leyva *et al.*, 2023).

Materials and methods

This research is based on an exploratory perspective, recognizing that the theory on intelligent organizations is under construction. The methodology used was quantitative, with an exploratory scope and cross-section. The data used are numerical in order to provide information that shows the little approach to the topic of intelligent organizations. The bibliographic study is based on the search for articles in the Elsevier Scopus database (Ardanuy , 2012; Escorcia-Otálora and Poutou -Piñales, 2008). English keywords were used, among which the terms *intelligent and intelligent organizations stand out. organizations AND universities* , to facilitate the search for information, in addition to guaranteeing the veracity and reliability of the publications by having high-impact indexes and leading research regarding the research topic, during the period from 1981 to 2023.

Strategies and methodological sequence for the analysis

For the analysis of the information obtained from the database, bibliometric analysis is used considering previous studies that address the topic of intelligent organizations. In this sense, the following methodological strategies are considered:

1. Enter *Elsevier Scopus* and enter the simple equation in search: *intelligent organizations AND universities* , in order to obtain information related to the variable intelligent organizations and its approach in the context of HEIs.
2. The search and exploration of the database in Spanish and English with the intention of establishing research of an international nature and representation, given that the concept of intelligent organizations is an emerging variable.
3. Considering that the variable has been little addressed, a cross-sectional analysis is carried out with the database, over 40 years covering the period from 1981 to 2023.
4. From the results obtained, information is downloaded for the construction of a database that will provide information on the research that has been carried out on intelligent organizations.
5. Scientific production is observed and, based on this, reflections and value judgments are generated on the variable.

It is worth noting that within the publications on the topic of intelligent organizations, there are no bibliometric analyses on the subject. The most notable recent contribution is from Ortega *et al.* (2017), who propose ways to introduce good practices in the management of higher education under the precepts of intelligent organizations, in order to contribute to generating spaces where innovation in traditional processes is a reality. However, there is a lack of documents that allow us to understand how the theory on intelligent organizations has been built and where the debate is headed, especially if there is consensus on its definition. In this sense, the concept of intelligent organizations as a variable under construction requires research that contributes to consolidating the theory. Therefore, this study considers the contributions on this variable and the relationship with educational organizations.

Data Extraction

To obtain the data, the database was extracted in RIS format for later processing in *Vosviewer* . *Using the Scopus* database , *Analyze* option *results* , statistics on the behavior of publications were obtained, highlighting the number of publications per year, the authors, affiliation of the author's university of origin, country of origin, research by area of knowledge, among others. In addition, with the help of *Vosviewer* An analysis of the keywords was established, resulting in a word cloud that allows the behavior of the variable to be observed.

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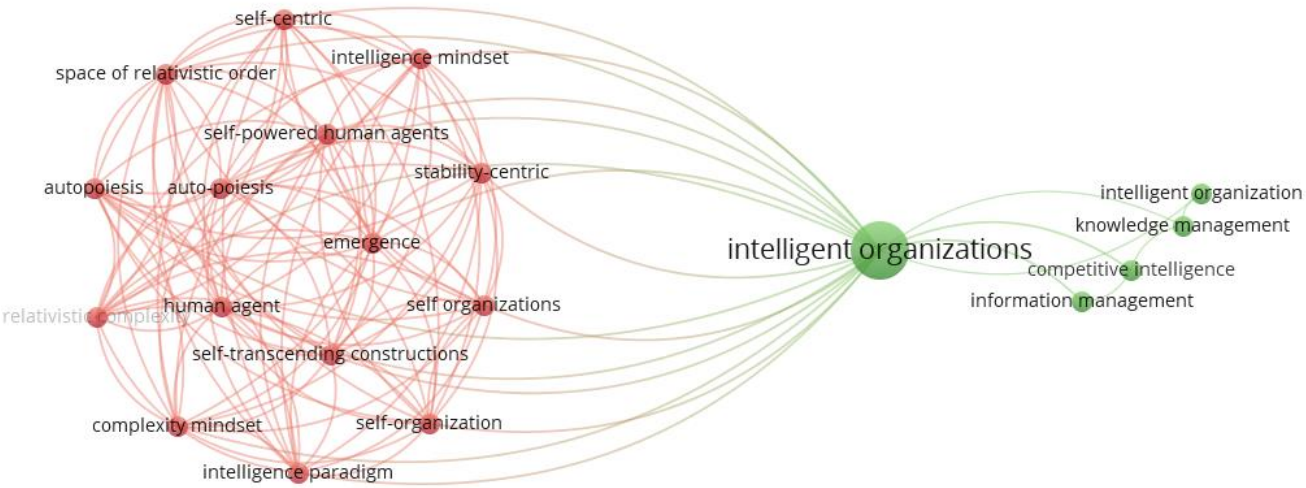
Results

The results of this research show a bibliometric analysis of the main contributions made to the theory of intelligent organizations, considering HEIs as a second-order variable. Figure 1 shows the themes surrounding the term intelligent organizations, highlighting knowledge, learning, management and competitiveness.

Figure 1. Word cloud related to the concept of intelligent organizations



Source: Prepared by the authors with information from Elsevier Scopus , processed in *Vosviewer* .

The various terms surrounding the concept of intelligent organizations allow us to understand how theory, knowledge and learning are being built, and they stand out as necessary attributes that HEIs must consider when innovating in their processes. In this sense, the number of published articles, chapters and other scientific documents is analyzed in order to show how knowledge about intelligent organizations has been generated. Table 4 analyzes the documents published by year.

Table 4. Articles published by year on intelligent organizations in HEIs.

Year	Published articles
1981	1
1985	0
1989	4
1993	4
1997	1
2001	1
2005	3
2009	2
2013	8
2017	5
2021	4
2023	3
Total	36

Source: Prepared by the authors, using data from *Elsevier Scopus* .

According to the information, the first publication on the subject of study appears in 1981 and has a rebound in 1989. Due to the changes in the environment, generated by globalization, economy, politics, culture, technology, changes in the environment and progress generated by organizations in various contexts, the variable acquires relevance between 2009 and 2017, where the discussion on intelligent organizations from the perspective of higher education increases, allowing to demonstrate the need to continue discussing.

As a consequence of COVID-19 in the world, the topic of intelligent organizations in the university context becomes a field of study of great interest, because HEIs are also considered as organizations, due to the interaction between the groups in their context. Table 5 identifies the main researchers on the subject, which implies that in order to undertake research it is necessary to know their contributions.

Table 5. Exponents of the topic of intelligent organizations

Exponent	Published articles
Lyang , TY	8
Schwaninger , M	5
Kayman , E.A.	4
Lobaziewicz , M.	4
Beckford, J.,	3
Chen, M	3
Nunamaker , J.F.	3
Weber, ES	3
Bayoumi , M	2
Clegg, S	2

Source: Prepared by the authors, using data from Elsevier Scopus .

The main researchers who have contributed to the construction of this theory are: Lyang , TY, Schwaninger , M., Kayman , EA, Lobaziewicz , M., Beckford, J., Chen, M., Nunamaker , JF ., Weber, E.S., Bayoumi , M., and Clegg, S, whose contributions are oriented to the creation of models, implementation of information technologies, data science and decision making through automated systems. Table 6 lists the main institutions in the areas of intelligent organizations.

Table 6. Institutions with publications on intelligent organizations.

Institution	Documents
Singapore Business University	11
Hacettepe University	6
University of St. Gallen	5
Nanyang Technological University	4
University of Zulia	4
University of Arizona	3
National Institute of Education	3
Lubeck Polytechnic	3
Innovation Research Institute	3
University College London	3

Source: Prepared by the authors, using data from *Elsevier Scopus* .

The main HEIs in which research on learning organizations has been carried out are: Singapore Business University with 11 publications, Hacettepe University with 6 publications, University of St. Gallen with 5 publications, Nanyang Technological University with 4 publications, University of Zulia with 4 publications, University of Arizona with 3 publications, National Institute of Education with 3 publications, Lubeck Polytechnic with 3 publications, Innovation Research Institute with 3 publications and University College London with 3 publications, with a total productivity of 45 publications on learning

organizations, all institutions are related to business management and administration respectively. Table 7 shows the analysis of the countries with the greatest interest in this topic.

Table 7. Countries with publications on learning organizations

Countries	Documents
United States of North America	22
United Kingdom	13
Poland	13
China	12
Singapore	12
Swiss	8
Romania	7
Venezuela	7
Mexico	6
Türkiye	6

Source: Prepared by the authors, using data from *Elsevier Scopus* .

In terms of scientific production in relation to the country where the research was published, the United States of North America stands out with a production of 22 articles, the United Kingdom with 13 articles, Poland with 13 articles, China and Singapore with 12 articles, Switzerland with 8 articles, Romania and Venezuela with 7 articles, Mexico and Turkey with 6 articles each. It should be noted that the countries with the highest scientific production are considered to be the world's leading powers in science, technology and innovation. Continuing with the analysis, Table 8 shows the main scenarios for the publications made.

Table 8. Publication diversity in learning organizations.

Publishing event	Documents
Grades	0.6%
Magazines	2.8%
Journal congresses	3.3%
Books	6.6%
Book chapters	9.4%
Conference papers	34.3%
Articles	43.1%

Source: Prepared by the authors, using data from *Elsevier Scopus* .

Regarding the type of document where the concept of intelligent organizations has been used, the following was found: Notes with 0.6%, Journals 2.8%, Journal conferences

3.3%, Books 6.6%, Book chapters 9.4%, Conference articles 34.3% and Articles 43.1% with the highest participation obtained. Table 9 classifies the documents by thematic area.

Table 9. Thematic areas related to intelligent organizations.

Subject area	Documents
Energy	1.6%
Planet Earth	1.6%
Medicine	1.9
Economy	5.3%
Math	6%
Scientific decisions	8.5%
Social sciences	9.1%
Engineering	13.5%
Administration and business	19.5%
Computer science	24.2%

Source: Prepared by the authors, using data from *Elsevier Scopus* .

The topics of energy are appreciated with 1.6%, planet earth 1.6%, medicine, 1.9%, economy 5.3%, mathematics 6%, scientific decisions 8.5%, social sciences 9.1%, engineering 13.5%, administration and business 19.5% and computer sciences 24.2%. The topic of intelligent organizations involves various areas of study because a great variety of disciplines, skills and competencies converge to achieve a common goal, the development of new products, services and processes that satisfy the needs of emerging markets. In this sense, from the perspective of higher education, HEIs considered educational organizations are in constant change and transformation, the results described above show the need to contribute with more studies of intelligent organizations in HEIs, in short, it is an imperative need that allows building knowledge that can be applied by universities and contributes to the generation of changes in internal processes that are so necessary.

Discussion

It is complex to understand that HEIs are considered as intelligent organizations, because according to Hernández-Trillo (2020), they must comply with certain characteristics inherent to their function, thus recognizing the existence of a variety of competent HEIs willing to become the best option on the market. A smart HEI is a mix of science, technology, research, learning and knowledge generation.

In this sense, the following characteristics stand out: compliance with international standards, promoting research among collaborators and the student community, having a culture of excellence, access to reliable sources of financing, students with skills and abilities

that allow them to develop talent, the value of freedom and autonomy in decision-making, and having the infrastructure for the development of ideas, projects and prototypes in favor of society and the country. The above represents a challenge for HEIs to be considered intelligent, because they are limited and subject to existing government provisions for decision-making and management of financial and economic resources. Freedom and autonomy are subject to control and authority, in addition, budgets are limited and demands exceed the capacity to cover real needs in a timely manner, so management is a key response to strengthen efficient operation, especially in public HEIs.

For González-Campo *et al.* (2020) the leadership of managers is an essential element for the construction of smart HEIs. For their part, Brunner *et al.* (2021) propose as a first step, to consider the academic capitalism of professors and students to obtain income outside of public policies. The learning, knowledge, experiences, capabilities and talents of collaborators are an invisible resource that needs to be made visible and monetized to promote progress, growth, development, competitiveness and guarantee the well-being of all those collaborators who provide their work and service to HEIs.

The above-mentioned denotes the direction of the debate on intelligent organizations, specifically those in the higher education sector. The results of the bibliometric analysis allowed us to understand how the theory on intelligent organizations is developing, that the main theoretical elements with which it is related are learning and knowledge, this binomial is essential for the transformation of the traditional processes of an educational organization. In order for HEIs to be considered as an intelligent organization or as an organization that learns, it is necessary to consider the following aspects:

- The value of trust in collaborators to communicate ideas and be subject to trial and error. Creative ideas can be exposed to failure derived from the various efforts until finding the optimal answer, collaborators require the use of machinery, equipment, laboratories and raw materials that allow them to experiment with their mental processes, and they also need the approval of management to continue with the experimental work. One of the benefits of the value of trust is the security that collaborators have and the certainty of working on creative ideas.
- Promoting collaborative work among participants fosters the integration of efficient, competitive work teams that generate growth and development in the institution to intelligently face changes in the current context. The multidisciplinary nature of its members enriches and strengthens diversity in HEIs.

- Institutional leaders are the main actors in promoting learning and knowledge generation through motivation and the creation of incentives. A business culture with leaders willing to encourage change, preach by example in behaviors and attitudes, as well as establishing the necessary conditions to guarantee equal compensation for the benefits of incentivizing learning and knowledge generation in an institutional context. Today, the competitiveness and survival of organizations and institutions depends on the vision and direction projected by leaders.
- Organizational learning is a constant that enriches the spirit of collaborators by enhancing experiences, knowledge and the generation of creative ideas. The various events that have arisen in the environment, from geopolitical, cultural, economic analysis and currently health aspects, are emerging situations that force leaders and collaborators to conceive new strategies, ways of working, new products and/or services and processes that guarantee the satisfaction of consumers and the global market.
- A shared business vision in the organization focuses the strategies designed towards achieving goals and objectives. Having a futuristic vision is an intuitive quality possessed by leaders who have knowledge of the internal and external context of the organization. The vision positions the organization in the ideal state to establish medium and long-term goals.
- Technology is a crucial factor for the optimization of institutional resources that provides the opportunity to have agile processes. Currently, *big data* , artificial intelligence, gamification, digital platforms, biotechnology, digitalization, the Internet of Things, social networks, sustainability, cloud computing, among other related topics, promote learning in an agile way, but at the same time with the awareness of responsible and ethical use that does not affect the interests of third parties or establish a conflict of interest.
- The link with various business sectors, research centres and HEIs at national and international level enriches the work of research networks for open innovation among participants. The benefits of the interrelation generate new ways of working, better expectations and commitments, enrich creative ideas and strengthen the bonds of trust and work between HEIs and collaborators.
- Efficient data management and administration is essential for the visualization and resolution of emerging challenges in the institution. The information generated by

HEIs is a resource that should promote a culture of protection and ethical practices, the ability to interpret information, make decisions and design strategies to face the financial and administrative challenges existing in HEIs. Quantifiable information and data are instruments for decision-making.

- Recognition of the business, contextual and cultural intelligence of both institutional managers and collaborators is an indicator for integration and the opportunity to create a business culture aimed at innovation. Derived from the latent diversity in collaborators and therefore in the organization, it is the optimal opportunity to highlight the talent, knowledge, skills and experience of collaborators; as well as other factors related to diversity, among which stand out age, gender, religion, ideology, geographic location, level of education, marital status, traditions and customs immersed in collaborators, which become a competitive advantage for HEIs.

Conclusions

The concept of intelligent organization is complex and profound, because it implies a series of elements involved and tangible results in the eyes of managers, executives, operators and all those collaborators who work directly and indirectly in the production of the same, but also in the society to which products and services that satisfy needs are offered. In this sense, organizations must take the initiative to design strategies to become intelligent environments to guarantee their existence in the face of changes generated in the context. As a result of the literature review, the design of the theoretical framework, the methodology used and the results obtained in the *Elsevier Scopus database* , the following considerations are presented on the subject of intelligent organizations from the perspective of higher education: the traditional administration model based on authority, control and centralization of power is the most common way of managing organizations, so new ways of managing human talent are required in a comprehensive, systemic way and based on the opportunities and demands offered by the current context. Management, administrative, service, teaching and student staff must be part of the management process, since each of them is an indispensable element and belongs to an interest group of the institution.

Employees require the necessary resources and factors to develop their capabilities, skills and competencies that allow them to learn, unlearn and devise new ways of working individually, collaboratively and in groups. Creativity in this sense must be maximised for implementation through innovation. It is necessary to promote the value of freedom as part

of the organisational culture, risk-taking and learning from failure among employees, as well as allocating risk capital that allows the possibility of learning about the ideas applied in the environment, in order to implement improvements that contribute to the organisational learning of participants.

The context is dynamic, changing, vulnerable, emerging and at risk, where globalization and geopolitical situations set the tone for any unpredictable event and where competition is constantly evolving and transforming with respect to the use of technology, with trends that stand out among the following: nanotechnology, artificial intelligence, *big data, the* Internet of Things, robotics, virtual reality, among others. Currently, societies converge under the scheme of diversity and inclusion, which enriches human relations and effective and affective communication between its members.

Learning in educational organizations should be considered as an essential and essential resource for the generation of knowledge among employees, from which come the answers to existing problems and challenges they currently face. Organizations should question how employees learn and design strategies to generate and increase the intellectual wealth of human talent to ensure their permanence in the organization. The existing accumulation of knowledge can be used in various opportunities for improvement, to change, rethink, solve, modify processes, methods, systems, products, services and any activity that is part of organizations.

Organizational culture strengthens the bond and entrepreneurial spirit among employees, based on strategic philosophy, mission, vision and values. Trust, freedom and solidarity must be guaranteed to achieve objectives. Individual, team and group work contribute to improving communication and human relations. Transformational leadership can lead organizations to rethink the climate generated within and seek changes that encourage employees to participate in the actions undertaken by the organizations.

As a consequence of the COVID-19 pandemic and in the post-pandemic context, HEIs face constant challenges to meet the needs of students, society and the labor market, to establish links with the various economic sectors, research centers, among HEIs at local, national and international level, both public and private, to achieve strategic alliances for problem solving. Today, HEIs must move towards a quality system, which according to Clara-Zafra and Vega-Zárate (2020) must be an impulse to economic development to meet the needs of a complex context and reduce poverty. Being an intelligent institution is giving way to creativity, innovation, entrepreneurship, technology that leads to the satisfaction and

enrichment of knowledge in collaborators and students who entrust their academic and professional training to an institution.

Future lines of research

Based on the debate generated by the bibliometric analysis on intelligent organizations, two lines of research are proposed: the first focuses on carrying out theoretical studies that allow consolidating the theory of intelligent organizations, for which it is necessary to analyze the concept in depth; the second refers to empirical studies on how HEIs apply characteristic elements of an intelligent organization in their environment, the results obtained and the challenges that changes in traditional processes have implied.

References

Amado, I. J., Olmos, K. S. y Rubio, K. V. (2022). *Servicio al cliente: el reto de la transformación digital en pandemia.* [Pregrado. Universidad Cooperativa de Colombia, Facultad de Ciencias Económicas, Administrativas y Contables, Administración de Empresas, Bogotá] Repositorio institucional. http://hdl.handle.net/20.500.12494/43537

Alnuaimi, M., Alzoubi, HM, Ajelat, D. y Alzoubi, A.A. (2021). Hacia organizaciones inteligentes: una investigación empírica del papel de la orientación al aprendizaje en la innovación técnica. *Revista Internacional de Innovación y Aprendizaje*, *29* (2), 207-221. https://doi.org/10.1504/IJIL.2021.112996

Ardanuy, J. (2012). Breve introducción a la bibliometría. La base de datos scopus y otros recursos electrónicos del CBUES como instrumento de gestión de la actividad investigadora. *Universidad de Barcelona*, *1*-25. https://diposit.ub.edu/dspace/bitstream/2445/30962/1/breve%20introduccion%20bibliometria.pdf

Bauman, Zygmunt, (2005). *Modernidad líquida*. Fondo de Cultura Económica

Bertalanffy, L. (1989). Teoría General de los Sistemas. México: Fondo de Cultura Económica

Blanchart, C. H.R. (08 de septiembre de 2023). *Organización Inteligente. Información, Decisión y Gestión: Apuntes para un Modelo de Conducción Estratégica*. [Informe de investigación] http://www.jstor.org/stable/resrep21026.9.

Briceño P. y Yraima N. (2021). Las organizaciones educativas inteligentes: una indagación de sus aspectos funcionales. *Revista Arbitrada del Centro de Investigación de Estudios Gerenciales*, 48, 219-231. https://revista.grupocieg.org/revista/revista-cieg-no-48-marzo-abril-2021/

Brunner, J.J., Labraña, J., Rodríguez-Ponce, E. y Ganga, F. (2021). Variedades de capitalismo académico: un marco conceptual de análisis. *Archivos de análisis de políticas educativas*, *29*(35), 1-32. https://doi.org/10.14507/epaa.29.6245

Castellanos-Rivero, P. A. y Escott-Mota, M. P. (2021). Innovación disruptiva de las organizaciones en tiempos de covid-19. *Revista Innova ITFIP*, *9*(1), 44-56. https://doi.org/10.54198/innova09.04

Céspedes-Gallegos, S., Clara-Zafra, M. Á. y de León-Cortés, G. (2022). Factores de economía del aprendizaje en un contexto educativo. Revista *Vinculatégica EFAN*, *8*(5), 1-13. https://doi.org/10.29105/vtga8.5-181

Chávez-Hernández, N. y Torres-Sanabria, G. (2012). La organización inteligente en un ambiente de aprendizaje: una exploración de sus aspectos generales. *AD-minister*, (21), 101-115. https://www.redalyc.org/comocitar.oa?id=322327351007

Clara-Zafra, M. Á. y Vega-Zárate, C. (2020). La noción de Educación de Calidad a nivel superior: una reflexión crítica desde el discurso del desarrollo. *Interconectando Saberes*, (10), 67-82 https://doi.org/10.25009/is.v0i10.2672

Clara-Zafra, M. Á. y Vega-Zárate, C. (2021). El carácter polisémico de educación de calidad en el nivel universitario: una aproximación desde sus actores principales. *RIDE. Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, 12(23), 1-22. https://doi.org/10.23913/ride.v12i23.983

Crossan, M. M., Lane, H. W. y White, R. E. (1999). An organizational learning framework: From intuition to institution. *Academy of Management Review*, 24 (3), 522-537.

Escorcia-Otálora, T.A. y Poutou-Piñales, R.A. (2008). Análisis bibliométrico de los artículos originales publicados en la revista Universitas Scientiarum (1987-2007). *Universitas Scientiarum*, *13*(3), 236-244. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0122-74832008000300002&lng=en&tlng=es.

Fierro-Moreno, E. (2021). Change management, virtual collaboration and strategic organizational agility of Mexican companies in the face of COVID-19 impacts. *Nova Scientia*, 13, 1-30. https://doi.org/10.21640/ns.v13ie.2762

González-Campo, C. H., García-Solarte, M. y Murillo-Vargas, G. (2020). Efecto de los estilos de liderazgo en la gestión del conocimiento en las Instituciones de Educación Superior. *Revista Prisma Social*, (31), 283-303. https://revistaprismasocial.es/article/view/3902

Guerrero, E. A. S., Marneou, J. E. N., Peña, L. J. A. y Licandro, Ó. D. (2020). Diagnóstico situacional en microempresas mexicanas: Fracaso o sobrevivencia empresarial. *Revista de ciencias sociales*, *26*(1), 61-76. https://www.redalyc.org/journal/280/28063104008/28063104008.pdf

Hernández-Trillo, F. (2020). Universidades de clase mundial. Reflexiones para México. *Gestión y política pública*, *29*(1), 223-246. https://doi.org/10.29265/gypp.v29i1.661

Hsieh, T.(2011). *How Zappos Creates Happy Customers and Employee.* Great Place to Work

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science,* 2 (1), 88-115. https://www.jstor.org/stable/2634941

Índice Internacional de Competitividad, IMCO. (2023, 16 de abril). Índice Internacional de Competitividad 2022. https://imco.org.mx/indice-de-competitividad-internacional-2022/

Índice Mundial de Innovación, WIPO. (16 de abril de 2023). Índice mundial de innovación 2022. ¿Cuál es el futuro del crecimiento impulsado por la innovación? https://www.wipo.int/global_innovation_index/es/2022/

Kolbjørnsrud, V. (2024). Designing the Intelligent Organization: six principles for human-ai collaboration. *California Management Review*. 6(2), 44-64. https://doi.org/10.1177/00081256231211020 https://doi.org/10.1177/00081256231211020

Larrota-Castro, S.Y. (2012). La evolución del conocimiento en las organizaciones inteligentes. *Revista Punto de Vista*, 3(5), 121-137. https://dialnet.unirioja.es/servlet/articulo?codigo=4776959

Lawrence, P. R. y Lorsch, J. W. (1968). Organization and environment: Managing diferentiation and integration. JSTOR, 13(1), 180-186. https://doi.org/10.2307/2391270

León, R., Tejada, E. y Yataco, M. (2003). Las organizaciones inteligentes. *Industrial data*, *6*(2), 82-87. https://www.redalyc.org/pdf/816/81660213.pdf

Licorish, S. A., da Costa, D. A., Zolduoarrati, E. y Grattan, N. (2024). Relating team atmosphere and group dynamics to student software development teams' performance. *Information and Software Technology,* 167, 1-15. https://doi.org/10.1016/j.infsof.2023.107377

López-Zapata, E. García-Muñía, F. y García-Moreno, S. (2012). De la organización que aprende a la organización ambidiestra: evolución teórica del aprendizaje organizativo. *Cuadernos de Administración*, *25* (45), 11-37. https://www.redalyc.org/pdf/205/20524844002.pdf

Marcano-Durán, M. V. y Cirera-Bianco, J. M. (2021). Integración conocimiento y entorno: un enfoque contingente de las organizaciones inteligentes. *Acta Sociológica*, (84), 99-123. https://doi.org/10.22201/fcpys.24484938e.2021.84.81510

Mokeddem, A. (2020). How Artificial Intelligence can make Competition more Intelligent. *Communications of the IBIMA*, 1-11. https://doi.org/10.5171/2020.622155

Navarrete-de la O, G. S. y Sánchez-Valdés, A. (2022). Organizaciones inteligentes y su incipiente incursión en la esfera turística. Una aproximación al estado del conocimiento. *Telos: Revista de Estudios Interdisciplinarios en Ciencias Sociales*, *24*(1), 100-122. https://doi.org/10.36390/telos241.07

Noboa-González, M. F. (2019). Liderazgo caórdico para organizaciones líquidas. Innovación estratégica ante la incertidumbre para la construcción de futuros deseables. *Revista Estrategia Organizacional*, 8 (1), 27-42. https://doi.org/10.22490/25392786.3170

Ortega, C., Passailaigue, R., Febles, A. y Estrada, V. (2017). El desarrollo de competencias científicas desde los programas de posgrado. *REDVET. Revista Electrónica de Veterinaria*, *18*(11), 1-16. https://www.redalyc.org/pdf/636/63653574007.pdf

Otero, M. C., Sánchez, J. y Giraldo, W. (2022). Diversidad organizacional universitaria. Investigación aplicada a estudiantes de Colombia y México: University organizational diversity. Research applied to students from Colombia and Mexico . *Educación y Humanismo*, *24*(43), 50-66. https://doi.org/10.17081/eduhum.24.43.5734

Prieto-Lee, A., Martínes-Carballo, M. y Echarri-Chávez, M. (2021). San Miguel de los Baños, un paraíso para rescatar. *AlfaPublicaciones*, *3*(2), 77-100. https://doi.org/10.33262/ap.v3i2.45

Sánchez-Leyva, J. L., Clara-Zafra, M., Zapata-Lara, H. del C. y Bozas-Gómez, V. (2023). Evidencia empírica de la actitud de estudiantes universitarios ante la educación online en tiempos de covid-19. *RIDE Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, *14*(27), 1-30 https://doi.org/10.23913/ride.v14i27.1705

Sánchez-Leyva, J. L., Sánchez-Zeferino, D. E. y Zapata-Lara, H. D. C. (2021). La gestión de la diversidad en las organizaciones como factor de innovación: una aproximación teórica. *Revista Colombiana de Contabilidad-ASFACOP*, 9(18), 93-110. https://doi.org/10.56241/asf.v9n18.214

Schwaninger, M. (2019). Governance for intelligent organizations: a cybernetic contribution. *Kybernetes*, 48(1), 35-57. https://doi.org/10.1108/K-01-2018-00 19

Schwarzman, S. (2001). La universidad como empresa económica. *Revista de la educación superior*, *30*(1), 99-104. https://www.schwartzman.org.br/simon/valdivia.htm

Seminario-Córdova, R. A. y Seminario-Córdova, R. B. (2020). La Organización Inteligente: Una mirada hacia la estabilidad empresarial. *Business Innova Sciences*, *1*(3), 57-66. https://doi.org/10.58720/bis.v1i3.19

Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization.* New York: Doubleday.

Sokolov, S., Antonova, A. y Knysh, T. (2022). Increasing the efficiency of automation in shipbuilding and ship-repairing by building a control system using lean manufacturing principles. *In E3S Web of Conferences*. *EDP Sciences*, 363, 1-5 https://doi.org/10.1051/e3sconf/202236301034

Suchar, D. (2015). Organizaciones inteligentes y gestión del conocimiento. 1-15. https://www.researchgate.net/publication/290818765_ORGANIZACIONES_INTELIGENTES_Y_GESTION_DEL_CONOCIMIENTO

Valecillos, C. y Quintero, N. (2007). Enfoque de las organizaciones inteligentes en la implementación de nuevas técnicas de dirección en las pequeñas y medianas empresas (PYMES). *Revista de Ciencias Sociales* (RSC), 13(2), 278-289. https://www.redalyc.org/articulo.oa?id=28011677007

Vázquez-González, L., Clara-Zafra, M., Céspedes-Gallegos, S., Ceja-Romay, S. y Pacheco-López, E. (2022). Estudio sobre habilidades blandas en estudiantes universitarios: el caso del TECNM Coatzacoalcos. *IPSA Scientia, Revista científica Multidisciplinaria*, *7*(1), 10-25. https://doi.org/10.25214/27114406.1311

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

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