



## Green Entrepreneurship and Digital Transformation of SMEs in Food Industry: A Bibliometric Analysis

George Sklavos\*<sup>id</sup>, Marie-Noelle Duquenne\*\*<sup>id</sup>, George Theodossiou\*\*\*<sup>id</sup>

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### Abstract

The emerging of green entrepreneurship and digital transformation improve businesses' efficiency and meet consumers' demand for environmentally sustainable products, reducing the environmental footprint and strengthening corporate responsibility to society. Moreover, the COVID-19 pandemic has become a key event changing our lives while businesses have to change their daily operations and working from home has become the norm. So, it is possible to say that business activities and business models have undergone some form of digital transformation due to the COVID-19 pandemic. In Greece, the Food Industry can be characterized as one of the most dynamic and competitive economic sectors which is distinguished for its growth prospects. The aim of this study is twofold: (i) to investigate the impact of green entrepreneurship and digital transformation into the performance of Greek SMEs in the food sector and (ii) to highlight the new trends integrated in new business models in the sector. To meet the research purpose, a bibliometric and co-citation analysis was used based on the R package and graphene as a subject of research for bibliometric analysis. The knowledge gained in this article shows how the digital transformation changed the functioning of the companies in the food industry. The conclusions of this article are mainly for the enterprises that are considering their own digitalization, which contributes to the long-term sustainability of them.

**Keywords:** green entrepreneurship; digital transformation; food industry; business performance; Greece; COVID-19.

**JEL classification:** L25; L26; L66.

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### 1. INTRODUCTION

In the age of green and digital transformation, food industry is called to redefine its priorities and goals. The emerging technologies of the 4<sup>th</sup> industrial revolution “invade” in every step of the food industry, such as from the production to the distribution of the products

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\* Department of Business Administration, University of Thessaly, Greece; e-mail: [gesklavos@uth.gr](mailto:gesklavos@uth.gr) (corresponding author).

\*\* Department of Planning and Regional Development, University of Thessaly, Greece; e-mail: [mdyken@uth.gr](mailto:mdyken@uth.gr).

\*\*\* Department of Business Administration, University of Thessaly, Greece; e-mail: [geortheo@uth.gr](mailto:geortheo@uth.gr).

to the final consumer. At the same time, the growing consumer demand for environmentally friendly business practices is fully in line with the European Commission's guidelines for Member States. So, both transformations, digital and environmental, occur simultaneously and change the way companies operate in the context of the global business arena. The speed of change is such that in no time it emerges new ideas, as well as business initiatives to the key players of the market. Thus, this turns into the tails of digital and green competition of SMEs (Ragazou, 2021).

The emerging global market is characterized by the "rewriting of the rules" in the industry. SMEs in the food industry can proceed their production by using environmentally friendly means, such as the integration of renewable energy sources (Brown *et al.*, 2019). Also, the marketing of the products of companies in the industry can be done with new innovative methods, such as the use of social media. In addition, companies in the industry can combine their physical store with the e-shop or even create two different companies. For example, an online store may be based in Greece, but its suppliers, warehouses and customers may be located abroad (Alwis *et al.*, 2022). However, the realization of new possibilities brings the entrepreneur faced with new needs: from the transition to the "cloud" of business's data, to the modification of marketing methods and the adoption of a "multi-channel" approach to its sales. Moreover, the improvement of the logistics system and the delivery of the products to the "last mile" to its harmonization with the provisions of the laws on circular economy and on the reduction of the energy footprint of its business can be integrated in the new "age" of food industry (Niknejad *et al.*, 2021).

In Greece, entrepreneurs in the food industry are in favor of the green and digital transition as well, based on a series of advantages of Greece that contribute positively on that (Kok *et al.*, 2020). Specifically, the country has a rich natural and cultural environment. This, combined with its geographical location on the global map, that gives Greece a comparative advantage over other countries. Moreover, the EU funds provide opportunities for environmental protection. However, due to the economic situation of the country, many companies find difficult to get funding and adapt green practices, since the costs are quite high. But as it has pointed out, Greece has a rich natural and cultural environment, which can attract investors who want to support businesses in the food industry in their transition from the conventional model to the green and digital one (Hadjjelias *et al.*, 2022).

In this context, the objective of the present study is twofold: (i) to highlight the research trends for both green and digital transformation in the food industry and (ii) to investigate the contribution of the above business models to the efficiency and sustainability of SMEs in the sector. Digital Transformation is defined as the adoption and implementation of digital technologies and solutions by the business to automate its way of operating by fundamentally changing the model of delivering value to its customers. It's not just about applying more technology but mostly about adopting technological solutions in areas that don't exist before. Through the integration and automation of processes and functions provided by digital technology, both executives and staff as well as customers, suppliers and other third parties, partners have the possibility of constant communication with each other. the company's systems as well as those of third parties allowing the undisturbed creation of value. By adopting the best practices described below, which are ultimately the pillars of digital transformation, it is certain to improve business continuity especially in situations similar to that of the Covid-19 pandemic but also in the environment that seems to be shaping up in the immediate future as a result of the current crisis. Today, due to the COVID-19 pandemic, the

critical role of Digital Transformation in improving the business continuity of businesses in the food sector is highlighted and it is confirmed that, especially in similar crises the digital technology is a guarantee for the very survival of businesses in most sectors of the industry. At the same time, the intensifying consumer demand for business practices that do not burden the environment is fully aligned with the direction of the food industry for a green digital transition. Both transformations are happening at the same time and are changing the way food industry SMEs operate. The speed of changes is such that in no time it brings out new ideas and commercial initiatives in the protagonists of the business and just as quickly turns the SMEs that do not have the resources to cope with the new type of challenges into tails of the digital and green competition.

To approach these issues bibliometric analysis based on R package was applied. The bibliometric analysis was used to highlight the main trends of green entrepreneurship and digital transformation in the food industry. Based on that, different bibliometric methods were integrated in the analysis, such as co-citation, keywords, and content analysis. The data were retrieved from Scopus database, which offers the ability to scholars to search more than 22,000 titles of scientific journals and more than 5,000 publishers (Hossain *et al.*, 2022). The visualization of the results from Bibliometric analysis was performed by Biblioshiny based on R package and VOSviewer software.

The paper is broken into six sections. Section 1 introduces the reader in the research field that will be discussed in the paper and presents the main objective of the paper. Section 2 presents the literature review regards the transition of SMEs in the food industry from a conventional business model to that of green and digital transformation model. Section 3 describes the materials and methods applied to approach the objective of this research work. Section 4 illustrates the results from the bibliometric analysis of the 336 published papers in the studied field. Section 5 discusses the results, while Section 6 concludes the paper.

## 2. LITERATURE REVIEW

Digital transformation can be characterized as the “vehicle” to change the way that a state serves its citizens, plans processes, implements actions and solutions in solving different issues. The ranking of Greece in international indicators that assessing the digital maturity of countries around the world is relatively low (Shrivastava *et al.*, 2021; Allen *et al.*, 2022; Chaudhuri *et al.*, 2022; Hadjielias *et al.*, 2022). In 2020, the country is ranked 27<sup>th</sup> among the 28 EU countries considering the Digital Economy and Society Index (DESI). Also, Greece occupies the 42<sup>nd</sup> position among the 193 countries of the 2020 survey for the E-Government Development Index (EGDI), the 27<sup>th</sup> place among the 28 EU countries for the ICT Development Index (IDI). Greece is ranked 38<sup>th</sup> among 192 countries (2017) and 25<sup>th</sup> among EU countries for the Digital Evolution Index (DEI). Finally, the country is in the 38<sup>th</sup> place among the 60 countries surveyed for 2017, while in the Enabling Digitalization Index (EDI) Greece is ranked 43<sup>rd</sup> among 115 countries for in 2019. Given the low digital performance, Greece now lacks valuable time to implement gradual and “evolving” digital strategies, as did other digitally developed countries today (e.g., Norway, Finland, the United Kingdom, etc.). These countries began their digital transformation several years ago, while the pace of technological developments was still low, implementing gradual steps, which were redefined at regular intervals, to meet their changing national goals and to integrate emerging digital technologies (Chaudhuri *et al.*, 2022).

The rapid speed of technological changes, combined with the low digital maturity of Greece, creates the urgent need for the country to act directly, in multiple axes, synchronized and in a limited time horizon, through the implementation of a "holistic" digital approach (Faruk *et al.*, 2021). Steps have already been taken in this direction, such as, for example, the important technological solutions developed by the Ministry of Digital Governance at a very fast pace to address the consequences of the coronavirus pandemic (Pan *et al.*, 2022). Only through such a direct, coordinated, and organized approach will Greece be able to accelerate its digital transformation, thus improving its position in indicators related to technology and innovation. The challenge is big, given the fact that digital technologies and related service creation models are evolving at speeds far beyond the adaptability of states. The forthcoming decades will be marked by the digital divide, as states that fail to achieve high levels of digital transformation and leverage effective digital tools such as Artificial Intelligence and big data analytics will be fatally marginalized (Said Mohamed *et al.*, 2021).

However, in the modern business arena, digital transformation is becoming more and more important for building a successful and sustainable business. Consumer buying behavior has changed, shaping a new reality, that of e-commerce and eco-friendly. As a result, companies need to evolve technologically and apply innovative digital methods to achieve customer satisfaction and loyalty (Pan *et al.*, 2022). The integration of new technologies in business operations can lead to improved customer satisfaction, increase business efficiency, and maximize profits. However, it is not enough for companies to adopt new technologies, it is also necessary to adapt them into their business strategy. So, digital transformation can be pointed out as the biggest strategic challenge for businesses today (Li *et al.*, 2020). Digital transformation is among the priorities of Greek food industry because this business sector is depended on consumer buying behavior. The industry is called upon to increase its production by 2050, to ensure the food security of the population. Although, productivity growth must be achieved through sustainable methods, addressing modern environmental challenges. In addition, food safety and quality requirements are needed to standardize and comply with specific certification and traceability systems for agricultural products and foodstuffs as well as propagating material (Riccaboni *et al.*, 2021). The digital transformation of the Ministry of Rural Development and Food from the current situation is now the only available way out to fulfill the industry its obligations towards the Greek state. The main priorities for the food sector serve the following objectives: (i) increase the efficiency of the management mechanism, reducing the administrative burden and offering better services to traders, through innovative tools, (ii) assistance in decision making and effective execution of controls utilizing modern remote sensing applications as well as big data technologies and Artificial Intelligence, (iii) the creation of data infrastructures and consulting services that will lead to the development of a long-term sustainable, efficient, transparent and sustainable agri-food system, and (iv) the traceability of Greek food (Ragazou, 2021).

Apart from digital transformation, green entrepreneurship was among the top priorities of the SMEs in the food industry as well in the pandemic of COVID-19. Green entrepreneurship is highlighted as an economic activity that respects the natural environment, at all stages from the production stage to the final disposal of the product and defers from sustainable entrepreneurship which aims to discover, create, and exploit the entrepreneurial opportunities that contribute to the sustainability by generating social and environmental gains for others in society. Green entrepreneurship tries to find solutions to various environmental and social problems, by implementing business ideas that are sustainable and have a positive impact on the

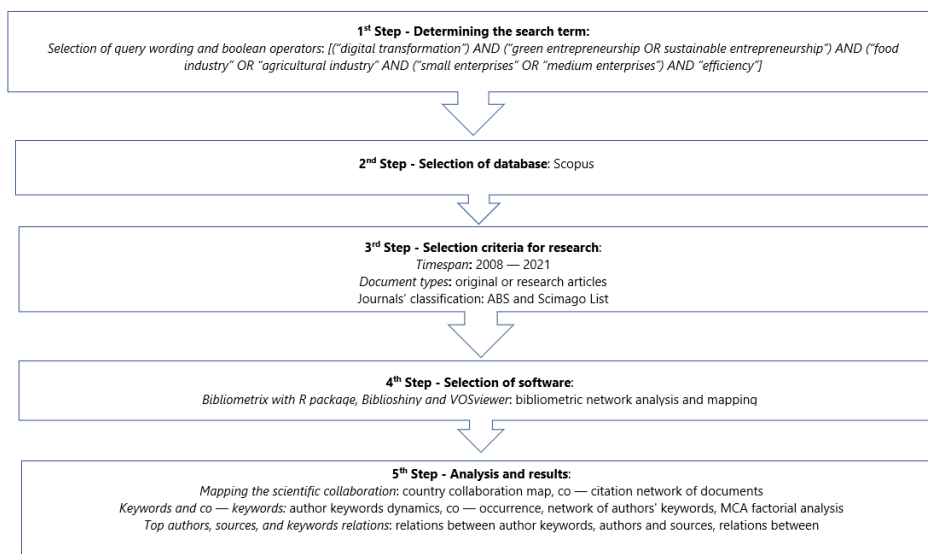
environment. In a business environment, businesses wish to utilize natural resources to produce quality products in an efficient manner. However, the use of these resources at a global level has led to a decrease in them, which does not help sustainable development. Compared to the traditional business model, green entrepreneurship set the protection of the environment as a priority. More specifically, a greater emphasis is placed on reducing the environmental footprint than on profitability. Moreover, the aim of green entrepreneurship is to improve people's quality of life and preserve or gently exploit the environment. Its activities cover all sectors of the economy, primary, secondary, tertiary. And all businesses can adopt them. A new market for products and services is being created for environmental practices. This is how businesses turn into new and innovative businesses with sustainable development and additional benefits for the local and national economy. Technological development combined with the increased interest of consumers in green products and services encourage changes in the existing business models of companies. Finally, SMEs that follow the green model presents a higher possibility to gain a comparative advantage due to high quality and loyal customers, since they address a special category of consumers who care about the environment. Also, this form of entrepreneurship attracts a more skilled workforce. In addition, green entrepreneurship can lead to the efficiency and resilient of the SMEs in the sector. For example, energy saving, reduction of imported quantities, reduction of trade balance deficit can increase of domestic energy autonomy. This will be achieved both through the energy that will be produced by the increase of businesses that will be active in the field of renewable energy sources, as well as through the energy that will be saved from the energy upgrades of public and private buildings and the environmental practices that will be followed in all stages of running a green business. In Greece country has a comparative advantage over other countries for the adoption of practices, such as the renewable energy practices (sunshine, high wind intensities especially on the islands, etc.), the utilization of ecotourism (it has one of the richest ecosystems in the world), but also a lot of room for improvement in other green sectors such as the energy upgrade of buildings, the circular economy through good waste management, etc. However, a few factors, such as economic instability, the prolonged period of economic recession, the high taxation, the pandemic of COVID-19 have act as a deterrent for the establishment of new green-oriented businesses, but also for the implementation of environmental investments by existing ones.

### 3. MATERIALS AND METHODS

Bibliometric analysis is one of the most well-known methods that can be used as a statistical evaluation for exploring and analyzing large volumes of scientific data. The aim of the bibliometric analysis is to detect the state of the art for a particular field and to highlight the most cited papers and examine their impact on the subsequent research by others. Among the most used bibliometric methods are citation or co-citation and content analysis. Regardless of the method to be used by the researcher, bibliometric analysis presents a comprehensive map of the structure of knowledge, its evaluation, and measurement that focuses on the bibliographic analysis of scientific publications collected in a database (Ellegaard & Wallin, 2015; Bui *et al.*, 2021; Niknejad *et al.*, 2021).

In the context of the study, Scopus database was selected as the main data source. Scopus is Elsevier's bibliography and citation search services. It is the largest database in the world of references and summaries from reputable international literature with smart tools that help researchers globally to retrieve, analyze and visualize parts of the information that they are

interested in. It includes over 20,500 titles from 5000 publishers worldwide, 49 million subscriptions, over 5.3 million conference papers, and 100% Medline coverage (Xie *et al.*, 2020). The data collection was carried out in February 2022 with the entered search terms to be the following: [“digital transformation” AND (“green entrepreneurship” or “sustainable entrepreneurship”) AND (“small enterprises” OR “medium enterprises” AND (“efficiency” OR “residence”))] (Figure no. 1). The search was carried out in English language, and the search of the keywords was made in the titles, abstracts, the main text, and authors’ keywords of the published work in the research field. The Scopus bibliographic citation database includes various types of documents, but only original articles, book chapters, and conference proceedings were considered in the present analysis. Consequently, 2,000 documents were selected for this analysis. The records for each publication retrieved during the search were converted as a Scopus BibTex file and imported into Biblioshiny and VOSviewer.



**Figure no. 1 – Workflow of research**

Source: own elaboration

Both the use of Bibliometrix and Biblioshiny packages allows the current research to produce bibliometric indicators for digital transformation as well as green entrepreneurship and its impact on the efficiency of Greek SMEs in the food sector, through the volume of publications or original papers, the number of citations and keywords. Moreover, the main results of the analysis are summarized through diagrams and maps, such as thematic map, country collaboration map, network visualization, which illustrate the research situation, MCA factorial analysis.

#### 4. RESULTS

The current study analyzed a total of 336 original articles for the timespan 2008-2021. Table no. 1 presents the journals with the most published articles in the field of digital

transformation and green entrepreneurship for the years 2008-2021. “Sustainability” was the journal with the highest number of published articles on the research field (44) during the period 2008-2021. “Technological Forecasting and Social Change” ranked second with 14 articles found on the subject area. Both “British Food Journal” and “Journal of Business Research” published 11 articles each, while the “Journal of Cleaner Production” published 9 articles. It is worthy to note that only 5 journals have produced the 26% of the 336 articles. Moreover, many of the most cited journals on the field digital transformation and green entrepreneurship of SMEs in the food industry are indexed by Scopus, Scimago list and ABS list.

**Table no. 1 – Most related sources in the research field**

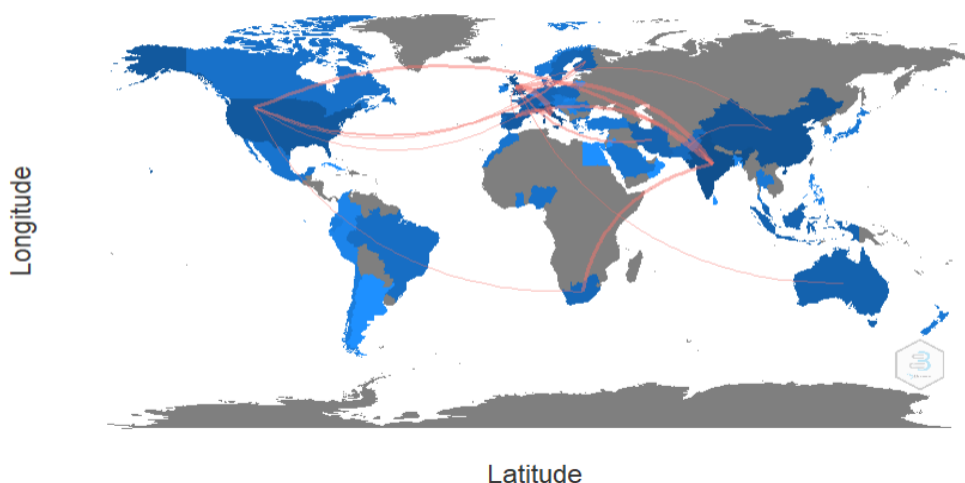
Sources	Articles	Research subject area	h-Index	Ranking by Scimago	Ranking by ABS list
Sustainability (Switzerland)	44	Environmental Science	109	Q1	
Technological Forecasting and Social Change	14	Business, Management and Accounting	134	Q1	3***
British Food Journal	11	Food Science	86	Q2	1*
Journal of Business Research	11	Business, Management and Accounting	217	Q1	3***
Journal of Cleaner Production	9	Business, Management and Accounting	232	Q1	2**
Energies	7	Energy	111	Q1	
Journal of Open Innovation: Technology Market and Complexity	6	Economics, Econometrics and Finance	28	Q1	
IEEE Access	4	Computer Science	158	Q1	
Industrial Management and Data Systems	4	Business, Management and Accounting	109	Q1	2**
Technovation	4	Business, Management and Accounting	140	Q1	3***
Business Strategy and the Environment	3	Business, Management and Accounting	115	Q1	3***
Environmental Science and Pollution Research	3				
European Management Journal	3	Business, Management and Accounting	109	Q1	2**
IOP Conference Series: Earth and Environmental Science	3	Environmental Science	34		
Journal of Asia Business Studies	3	Business, Management and Accounting	20	Q1	1*
Journal of Enterprise Information Management	3	Business, Management and Accounting	67	Q1	2**
Meditari Accountancy Research	3	Business, Management and Accounting	27	Q1	1*
Sustainable Production and Consumption	3	Environmental Science	38	Q1	
Agronomy	2	Agricultural and Biological Sciences	50	Q1	

Source: Scopus/Biblioshiny

Figure no. 2 presents the geographical collaboration of the authors in the field of digital transformation and green entrepreneurship in the Greek SMEs in the food industry. The visualization of this scientific collaboration was actualized by using Bibliometrix's tool Biblioshiny. The aim of this geographical collaboration analysis is to highlight the social structure of the research community in the studied field. The nodes in the graph represents the authors, while links represent the co-authorship. It is obvious from the map that USA is the origin of most of the scientific collaborations in the field, as well as the strongest scientific channel is between USA and Europe, as well as Europe and India. Digital technologies are radically changing all sectors of the economy. The application and adoption of digital technologies as well as the utilization of digital skills are no longer an optional action for businesses but a key factor of survival. European Union (EU) has recognized the importance of the digitization of the economy and its role as a lever for growth and prosperity of the European countries. So, Europe in 2016 developed the strategy for the digitization of the European Industry (Digitizing European Industry-DEI Strategy), which aims to strengthen the competitiveness of the EU. This strategy will ensure that all European economic sectors have the opportunity to take full advantage of digital innovations. In the context of the strategy for the digitization of European Industry, the Digital Transformation Scorecard was created, complementary to the DESI index, which deepens the digital maturity of the economies of the EU Member States (Alwis *et al.*, 2022).

Greece, both in the Digital Economy & Society Index - DESI and the Digital Transformation Scorecard, lags behind its European partners in most areas related to the digitization and digital education of the workforce, while it is relatively high in the individual indicators concerning businesses (Alwis *et al.*, 2022). The gradual increase of their digital maturity and the decrease of their distance from the European average is an encouraging element and possibly indicates that the Greek companies have already started their digital transformation. Greek companies today rely heavily on information systems to support their business processes, as well as customer and supply chain support. At the same time, online advertising services, such as advertising on search engines on the Internet as well as on social networking platforms, have begun to be used in promotional services (Hadjielias *et al.*, 2022). The online presence of domestic small and medium enterprises is gradually improving by utilizing more and more applications in mobile devices while at the same time improving the security of e-commerce. In terms of infrastructure, companies are already transferring part of their data to cloud computing services, while at the same time the preference for operating models of business information systems provided as a service is increasing (Donaldson, 2022). At the service level, progress is also being made in areas such as integrated service delivery, transaction processing and online customer support. Already, e-banking is being enriched with additional services while at the same time the market is already utilizing at an ever-increasing rate, e-invoicing services, a practice that is expected to be generalized in combination with the electronic bookkeeping. Regarding the actions of production automation, use of Industry 4.0 technologies (e.g., Big data analytics, Internet of Things - IoT, simulation and modeling, cybersecurity, forecast maintenance, etc.), it is observed that the largest industrial companies have already started serious investments. while SMEs, regardless of sector, seem to be lagging behind and in need of specialized support (Faruk *et al.*, 2021).

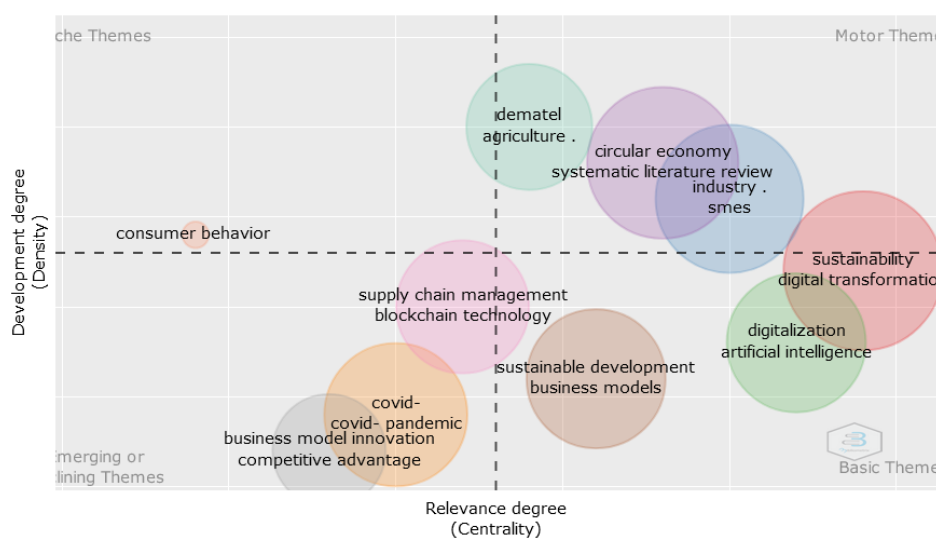




**Figure no. 2 – Country collaborations map**  
*Source: Scopus/Biblioshiny*

The aim of the keyword analysis is to highlight the direction and the key trends of the research. [Figure no. 3](#) presents the network visualization based on the co-occurrence of authors' keywords. To visualize the co-occurrence of authors' keywords VOSviewer tool was used. In [Figure no. 3](#) each of the circle illustrates the occurrence. The bigger the size of the circle, the stronger the is the co-occurrence of authors' keywords. The similar color of the circles indicates the cluster of the keywords and the lines between the circles show the link between the keywords. A total of 36 words were selected and divided into eight clusters, while each cluster has a different color. This figure shows that in the age of the green and digital transition, SMEs in the food industry should redefine its priorities and goals. The technologies of the 4th industrial revolution "invade" in every link of the food industry's operation from the production of the products to the delivery of them to the consumer ([Faruk et al., 2021](#)). At the same time, the growing consumer demand for environmentally business practices is fully in line with the European Commission's guidelines for Member States. Both transformations occur simultaneously and change the way commercial enterprises operate in every corner of the globe. The speed of change is such that in no time it brings new ideas and business initiatives to the protagonists of the business and just as quickly turns into the tails of digital and green competition the SMEs that do not find the resources to meet the new type of challenges ([Pan et al., 2022](#)).

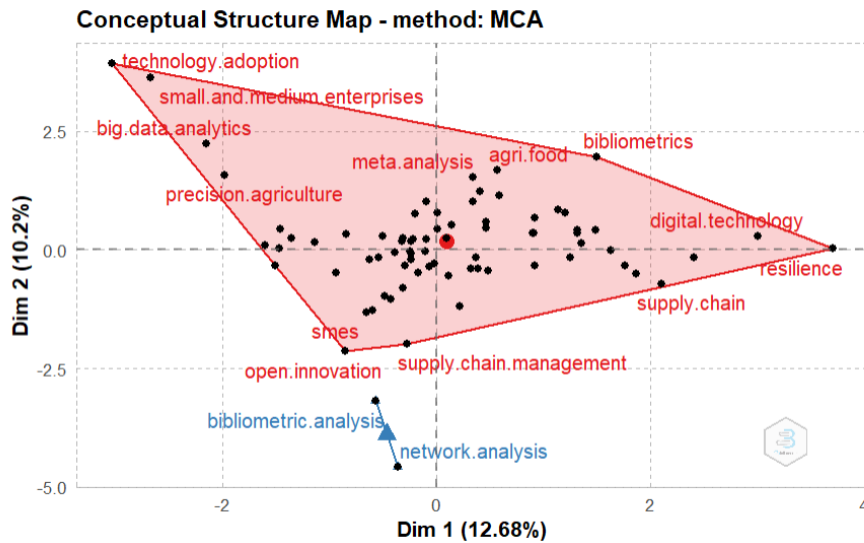




**Figure no. 4 – Thematic map**

Source: Scopus/Biblioshiny

Figure no. 5 illustrates the results from the factorial analysis of the documents with the assistance of Multiple Correspondence Analysis (MCA). MCA method is used to define, examine, and visualize the relationship among two or more categorical variables. The visualization of the results is presented in a conceptual structure map. In the current research, the map of the MCA method shows the clustering of documents and indicates the importance of integration of emerging and eco-friendly technologies by the SMEs in the food sector (Aria & Cuccurullo, 2017; Kamaruzzaman *et al.*, 2022). However, results of MCA show that SMEs in the food industry should focus mostly on the digitalization of their logistics. Logistics consists of the physical transport of goods, both as inputs to an industry, commercial enterprise or warehouse, their management within the premises, and their distribution to customers, usually within the urban fabric (Behera *et al.*, 2015; Suh *et al.*, 2019; Nekhoroshkov *et al.*, 2022). Each stage of logistics requires a digital capture of their physical management. The higher the level of digital maturity of logistics companies, the ability to collect, exchange and process data with partners, customers and public services that regulate the industry, the lower the cost and time of cargo management (Faruk *et al.*, 2021). The effectiveness of logistics of SMEs in the food sector depends not only on the level of their own digital maturity, but also that of their partners and the public. For the digital transformation and upgrading of the logistics, the following actions are considered as necessary: (i) establishment of digital documents (eCMR, bill of lading, invoices, consignment notes, etc.) that will be introduced only once and will be available primarily throughout the supply chain and regulators as well as statistics freely available to all companies in the industry, (ii) interconnection and possibility of digital customs clearance, before even the natural goods reach the customs, and (iii) support of the digital transformation of the facilities by strengthening investments in automation and robotic systems (Yang *et al.*, 2021; Zhang *et al.*, 2022).



**Figure no. 5 – Factorial analysis**  
 Source: Scopus/ Biblioshiny

## 5. DISCUSSION

Digital transformation is an ongoing process that creates opportunities for businesses but requires training and infrastructure. It requires a change in the way the organization or business is organized and not just a change in the technological tools it uses. Digital technology and automation are among the most serious challenges for our economy along with climate change and the reorganization of world trade (Saputra *et al.*, 2022). Countries that are left behind in this technological road race are in danger of receiving significant negative impacts on their economies and social cohesion. Access to high-speed broadband networks, the use of systems storage, analysis & data management, the use of mobile devices & mobile applications, the use of in-house design & customer service systems, employee specialization & digital skills, the use of electronic communication & social media systems, the use of e-commerce, financial services applications, digital applications in public administration, cybersecurity systems, 3D printing technology, Artificial Intelligence, augmented and digital reality, are some of the key tools a business can use to digitally transform itself (Faruk *et al.*, 2021; Ragazou, 2021; Verdouw *et al.*, 2021; Nekhoroshkov *et al.*, 2022). Digital policy at international level follows the guidelines of the OECD and the UN. At European level, it is directly linked to the European Union's "Digital Strategy", which focuses on three pillars that ensure the digital transformation for the benefit of its citizens, businesses, and governments. At the national level, digital policy is defined by the "National Digital Strategy" and the recent "Development Law". Indicators from the European Commission and official bodies, as well as quantitative business surveys, are used to assess a country's progress in integrating digital transformation and to compare it with other EU countries to determine its degree of convergence (Faruk *et al.*, 2021).

Greek companies are far behind in the integration of digital technology compared to the rest of the European Union, in the last positions compared to the rest of the EU countries, while this happens mainly in very large companies and very small degree in small businesses. Although there is a belief, especially in large companies, that digital transformation is important in the competitiveness and profitability of companies, investments and the introduction of digital transformation remain low in all Greek companies. The use of the internet in our country and the access to the broadband networks have been expanding in recent years in a large percentage of the population, a percentage that remains lower than the European average, both for households and for businesses. Nevertheless, household and business access to high-speed and ultra-high-speed broadband networks remains low. Less than half of the jobs in Greece use a computer and half of the companies use mobile devices, which allows them to work remotely. Almost half of the employees have basic computer skills, but the number of specialized staff and graduates in the field of Information & Communication Technology is very limited. The ICT sector in our country lags in relation to other European countries, has a small contribution to Greek GDP and with small percentages of exports in products and services.

The importance of the agri-food sector for the global and local economy is undeniable. In Greece, according to data for 2019, the food, beverage and tobacco industry maintains the first place in number of companies, among the manufacturing sectors (16,263 companies out of a total of 57,014), and is the largest employer of domestic processing, with a rate of 39% (Baltas, 2008; Niknejad *et al.*, 2021). At the same time, in 2020, the domestic agricultural sector contributed 4.7% of the total Gross Value Added (GVA), while employing over 400 thousand people, or a percentage that exceeds 10% of the total employed potential. This number is significantly lower than in 2001, when the industry employed 666 thousand people. By comparison, globally, the contribution of the agricultural sector to global Gross Domestic Product (GDP) is estimated at 4.3%. It is indicative that the value added of the industry internationally, increased by 73% between 2000 and 2019, to about \$ 3.5 trillion (Baltas, 2008). Along with its contribution to economic growth and prosperity, the industry also ensures social cohesion, while also contributing to the eradication of poverty. At EU level, Greece ranks second after Romania in terms of the value-added contribution of the agricultural sector to GDP in 2020 (3.5%), third, after Romania and Bulgaria, in 2019, in terms of employment in the agricultural sector (10%) and the seventh place in terms of population in rural areas over the total rural population of the EU. (3.6%) (Baltas, 2008). In 2020, Greece contributed to 3.4% of total EU agricultural production, a performance that places it in eighth place. The agri-food sector also contributes significantly to Greek exports. After many years, during which the trade balance of its products remained in deficit, in 2020 it presented a surplus in the trade balance, amounting to € 207 million, due to the improved export performance, combined with a small decrease in imports (Popkova & Sergi, 2020).

In the 1940s, the average farmer could produce food for about 10 people. Today, groundbreaking advances in equipment, genetics and digital tools make it possible for any farmer to produce food for more than 160 people, who can live long distances. In the coming years, developments in technology are expected to create even greater opportunities, so that the Agri-food sector can further increase its productivity and meet the challenges it faces (Varshney *et al.*, 2021; Alwis *et al.*, 2022; Boursianis *et al.*, 2022; Fraser, 2022). The farm of the future will take advantage of digital innovation, through a wide range of connected devices, while advanced data collection technologies (eg drones, robotic field scanners) and

machine learning algorithms will help farmers to monitor farm through control panels, and in making the right decisions (Ragazou, 2021). At the same time, productive innovations will continue to create new opportunities that will help reduce costs, exploit new resources and reduce the environmental footprint of the agri-food sector. So, food sector has begun to build next-generation food systems using new technologies. In this way they have been able to accelerate the path to a zero-emission future, improve flexibility and profitability, and meet consumer expectations for safety, sustainability, and transparency. In relation to the digital transformation of the food industry, we conclude that the use of digital technologies should focus on all areas of the value chain, with particular emphasis on end-consumer management (Fan, 2022).

Results of this study presents that SMEs' goal to improve efficiency is not the only one that leads them to follow practices related to the digital transformation and green entrepreneurship. The shift of consumers towards the environment has created a new type of consumer, the environmentally responsible or as it is better known, "green" consumer, which focus on products that are technological advanced and eco-friendly. This segment of consumers is characterized by their interest in environmental issues and shows a strong preference for "green" products and tries to meet their needs by looking for environmentally friendly items and environmentally conscious manufacturing companies. In fact, they are willing to pay more for the purchase of green products compared to conventional ones. Based on the above SMEs in the food industry should follow two main approaches to communicate to consumers information about sustainability and their attitude towards the environment: (i) they either have to resort to a free communication policy or (ii) to use sustainability labels attributed by a third party.

Moreover, findings of the study highlight that SMEs should focus on the digitalization and the integration of green practices to their logistics department. The COVID-19 pandemic has highlighted the need for greater flexibility, faster response, and resilience of businesses in the food sector to fluctuations in demand and supply. In this context, the utilization of solutions incorporating industry / logistics 4.0 technologies proved in practice to be the best solution for responding to the challenges of the emerging new era. In any case, the process of digital transformation of the logistics industry had started before the pandemic. The shift to the goal of greater flexibility over cost reduction was already beginning to become evident due to the gradual emergence of the electronic sales channel at the top of consumer preferences. To meet the technological intersections, the industry has had to find ways to adapt appropriately, reducing its reaction times so that supply converges with demand. Digital transformation creates multiple benefits that contribute decisively to the competitiveness and sustainability of businesses. The adoption of state-of-the-art technologies within the logistics facilities comes to make a decisive contribution to the monitoring, control and management of the goods. Their goal is to improve productivity, reduce cost and error rate, and accelerate rapid response to production and delivery requirements. It is a fact that in Greece too, more and more logistics companies are starting their digital transformation journey, investing in innovative technological solutions such as the Internet of Things, the management of large volumes of data, the use of augmented reality for order collection, the use of autonomous or / and unmanned vehicles, as well as the use of intelligent transport systems.

## 6. CONCLUSION

Historically, the role of technology has been particularly catalytic during the developments as recorded with the 3<sup>rd</sup> Industrial Revolution, through the effect of technology and engineering in particular that changed a lot both in the way people live and in the way businesses operate. Accepting that we are experiencing the 4th Revolution, this time Digital, the effects on society as well as the business world are enormous. The pandemic that is still ongoing has highlighted as a magnifying glass the role of digital technology and data, as the tools deployed both to deal with it and to adapt and continue operations under new conditions. One could not leave out of such a historical reference the fact that in recent years, the most valuable companies are companies that create and offer digital products, taking the scepter from industries that we now consider traditional. While the phrase has a different meaning for each business, it ultimately signals a radical rethinking of how the organization wishes to use technology, processes, and people to evolve its business performance. And while there are more and more references to the need for Digital Transformation of businesses, as the new inevitable evolutionary element in a Darwinian world where the fittest survives, the reference to the term is made with an emphasis on the digitization element rather than the transformation. The emphasis should be on given to the transformation, on the course, on the path (duration) and ideally following an agile approach, which a company should follow, during which by adopting digital tools it will redesign and improve its operations. The value therefore lies primarily in the transformation and secondarily in the digitization itself. Their difference is the same as the difference between outcomes and outputs. The main goal of Digital Transformation, which cannot be understood as one project or even as a set of projects, are the consequences in the whole operation of the business (business outcomes) and not in the individual results of the activities and actions that help to achieve the goals of the projects. The consequences of the transformation should be reflected in concepts such as corporate culture, skills, innovation, competitive advantages, etc., affecting every point of the company's value chain.

Today, technology is changing the way we live every day, shaping a brand new world. Companies evolve their services and products by offering consumers improved experiences while at the same time educating them in new conditions. For these very reasons, technological modernization is the immediate priority of every modern business, in whatever field it operates since it can offer unlimited possibilities and multiple benefits. In an environment where large enterprises are investing and becoming more competitive, widening the gap that separates them from SMEs and with a series of changes related to the pandemic such as the skyrocketing of e-commerce and the expansion of telecommuting, the digital transformation of SMEs it is not simply a choice but a strategic necessity. And the pandemic and the energy crisis may be putting pressure on profitability and dissipating SMEs' investments in their digitization, but there are today technological solutions such as the cloud that offer important solutions without requiring large investments in infrastructure.

In the modern era, digital technology is becoming more and more important for building a successful business. The purchasing behavior of consumers has changed forming a new reality, that of e-commerce. This has resulted in companies having to evolve technologically and implement innovative digital methods in order to achieve customer satisfaction and loyalty. Integrating new technologies into business operations can lead to improved customer satisfaction, lead to increased business efficiency and maximized profit. However, it is not enough for companies to simply adopt new technologies, it is necessary to adapt their business

strategy as well. We could say that digital transformation is the biggest strategic challenge facing businesses today. The scope of this study was to highlight the research trends for both green and digital transformation in the food industry and (ii) to investigate the contribution of the above business models to the efficiency and sustainability of SMEs in the sector. However, future research should focus on the investigation of the role of digital transformation in the strategic planning of businesses both at the European and national level emphasizing the digital technologies that are considered important for their future development and the digital skills of the staff.

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#### ORCID

George Sklavos  <https://orcid.org/0000-0003-4291-855X>

Marie-Noelle Duquenne  <https://orcid.org/0000-0002-3189-5658>

George Theodossiou  <https://orcid.org/0000-0001-7241-8084>

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