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Research Paper

Digitalization and Internationalization: A Bibliometric Approach and Content Analysis

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ABSTRACT

The concept of digitalization is evolving, and there is greater interest in researching the relationship between digitalization and internationalization. The objective of this study is to identify and visualize the intellectual structure and dynamics of the internationalization and digitalization field, due to the lack of studies with this approach. This research is based on bibliometric analysis and a systematic review of the literature to identify, evaluate, and synthesize all the relevant studies from the existing literature related to digitalization and internationalization. A science mapping based on co-occurrence analysis of keywords with SciMAT software is employed to identify the basic themes of a scientific field, showing conceptual and cognitive aspects, the composition of the research field, its evolution, and future challenges. The results identify consolidated, emerging, and declining topics in the research field. Moreover, results also identify four main lines of research that provide a comprehensive and interconnected view of the research on this topic. This research contributes to identifying the main research areas in the field, the key contributions that have led to its dissemination, the factors that interest researchers the most, and the trends that have emerged. Future lines of research are also proposed. All these allow future researchers to design new research to further develop this field.

Keywords: Digitalization, internationalization, intellectual structure, bibliometric, SciMAT.

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1. INTRODUCTION

The increasing globalization of the economy is a driver of international trade activities (Łoboda, 2007). Internationalization is the increasing participation of the company in international operations by changing activities from its home market to global markets or adapting corporate strategy and activities for international markets (Acedo & Jones, 2007; Brieger et al., 2022). Although in the past, the costs of internationalization were always a major barrier for companies to enter new markets, companies can now internationalize at a lower cost thanks to digitalization (Autio, 2017; Laudon & Laudon, 2015; Nambisan et al., 2019). That is why digitalization has become increasingly relevant for companies in the development of their business model and strategy in international markets (Belniak, 2015). In fact, companies with a digitalized model and strategy are more likely to internationalize (Brieger et al., 2022).

Digitalization enables companies to identify and explore new opportunities, make planning more efficient and effective, and aid decision-making. Digitalization also facilitates adaptation to new markets and access and interaction with the client, allowing better knowledge of international markets (Autio, 2017). Digitalization in companies can be approached from different areas: automation of production and supply chain processes, information and resource management, transformation of sales channels for their products and services and communication channels with suppliers, employees, and customers.

The concept of digitalization is evolving and there is greater interest in researching the relationship between digitalization and internationalization: the role of digitalization in the international experience (Dillon et al., 2020; Eduardsen, 2018), the impact of digitalization on the performance of international startups (Cavusgil & Knight, 2015; Sinkovics et al., 2013), the feasibility of digitalization in internationalization (Chen et al., 2019; Pergelova et al., 2019) and the risks of digitalization related to internationalization (De Araújo Lima et al., 2020; Eduardsen & Marinova, 2020; Jean et al., 2020). The growing number of publications on digitalization and internationalization and the considerable variety in both theory and methodology, make it difficult to follow this evolving research field. As knowledge accumulates in any given field, it must be periodically analysed.

The literature reviews in the field of internationalization (Alon et al., 2018; Bužavaitė et al., 2019; Dabić et al., 2020; Dzikowski, 2018), and in the field of digitalization are known (Laksch et al., 2021; Pan et al., 2021; Shi et al., 2022; Sklavos et al., 2022), but independently. The importance of these reviews lies in being key to the development of both research fields. However, there are some aspects that have not been identified and are essential to understand the evolution and the current situation of research in the relationship between internationalization and digitalization. What are the main current research areas in internationalization related to digitalization? Which investigations have favoured the dissemination of this field? Which papers have set the research trends, causing a greater attraction of researchers, and in what period did this occur? There are no reviews that include the concepts of internationalization and digitalization together, which constitutes a significant gap that this research will focus on. In short, intellectual structure of this research field needs to be defined. Based on this knowledge, research will be able to identify objectives for future research, both to develop research that contributes to current work areas, and to incorporate new research areas in the field of internationalization and digitalization.

The goal of this study is to identify and visualize the dynamics and intellectual structure of internationalization and digitalization field. This implies delimiting the scientific domain´s research traditions, their disciplinary composition, influential research topics, and the pattern of their interrelationships (Shafique, 2013). As opposed to previous reviews that increase the conceptual understanding of both individually internationalization and digitalization, this work contributes to the research on internationalization and digitalization by showing their unified intellectual structure. To this end, this paper uses bibliometrics, combining performance analysis and science mapping approaches to the internationalization and digitalization research field. A bibliometric methodology that aggregates large amounts of bibliographic information has been applied. Bibliometric techniques are particularly suitable to recognize and show the intellectual and dynamic structure of a field of knowledge (Donthu et al., 2021). Furthermore, bibliometrics overcomes some of the main limitations of qualitative methodologies: (1) an excess of new, relevant publications can easily saturate investigators´ information-processing capabilities (Díez-Martín et al., 2020); and (2) the results could be intrinsically biased because they tend to reflect the subjective view of their authors (Mukherjee et al., 2022). Thus, the following research questions (RQ) are defined:

- RQ1: Which are the most influential publications?

- RQ2: Which are the most influential journals?
- RQ3: Who are the most influential authors?
- RQ4: Which are the most influential countries and universities?
- RQ5: Which are the most active research themes?
- RQ6: Which are the trend topics in the research field?

This research contributes to identifiying the main research areas in the field, the main contributions that have led to its dissemination, the factors that interest researchers the most, the trends that have taken place and future lines of research are proposed. All these allow future researchers to design new research to further develop this field.

This document is organized according to the following sections. Firstly, the methodology and dataset are presented. Secondly, the results of the bibliometric analysis are shown. Finally, after the discussion section, the main conclusions, implications and future research lines are detailed.

2. METHODOLOGY AND DATASET

Bibliometrics is a science that allows the treatment and study of quantitative data from scientific publications, providing useful and objective tools in the processes of evaluating the results of scientific activity (Bordons & Zulueta, 1999). Bibliometrics helps researchers understand the origin and evolution of a discipline. Bibliometric techniques and methods represent some of the most common and widely accepted techniques to analyze the output of basic and advance research. Bibliometric methods seek to analyse the research and publication performance of individuals and to reveal the structure and development of scientific fields and disciplines (Donthu et al., 2021). Such methods are increasingly valued as tools for measuring scientific quality, productivity, and evolution (Garfield & Merton, 1979; Hirsch, 2005; Martínez et al., 2015; Moed, 2009; Moed et al., 1995).

2.1 Methodology

In this research, a bibliometric analysis of the field of internationalization and digitalization is developed, combined with performance analysis and science mapping approaches (Mukherjee et al., 2022). This methodology can be employed to analyze a field of research and to detect and visualize its conceptual subdomains (themes or general thematic areas).

This bibliometric study is approached from two fundamental procedures: (1) the evaluation and analysis of performance and scientific production through bibliometric indicators; and (2) the

creation and analysis of scientific maps. The analysis of scientific maps, also known as bibliometric maps, is a bibliometric technique whose objective is to monitor a scientific field to understand its structure, evolution, and main participants (Donthu et al., 2021). The digitalization and internationalization literature has been mapped through co-occurrence analysis of keywords (or co-word analysis), the h-index (Hirsch, 2005), the density index, the centrality index (Callon et al., 1991), and other additional indicators (Table 1).

Table 1. Bibliometric indicators used in the study

Indicators	Purpose	Measurement
H-index	To measure and rank the productivity and impact of authors and journals.	It is when at least h publications by a journal or author have been cited at least h times (Hirsch, 2005).
Density index	To measure the internal strength of the network.	It represents the internal cohesion of the network (Callon et al., 1991).
Centrality index	To measure the degree of interaction of a network with other networks.	It represents external cohesion of the network (Callon et al., 1991).
Sum citations	To measure the impact or influence of an article / author in a research field.	Total number of citations of an article / author in a field.
JCI (Journal Citation Indicator)	A normalized metric that would theoretically allow the comparison of journals between different categories.	It represents the average impact of normalized citations by category for articles published in the three-year period. JCI is a new indicator incorporated into the JCR (Journal Citation Report) 2021 edition (2020 data), to measure all the journals included in the JCR (Clarivate, 2022).
Average life of scientific literature	To measure the time interval in which new publications are relevant.	It is the number of years necessary for the cumulative number of publications to duplicate (Diodato, 2012).
Lotka´s productivity	To measure the concentration of the author´s productivity in a research field.	Concentration is detected by calculating the frequency distribution of the number of papers by author (Lotka, 1926).
Average Growth Rate (AGR)	To identify trending and in decline topics in a field through keywords.	It is the average difference between the number of documents published in one year and the number of documents published in the previous year during a given period of analysis. Positive values suggest a growth in the number of publications on the topic in recent years, while negative values suggest the opposite (Ruiz-Rosero et al., 2019).
Journal / author / country production index	To identify the level of concentration of knowledge in a research field.	It is the number of journals / authors / countries that concentrate 50% of the scholarly production in the field. Low values suggest a very high concentration of knowledge in the sources / authors / countries (Cadavid & Valencia-Arias, 2022).
Journal / author / country transiency index	To identify the level of stability of the scholarly production in a research field.	It is the number of journals / authors / countries that published a single paper (Cadavid & Valencia-Arias, 2022).

The co-occurrence analysis of keywords allows to identify the basic themes of a scientific field, showing conceptual and cognitive aspects (Cobo et al., 2012). The co-occurrence relationship occurs between two elements that appear together in a document. There will be a co-occurrence relationship between two elements *i* and *j* if both elements appear in the same document. Co-occurrence analysis can currently be performed through a variety of scientific visualization software programs such as SciMAT, CiteSpace, VOSviewer, CitNetExplorer, BibExcel, or Sci2Tool. Each of these tools has advantages and disadvantages (Cobo et al., 2011). For the current study, SciMAT has been used (Science Mapping Analysis software Tool). SciMAT provides different modules that help the analyst to carry out the steps of the science mapping workflow: (1) the management of the knowledge base and its entities; (2) the science mapping analysis, and (3) the visualization of the results and maps obtained.

The bibliometric methodology used in this study identifies four phases of analysis within a specified set of periods (Cobo et al., 2011; Herrera-Viedma et al., 2020; López-Robles et al., 2019a; López-Robles et al., 2019b):

- **Detection of research themes.** For the period analyzed, research themes are detected by applying a clustering algorithm (Coulter et al., 1998) over a normalized co-word network (Callon et al., 1983).

- **Visualizing research themes and the thematic network.** The detected research themes are classified based on their centrality and density rank values into a strategic diagram (Callon et al., 1991; He, 1999). The centrality index represents link strength among topics or external strength of the network. A topic with higher centrality has stronger connections to other topics in the research network. The density index represents the strength between keyworks in a single topic or the internal strength of the network. Higher density topics have greater maturity. By considering both types of measure, a field of research can be visualized as a set of research themes and plotted on a two-dimensional strategic diagram. Thereby, the themes can be classified into four categories (Cobo et al., 2012) (Figure 1):

  - Motor themes (quadrant Q1): The themes within this quadrant are relevant for developing and structuring the research field. They are known as the motor themes of the field, given that they present strong centrality and high density.

- Highly developed and isolated themes (quadrant Q2): These are strongly related, highly specialized, and peripheral, but they do not have the appropriate background or importance for the field.
- Emerging or in decline themes (quadrant Q3): These themes are relatively weak and exhibit low density and centrality. They mainly represent either emerging or disappearing themes.
- Basic and transversal themes (quadrant Q4): These themes are relevant for the field of research but are not well developed. This quadrant contains transverse and general basic themes.

- **Discovery of thematic areas**. The research themes are analyzed using an evolution map (Figure 1) which links the themes that maintain a conceptual nexus.

- **Performance analysis**. The relative contribution of research themes and thematic areas to the entire field of research is measured quantitatively and qualitatively. This can then be used to identify the most productive and relevant areas within the field.

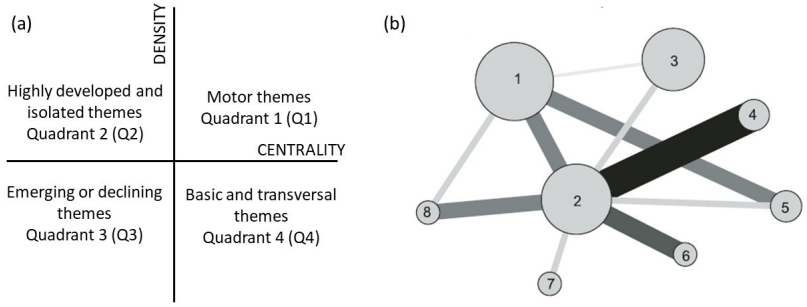

Figure 1. (a) Strategic diagram, (b) Thematic network

Fuente: Cobo et al. (2012); Herrera-Viedma et al. (2020)

2.2 Dataset and analysis

Publications related to internationalization and digitalization were collected to analyze their bibliometric characteristics and perform science mapping. This analysis has focused on the queries proposed for Web of Science (WoS), and the keywords contained in the documents in business research area from the Social Science Citation Index (SSCI), to study the conceptual and cognitive aspects of the business area. The Social Science Citation Index database has been selected because is the most frequently database used for bibliometric studies in business (Zupic & Carter, 2015).

The source of information for this study was the Web of Science Core Collection, to which the search equation *(TS=(international*)) AND TS=(digital*) and Business Economics (Research Areas) and Article or Early Access (Document Types),* was applied from all scientific journals included in the SSCI, ensuring that the most relevant documents that address the issues of internationalization and digitalization are covered simultaneously.

The time frame of the documents obtained with the search equation for the study has been 2010-2022, because 2010 was when papers that relate to digitalization and business management begin to be published and have relevance (Shi et al., 2022). This search strategy applied to this period and thematic category parameters retrieved a total data sample for this study of 521 published papers with 33913 references, included in 226 journals related to the Business Economics research area.

After importing this raw data into SciMAT software, a deduplication process was also applied to improve the data quality by grouping meanings and concepts that represent the same notion. Keywords were manually cleaned to: (1) exclude the expressions we used in the search equation to eliminate irrelevant information and avoid bias in the results about groups or trends, and (2) include non-obvious groups of terms in the field. For example, *big data* and *data analytics* were included in the *big-data and analytics* group because they represent the same concept for the purposes of this research.

At the last stage, the network was built using co-occurrence and a normalization process was performed using a similarity measure. Table 2 shows the parameters of the analysis configuration carried out in SciMAT to generate the strategic diagram and the cluster network that have been interpreted and presented by the researchers as results of this study.

Table 2. Parameters for analysis configuration with SciMAT

Parameter	Choice	Description
Time frame	2010 to 2022	
Unit of analysis	Words (authorRole=true, sourceRole=true, addedRoe=true)	Co-word analyses study the co-occurrence of pairs of items (for example, keywords), that are representative in a document, to identify relations between the ideas presented in the texts (Cobo et al., 2012).
Kind of network	Co-ocurrence	
Normalization measure	Equivalence index (E)	To calculate the association values between word pairs. Two terms that appear many times in isolation but only a few times together will yield a lower E value than two terms that appears relatively less often alone but have a higher ratio of co-occurrences. Terms with relatively high E values form the networks´ links. A term network consists of node (Callon et al., 1991).
Cluster algorithm	Centers simples	Simple centers algorithm is used to assign the word most related to the rest of the theme (Callon et al., 1991).
	Maximum cluster size=10	Maximum number of keywords that a topic should contain.
	Minimum cluster size=3	Minimum number of keywords that a topic should contain.
Evolution measure	Inclusion index	The number of common words to both sets divided by the number of words of the smallest set (Sternitzke et al., 2009).
Overlapping measure	Jaccard index	To gauge the similarity and diversity of sample sets (Agresti, 2020).
Data reduction: frequency reduction	Minimum frequency=2	Keywords that appear in less than 2 documents are excluded.
Network reduction: edge value reduction	Minimum frequency=2	Minimum number of documents in which 2 keywords appear.

3. RESULTS

3.1 Leading articles and the evolution of the number of publications over time

The search query retrieved a total of 521 documents featured in 226 different sources between 2010 and 2022, which have been written by 1393 authors in 73 countries. Figure 2 shows the evolution of the number of articles published each year. There has been a rapid growth of publications and citations, indicating a growing interest in the topic. The average growth rate (AGR) of the publications is 55.47% in the last five years. The years 2014 and 2017 are especially relevant because they have the highest average number of citations, which suggests that articles of relevance to this research field were published in these years. The average life of scientific literature is 2.1 years. That is, the findings in the studies become obsolete after 2.1 years on average.

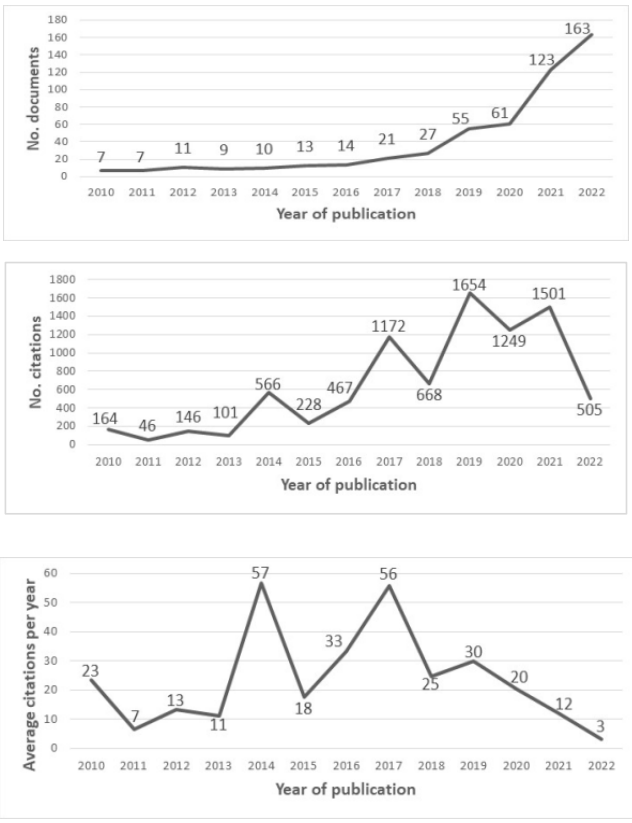

Figure 2. Growth of documents, number of citations, and average of citations per year (2010-2022)

Table 3 shows the 10 most relevant articles in studies on internationalization and digitalization by times cited. The top 10 documents ranked by number of citations hold 20.48% of the total number of citations. The first three documents hold 43.11% of the citations among the top 10 documents. The most cited article was published in 2014 and four of the most cited articles were published in 2017, which reaffirms the importance of these years for this field (Figure 4). Among the most cited articles, there is an interest in analyzing the role of digitalization of research methodology for internationalization (Oppe et al., 2014), as well as understand the implications of supply chain digitalization in international business (Cole et al., 2019; Strange & Zucchella, 2017). However, some articles are more immediately appreciated by the scientific community than others when the relevance is considered by the age. Moreover, Table 3 shows the 10 most relevant articles on internationalization and digitalization by average of citations per year since the publication year. According to the average of citations, the study of Cole et al. (2019), which is the second one by times cited, has the highest number of citations per year since publication, which reaffirms the high importance of its topic. The study of Zahra (2021) is the following by number of citations per

year, reached in a short period of 2 years, which shows the high interest of authors in the international entrepreneurship in a more digital post-covid world (Table 4).

In third and fourth position are the studies by Stallkamp and Schotter (2021) and Crolic et al. (2022), with 13 and 61 positions in terms of times cited respectively, highlighting the interest in new digital tools for the international strategy of companies.

Table 3. Top 10 documents

Top 10 documents by times cited					
Ranking	**Tittle**	**Authors**	**Year**	**Citations**	**Average citations per year**
1	A program of methodological research to arrive at the new international EQ-5D-SL Valuation Protocol	Oppe et al.	2014	284	31.6
2	Blockchain technology: implications for operations and supply chain management	Cole et al.	2019	247	61.8
3	Industry 4.0, global value chains and international business	Strange and Zucchella	2017	217	36.2
4	The digital revolution in financial inclusion: international development in the fintech era	Gabor and Brooks	2017	210	35.0
5	Adapting the Uppsala model to a modern world: Macrocontext and microfoundations	Coviello et al.	2017	170	28.3
6	Regulating work in the bid economy: What are the options?	Stewart and Stanford	2017	165	27.5
7	Global platforms and ecosystems: Implications for international business theories	Nambisan et al.	2019	118	29.5
8	Covid-19 and the case for global development	Oldekop et al.	2020	113	37.7
9	International entrepreneurship in the post covid world	Zahra	2021	106	53.0
10	Solving the crisis of immediacy: How digital technology can transform the customer experience	Parise et al.	2016	105	15.0
Top 10 documents by average of citations per year since publication					
Ranking	**Tittle**	**Authors**	**Year**	**Citations**	**Average citations per year**
1	Blockchain technology: implications for operations and supply chain management	Cole et al.	2019	247	61.8
2	International entrepreneurship in the post covid world	Zahra	2021	106	53.0
3	Platforms without borders? The international strategies of digital platform firms	Stallkamp and Schotter	2021	83	41.5
4	Blame the Bot: Anthropomorphism and anger in customer - chatbot interactions	Crolic et al.	2022	39	39.0
5	Covid-19 and the case for global development	Oldekop et al.	2020	113	37.7
6	Industry 4.0, global value chains and international business	Strange and Zucchella	2017	217	36.2

7	The digital revolution in financial inclusion: international development in the fintech era	Gabor and Brooks	2019	210	35.0
8	Marketing-to-Millennials: Marketing 4.0, customer satisfaction and purchase intention	Dash et al.	2021	65	32.5
9	A program of methodological research to arrive at the new international EQ-5D-SL Valuation Protocol	Oppe et al.	2014	284	31.6
10	Internationalization, digitalization, and sustainability: Are SMEs ready? A survey on synergies and substituting effects among growth paths	Zucchella et al.	2021	61	30.5

3.2 Leading journals

The selected documents were published in 226 journals related to the Business Economics research area. Of those, some are multidisciplinary while others are highly specialized. Table 4 displays the 10 leading journals according to their h-index, in which the most documents related to internationalization and digitalization are disclosed. They contribute 97.8% of the articles or early access since 2010 and include Journal of International Business Studies and Technological Forecasting and Social Change, with a contribution of 20 or more documents. The production index of the journals is 7, which means that 3.1% of the sources published 50% of the scholarly production and evidences a very high concentration of knowledge in the sources. Likewise, the journal transiency index is 127, which means that 56.2% of the sources published a single paper.

Table 4. Top 10 most productive and influential journals (2010-2022)

Ranking	**Journals**	**Docs**	**% of 521**	**JCI* (2021)**	**Research domain**
1	Journal of International Business Studies	25	11.1%	2.16	Management and Business
2	Technological Forecasting and Social Change	20	8.8%	2.40	Business / Regional and Urban Planning
3	Journal of Business Research	19	8.4%	2.14	Business
4	International Marketing Review	18	8.9%	1.04	Business
5	Journal of World Trade	14	6.2%	0.69	Economics / International Relations / Law
6	International Business Review	13	5.8%	1.46	Business
7	Journal of International Management	13	5.8%	1.32	Management
8	World Trade Review	9	4.0%	1.10	Economics / International Relations / Law
9	Historical Social Research-Historische Sozialforshung	9	4.0%	1.59	History / History of Social Sciences / Social Sciences, Interdisciplinary
10	Review of International Political Economy	8	3.5%	1.65	Political Science / Economics / International Relations

3.3 Leading authors and affiliation

In total, 1392 authors have published papers in this field. The author production index is 149, which represents 10.7% of academic documents. Likewise, the author transiency index is 1312, which means that 94.25% of the authors have published a single paper. As a result, the distribution of authors´ publications follows Lotka´s law (1926), according to which a few authors have a high number of publications, and many individuals have few.

Table 5 displays the 10 leading authors according to their h-index, who published the most documents in the period of 2010-2022 on internationalization and digitalization. This table highlights Li, Chen, Luo, Shaheer and Sinkovics, who have published four or more documents. However, the list in Table 5 does not include the authors with the highest number of citations with the publication of the two most relevant articles in this field: Oppe, Devlin, Van Hout, Krabbe and De Charro, who have published only one study on digitalization of research methodology for internationalization that has been cited 284 times (Oppe et al., 2014); Cole, Stevenson, and Aitken, who have published only one study with 247 citations on the implications of supply chain digitalization on international business (Cole et al., 2019). Zahra is the only author listed in the top 10 authors in both, by number of documents (6th position with 3 papers) and number of citations (10th position with 231 citations), for his participation in one of the top 10 documents by times cited and average of citations per year since publication (Zahra, 2021) on international entrepreneurship in a post Covid digitalized world.

Table 5. Top 10 authors by number of documents and number of citations

Top 10 authors by number of documents for 2010-2022						
Ranking	**Author**	**Docs**	**Citations**	**Average citations per year**	**Affiliation**	**Country**
1	Li, Sali	6	152	25.3	South Carolina University	United States
2	Chen, Liang	6	144	24.0	Melbourne University	Australia
3	Lou, Yadong	5	163	32.6	Sun Yat Sen University	China
4	Shaheer, Noman Ahmed	5	146	29.2	Sydney University	Australia
5	Sinkovics, Rudolf R.	4	76	19.0	Auckland University	New Zealand
6	Zahra, Shaker A.	3	231	77.0	Minnesota University	United States
7	Strange, Roger	3	217	72.3	Sussex University	United Kingdom
8	Nambisan, Satish	3	134	44.7	Case Western Reserve University	United States

9	Yi, Jingtao	3	125	41.7	Renmin University China	China
10	Jean, Ruey-Jer Bryan	3	123	41.0	Natl Chengchi University	Taiwan
Top 10 authors by number of citations for 2010-2022						
Ranking	**Author**	**Docs**	**Citations**	**Average citations per year**	**Affiliation**	**Country**
1	Oppe, Mark	1	284	284	EuroQol Group Foundation	Netherlands
2	Devlin, Nancy J.	1	284	284	Office of Health Economics	United Kingdom
3	Van Hout, Ben	1	284	284	Sheffield University	United Kingdom
4	Krabbe, Paul F.M.	1	284	284	Groningen University	Netherlands
5	De Charro, Frank	1	284	284	EuroQol Group Foundation	Netherlands
6	Cole, Rosanna	1	247	247	Surrey University	United Kingdom
7	Stevenson, Mark	1	247	247	Lancaster University	United Kingdom
8	Aitken, James	1	247	247	Surrey University	United Kingdom
9	Coviello, Nicole	2	238	119	Wilfrid Laurier University	United Kingdom
10	Zahra, Shaker A.	3	231	77	Minnesota University	United States

Regarding the universities of the authors with the highest volume of academic production on internationalization and digitalization, South Carolina University (United States) and Merlbourne University (Australia) stand out with 6 papers, and Sun Yat Sen University (China) and Sydney University (Australia) with five papers each. By country of affiliation of the authors' universities, the United States stands out with 3 universities, followed by China and Australia with 2 institutions, while the United Kingdom only ranks one (Sussex University).

3.4 Leading countries in scientific publication

All the publications in our dataset come from 68 countries. The national production index is 6, which means that 8.8% of the countries published 50% of the scholarly production. Likewise, the country transiency index is 18, which means that 26.5% of the countries published a single paper. The Figure 3 shows the top countries in number of publications, recognizing United Kingdom as the leader with 139 documents (26.7%), followed by the United States with 127 documents (24.4%), China with 74 documents (14.2%), Germany with 50 documents (9.6%), and Australia and Italy with 46 documents (8.8%) respectively. Likewise, European countries contribute 36.1% of the total documents, Asian countries contribute 21.5%, and Australia leads in Oceania with

8.8% of the documents. Research on internationalization and digitalization in South America, Central America, and African countries is still incipient.

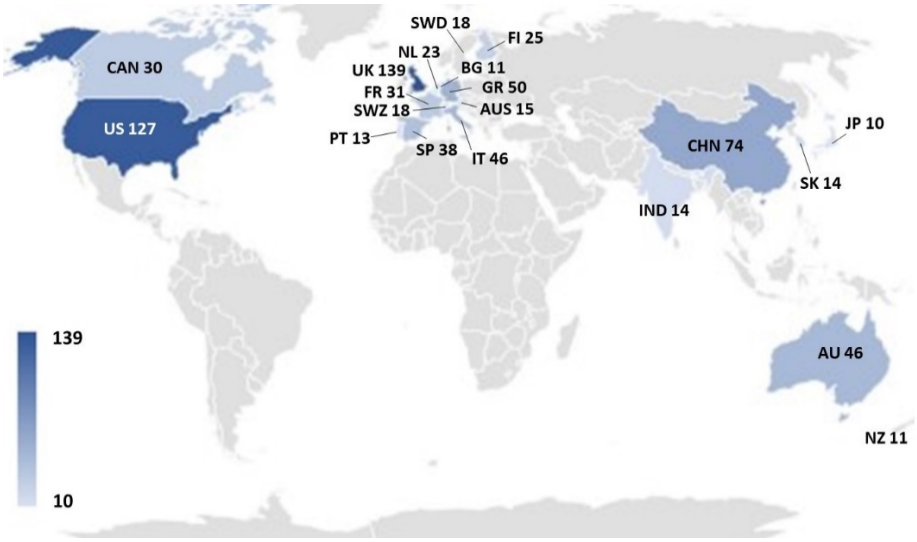

Figure 3. Scientific output by country/territory in 2010-2022

3.5 Most active research themes

Based on their centrality and density, three research themes have been identified and classified into only two categories, as shown in the strategic diagram (Figure 4), and the performance indicators (number of publication citations achieved, and h-index), of the themes for the period from 2010 to 2022 (Table 6). Furthermore, in this strategic diagram, the research themes are represented as spheres whose volume is proportional to the corresponding number of publications. In quadrant 1 (Q1), "Globalization" is the main motor theme of the field of internationalization and digitalization, with strong centrality and high density, followed by "Global supply chain". In quadrant 3 (Q3), "Covid-19 pandemic" is an emerging theme that presents low density and low centrality. Quadrant 2 (Q2) and quadrant 4 (Q4) contain neither highly developed and isolated themes nor basic and transversal themes.

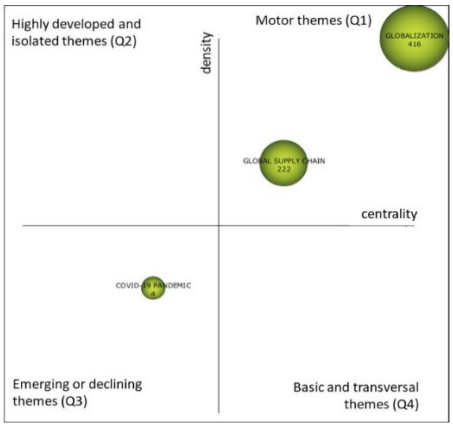

Figure 4. Global strategic diagram for the period 2010 to 2022

Table 6. Research themes information for the period 2010 to 2022

Theme Period 2010-2022	**Quadrant**	**Docs**	**Citations**	**Average docs citation**	**h-index**	**Centrality**	**Centrality range**	**Density**	**Density range**
Globalization	Q1	416	7357	17.7	46	57.77	1	75.45	1
Global supply chain	Q1	222	4383	19.7	35	55.28	0.67	8.91	0.67
Covid-19 pandemic	Q3	4	48	12.0	3	7.53	0.33	0.45	0.33
Theme Period 2010-2019	**Quadrant**	**Docs**	**Citations**	**Average docs citation**	**h-index**	**Centrality**	**Centrality range**	**Density**	**Density range**
Adoption process	Q1	119	4294	36.1	38	52.34	1	64.6	1
Markets	Q2	68	2492	36.6	26	49.58	0.5	12.64	0.5
Theme Period 2020-2022	**Quadrant**	**Docs**	**Citations**	**Average docs citation**	**h-index**	**Centrality**	**Centrality range**	**Density**	**Density range**
Innovation & Competitive advantage	Q1	288	3070	10.7	30	58.91	1	89.03	1
Regulatory framework	Q2	144	1403	9.7	18	48.69	0.5	10.71	0.5

In addition to the research themes, the content analysis reveals subcategories with relevant incidence. Some topics appear in the context of each of the research themes and have been divided to contribute to the process of systematization of the field of study. Figure 5 shows each research theme and its subcategories, extracted from the content analysis of the articles collected in the database for the period 2010-2022. The volume of the spheres of the research theme and its subcategories is proportional to the corresponding number of publications. Research theme 1 (cluster 1) represents the theme "Globalization", which includes nine subcategories, and is the

most extensive research area in the field of internationalization and digitalization within the business economics literature. It comprises the highest number of referenced documents, totaling 416. This means that a significant portion of research in this field has been devoted to exploring the companies´ internationalization strategies through the digitalization of their business model, in order to achieve the globalization of their activities. The most discussed applications in the field were "Innovation & Competitive advantage", "Adoption process", and "Big Data & Analytics". Researchers have focused on analyzing the use of digitalization to achieve a global international competitive positioning based on innovation (Innovation & Competitive advantage); the digitalization adoption processes in different areas of the company (Adoption process); information and resource management (Big-Data & Analytics), the transformation of sales channels for products and services (E-Commerce), the impact on the activity of exporting companies (Challenges & Impact), and the creation of customer value in international markets (Value & Customer orientation).

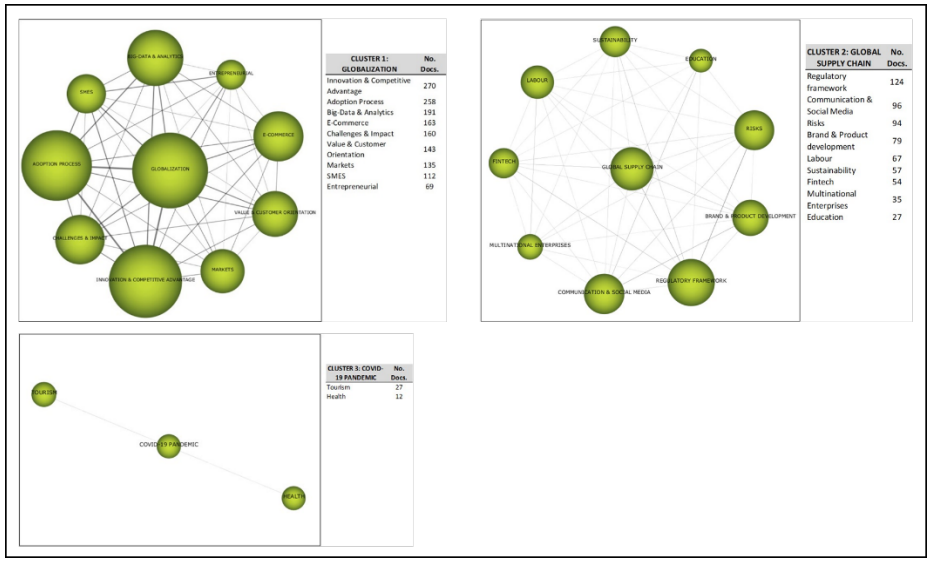

Figure 5. Research themes and subcategories (2010-2022)

Research theme 2 (cluster 2) represents the theme "Global supply chain", which includes eight subcategories, representing the second major research area with 222 documents. The most discussed applications in the field were "Regulatory framework", "Communication & Social Media", and "Risks". Specifically, the focus has been on the role of digitalization in operations management and global supply chain optimization to compete in globalized sectors or services.

The researchers have also focused on evaluating the international regulatory framework (Regulatory Framework), and the risks derived from digitalization (Risks), the optimization in the management of communication channels and social networks with customers, employees and suppliers (Communication & Social Media), and the applications for the development of an international sustainable brand and product image (Brand & Product development and Sustainability), especially in the financial sector (Fintech), human resources management (Labour), and the educational sector (Education).

Research theme 3 (cluster 3) represents the theme “Covid-19 pandemic”, which includes only two subcategories: “Tourism” and “Health”. This third cluster is an emerging research area, including 4 documents related to the tourism and health sectors. Researchers have focused on analyzing the effects of covid-19 on consumption habits in the tourism sector; on the role of digitalization for the economy and companies in the post-pandemic era, and on the use of technologies to control the international mobility of people during the health crisis.

1.1. Trends in the research field

The identification of the emerging theme "Covid-19 pandemic" in quadrant 3 of the global strategic diagram for the period 2010-2022, and the strong growth in the number of publications in 2020, have conditioned the periods defined for the longitudinal analysis. A first period (2010-2019) and a second period (2020-2022) have been defined to analyze the research carried out on internationalization and digitalization. The evolution of research themes in the field of study from 2010-2019 to 2020-2022 is shown in Figure 6. A solid line connecting themes indicates that the linked research theme shares the main item. A dotted line indicates that themes share elements that are not the main item (Cobo et al., 2012).

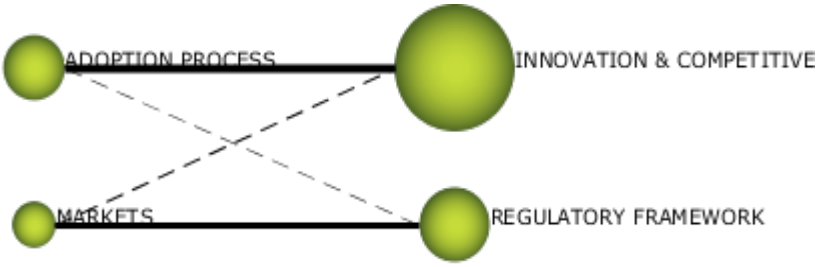

Figure 6. Evolution of research themes from the period 2010-2019 to 2020-2022

Table 6 shows the research themes for the period 2010-2019. It measures their performance by number of publications, citations achieved and the h-index. In its strategic diagram based on their centrality and density, two research themes have been identified and classified into only two categories: "Adoption process" (Q1 – motor theme) and "Markets" (Q2 – highly developed and isolated theme). Research theme 1 represents the theme "Adoption process", which includes nine subcategories (Figure 7). The most relevant are "Globalization", "Innovation & Competitive advantage", and "Big-Data & Analytics". Research theme 2 represents the theme "Markets", which includes nine subcategories (Figure 7). The most relevant are "Regulatory framework", "Global supply chain", and "Risks".

In this second period, research theme 1 represents the theme "Innovation & Competitive advantage", which includes nine subcategories. The most relevant are "Globalization", "Adoption process", and "Big-Data & Analytics". Research theme 2 represents the theme "Regulatory framework", which includes nine subcategories. The most relevant are "Markets", "Communication & Social Media", and "Risks".

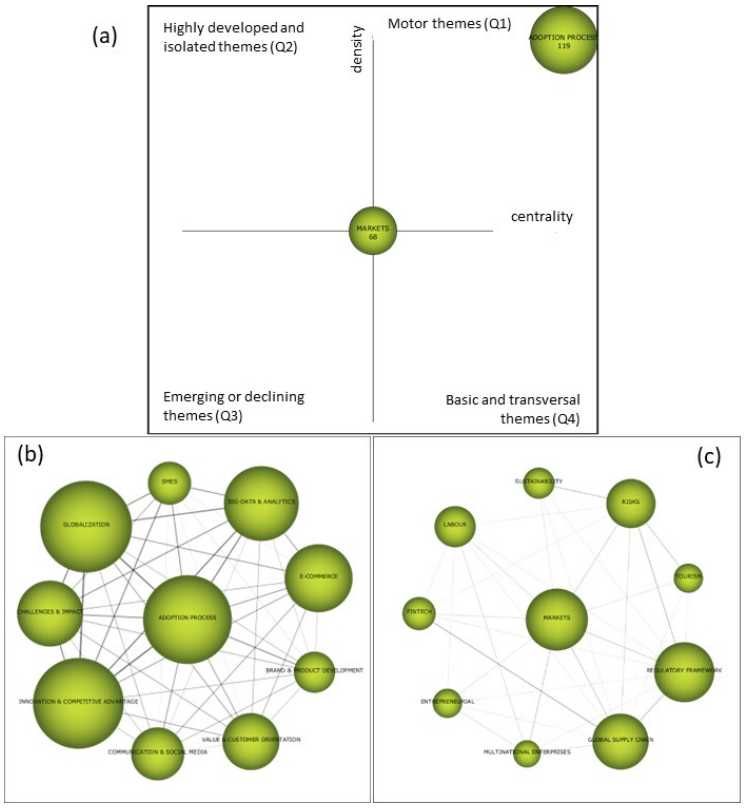

Figure 7. Period 2010-2019 (a) Strategic diagram; (b) Research theme 1: "Adoption process" and subcategories; (c) Research theme 2: "Markets" and subcategories

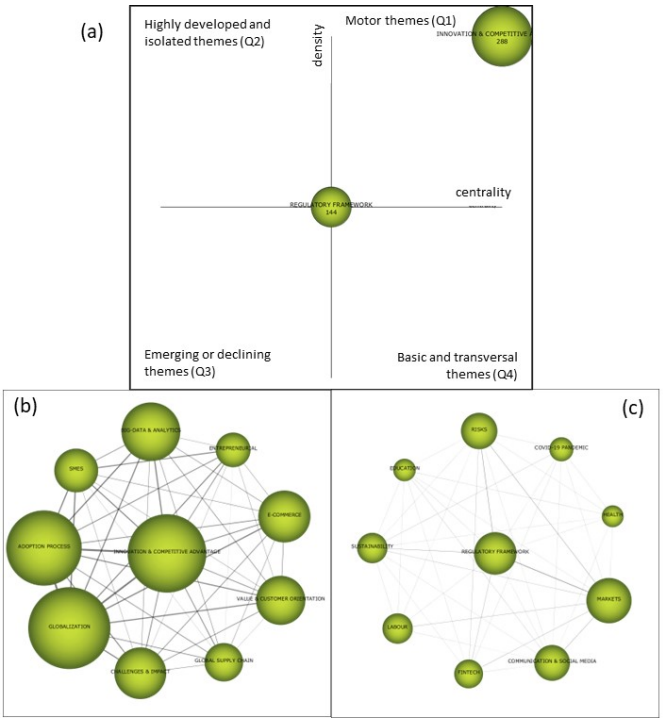

Figure 8. Period 2020-2022
(a) Strategic diagram; (b) Research theme 1: "Innovation & Competitive advantage" and subcategories; (c) Research theme 2: "Regulatory framework" and subcategories

The themes detected in each period can be jointly analyzed by means of their conceptual evolution, that is, discovering the shared terms and how they evolve through time. Thus, using the themes of the two consecutive time periods, a second analysis focused on the conceptual evolution was carried out.

Table 7. Consolidated, emerging and in decline topics in the internationalization and digitalization field

Theme / Subcategory	2010-2019	2020-2022	Trend	Comments
Adoption process	Q1 Theme	Q1	In decline	From Q1 Theme to Q2 Subcategory
Globalization	Q1	Q1	Consolidated	
Innovation & Competitive advantage	Q1	Q1 Theme	Emerging	From Q1 Subcategory to Q1 Theme
Big-Data & Analytics	Q1	Q1	Consolidated	
E-Commerce	Q1	Q1	Consolidated	
Challenges & Impact	Q1	Q1	Consolidated	
Value & Customer orientation	Q1	Q1	Consolidated	
Communication & Social Media	Q1	Q2	In decline	From Q1 Subcategory to Q2 Subcategory
SMEs	Q1	Q1	Consolidated	

Brand & Product development	Q1	---	In decline	Missing subcategory
Markets	Q2 Theme	Q2	In decline	From Q2 Theme to Q2 Subcategory
Regulatory framework	Q2	Q2 Theme	Emerging	From Q2 Subcategory to Q2 Theme
Global supply chain	Q2	Q1	Emerging	From Q2 Subcategory to Q1 Subcategory
Risks	Q2	Q2	Consolidated	
Labour	Q2	Q2	Consolidated	
Sustainability	Q2	Q2	Consolidated	
Fintech	Q2	Q2	Consolidated	
Entrepreneurial	Q2	Q1	Emerging	From Q2 Subcategory to Q1 Subcategory
Multinational enterprises	Q2	---	In decline	Missing subcategory
Tourism	Q2	---	In decline	Missing subcategory
Education	---	Q2	Emerging	Emerging subcategory
Health	---	Q2	Emerging	Emerging subcategory
Covid-19 pandemic	---	Q2	Emerging	Emerging subcategory

Table 7 summarizes the evolution of each theme or subcategory in both periods (2010-2019 and 2020-2022) to identify consolidated, emerging, and in decline topics in the field of research, according to the quartile (Q1, Q2, Q3 or Q4) and role adopted (theme or subcategory) in each period. For the first quartile Q1, research on the "Adoption process" of digitalization for the internationalization of companies loses its role as driving theme in the period 2020-2022 (in decline), giving up its position in favor of research on the use of digitalization as a competitive advantage based on innovation, as current motor theme (emerging). The Q1 subcategories “Globalization”, “Big-Data & Analytics”, “E-commerce”, “Challenges & Impact”, “Value & Customer orientation”, and “SMES” are consolidated and maintain their relevance. However, “Communication & Social Media” subcategory declines and changes from Q1 to Q2, while “Brand & Product development” subcategory even disappears as an area of interest in the second period.

For the second quartile Q2, “Markets” acts as highly developed and isolated theme in the first period but loses its role (in decline) in the second period, in favor of research on “Regulatory Framework” (emerging). The subcategories “Risks”, “Labour”, “Sustainability”, and “Fintech” are consolidated in Q2. “Global Supply Chain” and “Entrepreneurial” change from Q2 a Q1 (emerging) and acquire greater relevance and development by researchers.

"Multinational enterprises" and "Tourism" are losing relevance in the 2020-2022 period and are disappearing as subcategories of interest to researchers (in decline). However, "Education",

"Health" and "Covid-19 pandemic" emerge as new subcategories (emerging), due to the influence of the pandemic on internationalization strategies based on greater digitalization of companies.

4. DISCUSSION

The analysis of the evolution of the themes and subcategories between 2010-2019 and 2020-2022 has provided insight into the reasons and consequences of these results. The evolution of the themes and subcategories identified in Q1 is due to companies are no longer in an initial phase of process digitalization, but rather in an advanced phase of development and improvement of innovations, competitive advantages, and digitalization of the business model to improve positioning in a global market. It evolves from a model of brand and product development, supported by an intensive use of communication channels and social networks, towards a model of global supply chain optimization and shopping experience for international customers, based on data analysis and information management such as the main competitive advantage. Likewise, digitalization reduces costs and entry barriers to new markets, which represents an opportunity and facilitates entrepreneurship and the internationalization of SMEs.

The evolution of the themes and categories identified in Q2 confirms the maturity degree achieved by companies in their international experience in new markets, due to the intense digitalization process carried out by companies to maintain their international activity during the pandemic. On one hand, research on the use of digitalization for market research and new country selection has lost interest. On the other hand, the pandemic was a turning point in the research field. However, its influence on research is now very low, except in the educational and health fields.

5. CONCLUSIONS

This research identifies the intellectual structure of research on internationalization and digitalization in business economics between 2010 and 2022. So far, there have been no studies on this nature in this research field. Nonetheless, its growing relevance for companies, reflected in the proliferation of research, makes this work significant. In addition, this study provides a comprehensive and interconnected view of internationalization and digitalization research, enhancing our understanding of this relationship, its causes, and consequences. Through bibliometric analysis, the research field has been mapped and defined, addressing six essential research questions to understand its structure: (RQ1) Which are the most influential publications?;

(RQ2) Which are the most influential journals?; (RQ3) Who are the most influential authors?; (RQ4) Which are the most influential countries and universities?; (RQ5) Which are the most active research themes?, and (RQ6) Which are the trend topics in the research field?

The literature review was conducted using bibliometric techniques that provide objectivity to the process and reduce researcher bias (Mukherjee et al., 2022). A science mapping based on co-occurrence analysis of keywords is employed to identify the basic themes of a scientific field showing conceptual and cognitive aspects, the composition of the research field, its evolution, and future challenges.

This paper includes relevant implications for scholars and practitioners. For scholars, it contributes to the advancement of existing knowledge in the field of internationalization through digitalization. The mapping of research lines, showing the structure and boundaries of the field, can be a valuable starting point for new research. Furthermore, the provided evolution analysis can serve as a guide for advancing research on new topics that have not yet been explored. For practitioners, it provides an organized and clear understanding of the topics related to the digital transformation of companies´ business models for the internationalization and globalization of their activities. It also serves as a guide for the development of new internationalization strategies and access to new markets through digitalization. In fact, the use of artificial intelligence (AI) has become the key element, transforming the way companies can compete and create value for their international customers.

Finally, the analysis of the evolution of the themes and subcategories, in addition to helping us understand the reasons and consequences of the results obtained, has also allowed us to identify future research lines. Table 8 provides a description of the proposed research agenda, outlining future research directions.

Table 8. Research agenda for digitalization and internationalization field research

Emerging Themes & Subcategories	Future research
Innovation & Competitive advantage	- Relationship between the level of digitalization of the countries and the degree of adoption of the innovations of exporting companies. - Impact of digitalization on the development of radical, incremental or disruptive innovations in international markets. - New challenges of digitalization in international trade. - Relationship between value creation and digital business models in global markets.

Regulatory framework	- Risks of artificial intelligence (AI) to protect the copyright and privacy of customers in international markets. - Impact of massive automation in the equitable management of human resources by countries. - Risks of the application of AI and Data analysis in knowledge management for international markets. - Adoption and responsible use of technology: international sustainable digitalization models. - Challenges of digital sustainability to improve energy efficiency and waste management in international markets.
Global supply chain	- Influence of AI in the management of global supply chains. - Big-data and data-analysis applications for inventory management and optimization in international transport routes. - Impact of digitalization on off-shoring strategies: reconfiguration of the international context based on back-shoring and near-shoring.
Entrepreneurial	- Relationship between the level of international entrepreneurship of the SMEs with the level of digitalization of the countries. - Impact of digitalization on the creation of value of international start-ups (born global).

Research on "Innovation and Competitive Advantage," "Regulatory Framework," "Global Supply Chain," and "Entrepreneurship" has emerged as the main lines of future research, with a strong influence of AI. On the one hand, the research trend focuses on analyzing the effects of digitalization on the development of innovation by exporting companies. On the other hand, it focuses on analyzing new international regulatory frameworks for commercial, financial, and human resources activities, in order to ensure social, economic, and environmental sustainability, in a new international ecosystem where AI plays an important role in knowledge management and intellectual property protection. Furthermore, there is growing interest in studying the impact of AI on optimizing the global supply chain and reconfiguring the new international context. The development of entrepreneurship through the creation of start-ups based on new digitalized and international business models is also highlighted.

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