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NEW TRENDS AND PATTERNS IN GREEN COMPETITIVENESS: A BIBLIOMETRIC ANALYSIS OF EVOLUTION

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Abstract. Global population growth, advancement of technological innovations, features of economic development, total digitization of production, and increase of consumption determine the necessity of forming companies' green competitive advantages. In order to create a terminological basis and research the main trends in the development of the concept of "green competitiveness of businesses" there was carried out a bibliometric analysis using the VOSViewer software 1.6.13 and Scopus Tools Analysis. A sample of 54,753 relevant scientific publications indexed by Scopus scientometric databases was generated for the period of 1991–2021. The results of the bibliometric analysis made it possible to determine the basic prerequisites and the main stages of forming green competitive advantages: the first is related to the traditional understanding of competitiveness, its global measurement, the development of the processes of greening economic activity; the second is related to the greening of business activities and the development of the green economy; the third is related to the analysis of competitiveness in the context of green marketing strategies; the fourth is related to shaping the concept of green competitiveness directly. The conducted research formed a theoretical basis for clarifying the content of the concept of green competitiveness as an ability of an enterprise to form and effectively use green competitive advantages, their convergent and complementary effects, which ensure the sustainable development of enterprises, the expansion of the enterprise's competitive position on the market, the increase of investment attractiveness and capitalization, and the formation of an environmental brand.

Keywords: sustainable development, green economy, green marketing, green competitiveness

JEL Classification: O1; Q5; Q56

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1. Introduction

Modern trends in global population growth, advancement of technological innovations, features of economic development, total digitization of production and consumption are driving forces all over the world. Predictive estimations of the national economies' development indicate not only the preservation of existing consumption trends but their intensification as well. This especially applies to such countries as China, India, and the USA. According to World Bank estimates, the global population will reach 9 billion by 2050, which is largely due to the growth of national economies in developing countries and the increase in the population of the countries with the lower income per capita. Today, humanity already exceeds the Earth's capacity to maintain an appropriate level of consumption. Global GDP is projected to grow by 325% between 2007 and 2050 (Policies, 2011). At the same time, according to analysts' forecast, 60% of it will fall on the share of consumer spending on goods and services. An evaluation of the development trends in the leading countries shows that the most populated countries, China and India, are developing extremely quickly and intensively. Thus, by 2025, China's GDP should approach the level of the US GDP. India's GDP is expected to rival that of Japan, and by 2050, approach that of the United States. Meanwhile, by 2050, the GDP of Mexico, Brazil and Indonesia is projected to exceed that of the UK. In addition, most economies of developing countries can catch up with Great Britain in terms of GDP by 2050 (OECD, 1998). At the same time, rapid economic development leads to degradation of the natural environment, depletion of natural resources, and increasing of the global climate change. Today, both the reorientation of the business sector's activities towards environmentally oriented technologies in production and management, and the use of behavioural tools based on the stimulation of changing consumption traditions, the motivation of the transition to ecologically balanced and harmonious consumption, are relevant (Chygryn, O. et al, 2020). Appropriate measures will ensure green competitive advantages of the business sector in foreign and domestic markets and will decrease anthropogenic pressure on the environment. The purpose of the paper is to study the evolution and patterns of shaping the theory of green competitiveness as a basis for creating the relevant competitive advantages of enterprises.

2. Literature Review

The scientific community made a significant progress in determining the main determinants of sustainable development of the national economy and business sector. The main strategic directions that form the sustainable competitive development are the following: designing state strategies for sustainable development (Artyukhov et al. 2021; Bilan et al. 2019; Didenko et al. 2020; Lyulyov et al. 2019); ensuring the implementation of environmental protection programs (Hens et al. 2019), promoting the development of innovations (Tih et al. 2016; Kwilinski 2018; Pimonenko et al. 2021); improving organizational and economic mechanisms of ecologically oriented development at all levels of economic activity (Dementyev et al. 2020; Dzwigol et al., 2020; Kozlov 2021); providing renewable energy sources (Us et al. 2021); smart transformation of the energy sector (Kharazishvili 2021; Kuzior et al. 2021; Vakulenko et al. 2021; Lyulyov et al., 2021); promoting green investments, development of green

infrastructure and green marketing (Lyonov et al. 2021; Tambovceva et al. 2020; Panchenko et al. 2021; Letunovska et al. 2021; Yang et al. 2021); unlocking the economic potential (Abazov 1997, 2010; Dźwigoł & Wolniak, 2018; Miśkiewicz 2018, 2019, 2020, 2021a, 2021b, 2022); functioning and elaborating energy systems (Coban et al. 2022; Miskiewicz et al. 2021, 2022; Moskalenko et al. 2022a, 2022b); energy and social security (Kharazishvili et al. 2020, 2021; Kotowicz et al. 2022; Kuzior et al. 2021; Hezam et al. 2023; Hussainet al. 2021; Miskiewicz et al. 2021, 2022; Prokopenko and Miśkiewicz 2020; Saługa 2020, 2021); development of information systems (Bogachov et al. 2020; Borodin et al. 2021; Drożdż et al. 2020a, 2020b, 2021; Dzwigol 2020,2021, 2022; Dźwigol et al. 2019, 2020; Melnychenko 2020, 2021a, 2021b); determination of bifurcation points (Ingber 2017; Kianpour et al. 2021; Kwilinski 2019; Kwilinski et al. 2019a, 2019b, 2019c, 2020a, 2020b, 2020c, 2020d, 2021, 2022a, 2022b, 2022c); a systematic approach in determining the optimum (Lyulyov et al. 2021a, 2021b; Polcyn et al. 2022; Szczepańska-Woszczyna and Gatnar 2022; Tkachenko et al. 2019a, 2019b; Trzeciak et al. 2022; Vaníčková and Szczepańska-Woszczyna 2020; Yang et al. 2021). However, there are no studies of the evolution of forming green competitive advantages of enterprises.

3. Methods

Based on the past studies (Bilan et al., 2020) this this investigation applied the bibliometric analysis. A thorough study of the interrelationships among the related concepts of competitiveness, the study of the thematic focus of research, and authorship of publications, called for using the appropriate software VOSviewer 1.6.13, a software tool for constructing and visualising bibliometric networks, which may include journals, researchers, or individual publications, and are created based on citation, bibliographic linkage, co-citation, or co-authorship ratios.

With the aim of forming a terminological basis and researching the dominant trends in the development of the concept "green competitiveness of enterprises", this paper carried out a bibliometric analysis of the evolution of the concept "competitiveness" in relation to the theories of sustainable development, the business sector greening, green economy and green marketing using the VOSViewer software 1.6.13. For this purpose, a sample of 54,753 relevant scientific publications indexed by Scopus scientometric databases was generated for the period of 1991–2021.

4. Results and Discussion

The dynamics of publication activity, presented in Figure 1, characterizes the rapid growth of publications since 2002. The relevant trend is explained, among other things, by the World Summit on Sustainable Development, held from August 26 to September 4, 2002 in Johannesburg, South African Republic, with the purpose to analyse and evaluate achievements in the field of environmental protection, monitor the changes that have occurred, and identify new issues since the 1992 Planet Earth Summit (UNDP, 2018).

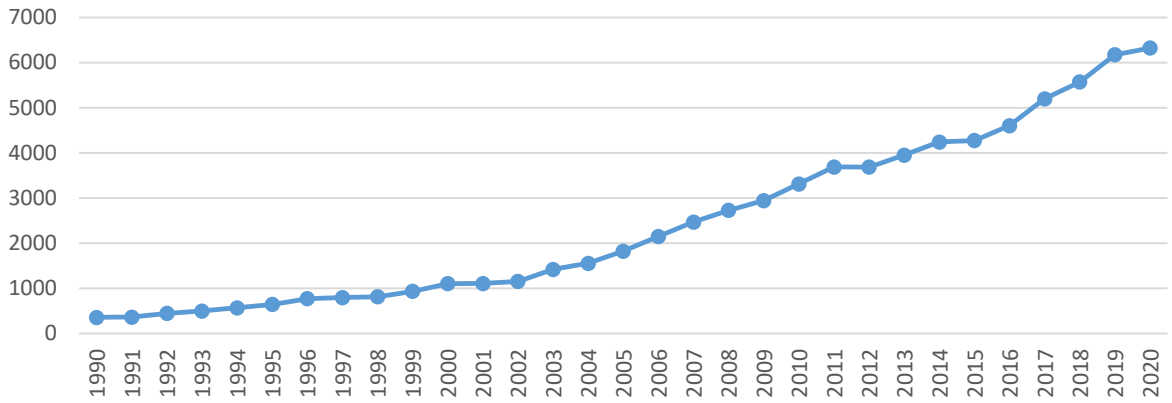

Figure 1. Dynamics of scientific publications devoted to competitiveness and green economy
Source: compiled by the authors based on the Scopus database.

The growing relevance of these studies is followed by the intensification of scientific articles that promote the principles of sustainable development, green economy and clean production. Figure 2 describes the growth of publishing activity in specific global publications.

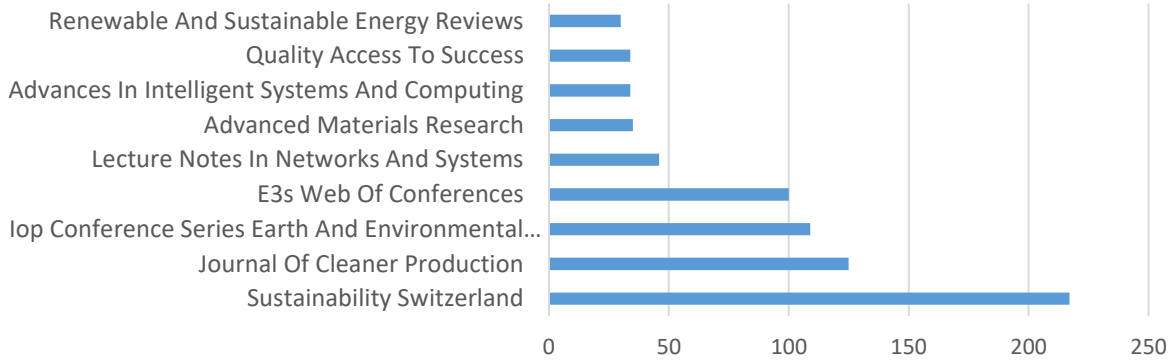

Figure 2. Scientific publications devoted to the issues of sustainable development
Source: compiled by the authors based on the Scopus database.

Thus, since 2012, the number of scientific articles on the topic of competitiveness and green economy in such scientific publications as "Sustainability," "IOP Conference Series Earth and Environmental Science," and "E3s Web of Conference" has significantly increased.

Figure 3 presents the results of the analysis of the affiliation of scientific publications on the subject of competitiveness and green economy. The results of studying the affiliation of scientific publications, presented in Figure 3, testify to the actualization of the relevant topic of scientific research at the state level, since affiliation is determined by such state scientific institutions as, for example: Chinese Academy of Sciences (more than 350 publications); Hong Kong Polytechnic University (more than 300 publications); Economic Academy in Bucharest; National University of Singapore; National Centre for Scientific Research of France; Ministry of Education of China; University of Cambridge; National Centre for Scientific Research of France.

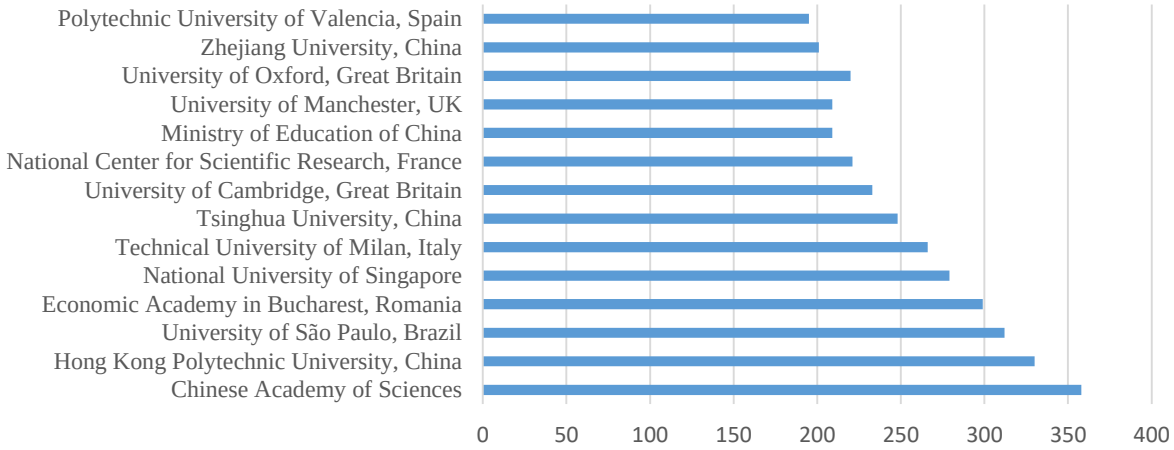

Figure 3. Affiliation of scientific publications on competitiveness and green economy
Source: compiled by the authors based on the Scopus database.

In addition, a significant part of scientific research on the topic of competitiveness and green economy is presented by such powerful scientific institutions as Cambridge University, Oxford University, and Manchester University.

The results of a retrospective analysis in the evolutionary time dimension made it possible to identify the four most significant evolution stages of the theory of green competitiveness (Figure 4).

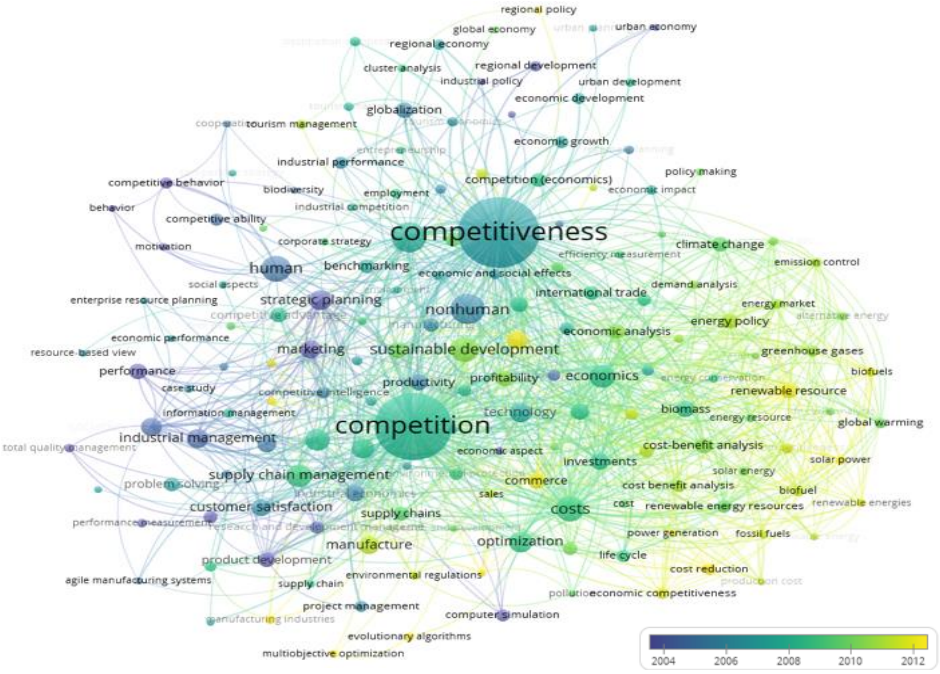

Figure 4. The results of the evolutionary clustering of economic research areas depending on their relationship with the theory of competitiveness
Source: compiled by the authors using the VOSViewer software.

The first stage is related to the transformation of the classical understanding of the category of "competitiveness". An evolutionary analysis of the cross-sector use of keyword combinations in scientific works made it possible to distinguish between the following dimensions: traditional (2004-2006), where competitiveness is studied in close relationship with the categories "resources," "technology," "staff," "management," "marketing;" global (2006-2010), where competitiveness is associated with the categories "economic growth," "globalization," "benchmarking," "international trade"; ecologically oriented (2010-2012), where competitiveness is related to the categories "environmental protection," "resource conservation," "renewable energy sources," "energy policy," "sustainable development."

The second stage of the green competitiveness evolution made it possible to reveal the following patterns. Relevant scientific research is characterized by the emergence and dominance of two new trends in cross-sector research that reflect the development of the green economy and determine the competitive advantages of enterprises through applying ecopolitics tools, and implementing resource-saving technologies, developing green production, and green innovations. Figure 5 presents the results of the evolution of the relationship among the concepts of "competitiveness", "greening of the business sector" and "green economy".

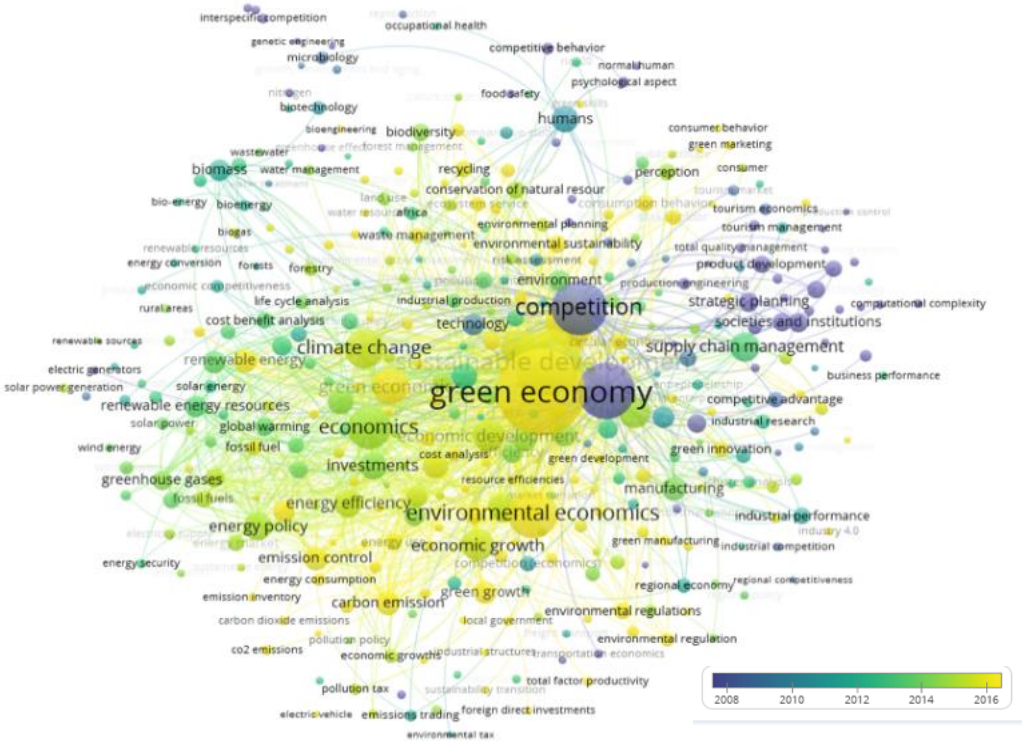

Figure 5. A visualization map of the evolution of the relationship among the concepts of "competitiveness", "greening of the business sector" and "green economy"
Source: compiled by the authors using the VOSViewer software

From the point of view of the time dimension, the first cluster (2010-2014) is singled out, which characterizes the processes of the business sector greening, where such categories as renewable energy sources, bioenergy, waste management, biotechnologies, etc. are used. The second cluster (2014-2018) determines the density of relationships among the key category of "competitiveness" and categories of the green economy (environmental regulation, recycling, environmental planning, environmental taxes, etc.) at the macro and micro levels.

The dynamics of relevant scientific publications, presented in Figure 6, shows a significant increase in publishing activity about competitiveness and green marketing, starting from 2008. This trend indicates that the scientific community is beginning to study competitiveness from the viewpoint of the determinants that ensure it. At the same time, one of the effective tools that will ensure the promotion of green competitive advantages in the market is green marketing.

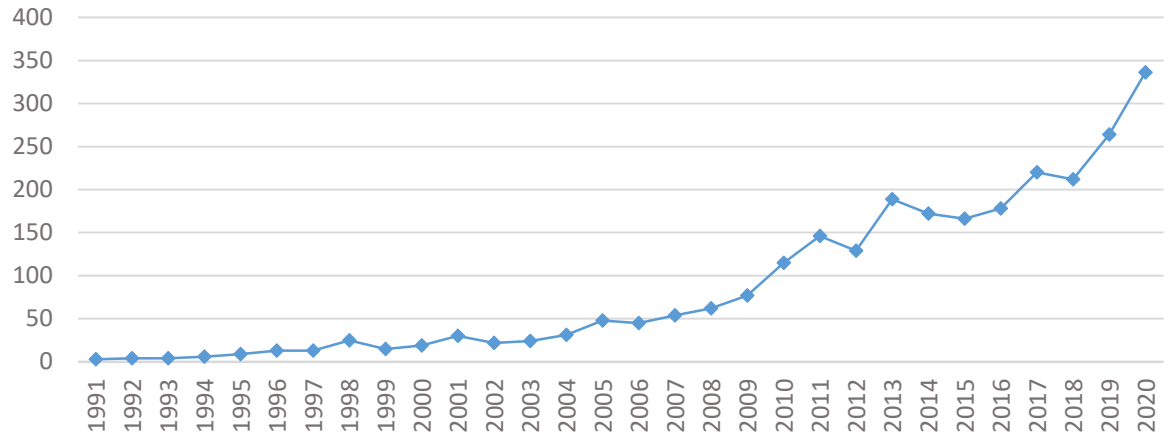

Figure 6. Dynamics of scientific publications devoted to competitiveness and green marketing
Source: compiled by the authors based on the Scopus database

The growth of relevant activity was, among other things, the result of holding the 2012 UN World Conference on Sustainable Development under the name "Rio-2012" or "Rio +20". The main topics raised at the conference were (Colenbrander et al., 2015): transition to a "green" economy, climate change, social aspects and the creation of green urban infrastructure, promoting the use of renewable energy sources in order to reduce greenhouse gas emissions and promote economic growth, improving forestry management, increasing the efficiency of using water resources. The main result of this stage was the formulation of the green economy concept and the establishment of the institutional framework for sustainable development. Figure 7 presents the authors who have the largest number of publications on the relevant topic.

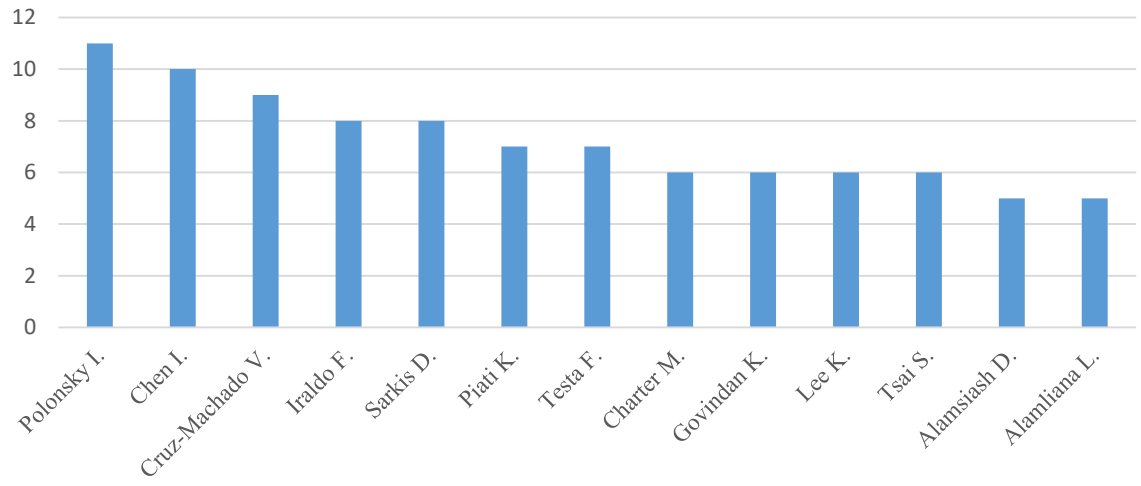

Figure 7. Contribution of individual scholars to the research on competitiveness and green marketing
Source: compiled by the authors based on the Scopus database

The diagram in Figure 8 presents the results of the analysis of the international affiliation of scientific publications devoted to competitiveness and green marketing.

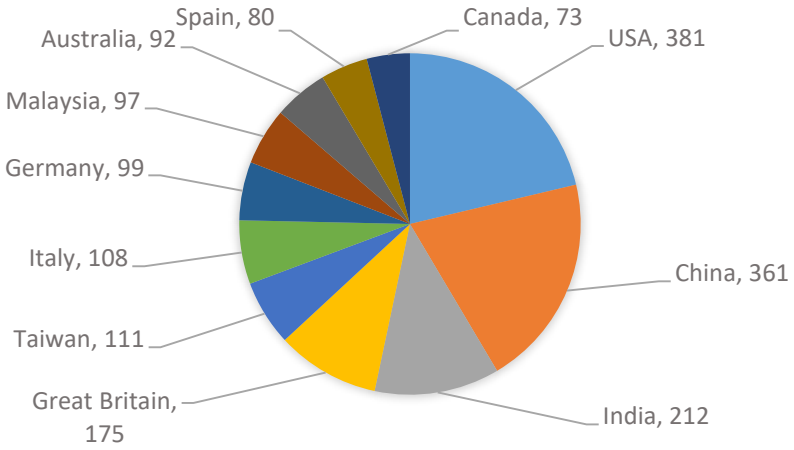

Figure 8. Contribution of individual scientists to research on competitiveness and green marketing
Source: compiled by the authors based on the Scopus database.

Thus, the USA (381 publications) and China (361 publications) are the undisputed leaders in promoting relevant scientific topics. The third position confidently belongs to Indian scientists, who have 212 publications on the specified topic, and the fourth place is occupied by Great Britain (175 publications). The analysis of the third stage of the evolution of the green competitiveness concept (Figure 9) indicate that it is related to the elaboration of the concept "green marketing" and the implementation of its tools as a determinant of ensuring competitiveness of enterprises. The dominant keywords in 2014 are environmental policy, and energy efficiency; in 2015 – green marketing strategies, green purchases; in 2016 - greenwashing, green advertising, ecological labelling, and green logistics.

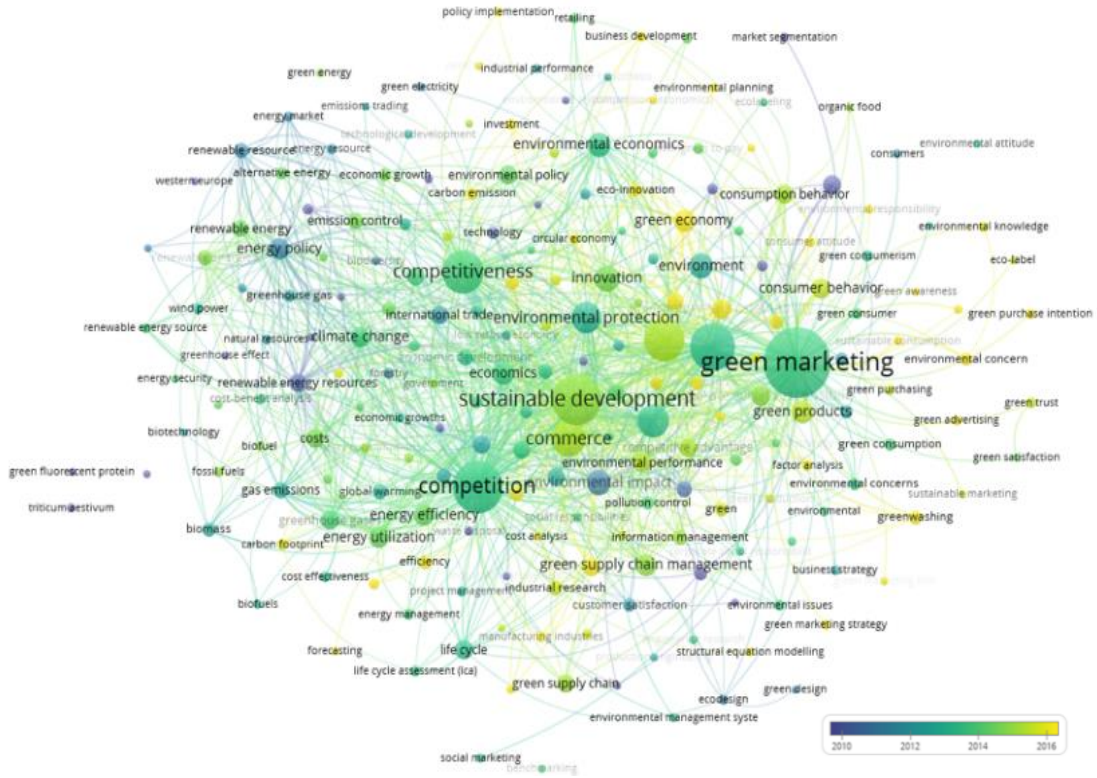

Figure 9. A visualization map of competitiveness studies depending on the relationship with green marketing theory
Source: compiled by the authors using the VOSViewer software

The dominant keywords in 2014 are environmental policy and energy efficiency; in 2015 – green marketing strategies, green purchases; in 2016 - greenwashing, green advertising, ecological labelling, and green logistics. Table 1 presents the most cited publications devoted to research on competitiveness in relation to green marketing.

Table 1. Top 10 cited articles on the issue of enterprise competitiveness and green marketing

Author	Title	Year	Source	Citations
Bansal P., Roth K.	Why companies go green: A model of ecological responsiveness	2000	Academy of Management Journal	1793
Rao P., Holt D.	Do green supply chains lead to competitiveness and economic performance?	2005	International Journal of Operations and Production Management	1258
Laroche M., Bergeron J., Barbaro-Forleo G.	Targeting consumers who are willing to pay more for environmentally friendly products	2001	Journal of Consumer Marketing	1258
Hart S.L., Ahuja G.	Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance	1996	Business Strategy and the Environment	999

Author	Title	Year	Source	Citations
Zhu K., Sarkis J., Gen Yu.	Green supply chain management in China: Pressures, practices and performance	2005	International Journal of Operations and Production Management	819
Ambek S., Lanois P.	Does it pay to be green? A systematic overview	2008	Academy of Management Perspectives	738
Ortiz O., Castells F., Zonnemann G.	Sustainability in the construction industry: A review of recent developments based on LCA	2009	Construction and Building Materials	714
Strogan, R, Roberts, J.	Environmental segmentation alternatives: A look at green consumer behaviour in the new millennium	1999	Journal of Consumer Marketing	665
Manaktola K., Jaukhari V.	Exploring consumer attitude and behaviour towards green practices in the lodging industry in India	2007	International Journal of Contemporary Hospitality Management	471
Pickett-Baker J., Ozaki R.	Pro-environmental products: Marketing influence on consumer purchase decision	2008	Journal of Consumer Marketing	457

Source: compiled by the authors based on the Scopus database.

The analysis of the publications listed in Table 1 shows that researchers analyse green goods and services and the features of their promotion on the market as an important determinant of ensuring green competitiveness. A corresponding query in the Scopus and Web of Science databases proved the presence of growing scientific interest in the relevant topic in recent years (Figure 10).

In total, about 500 academic articles were examined for the period from 1990 to 2020. The results of the analysis prove that since 2005, the number of publications devoted to the issues of marketing greening and competitiveness began to grow. At the same time, in 2016, part of the research is moving to studying green competitiveness. This is explained by the actualization of environmental issues (signing the Paris Agreement "On Climate Change" in December 2015), the expansion of research in the field of environmental degradation, depletion of natural resources, increasing inequality, strengthening of climate change, etc. (Pimonenko, T. et al., 2018). In addition, in 2020, compared to 2005, the number of scientists who researched the greening of competitiveness increased more than 20 times.

Further analysis of scientific publications on the topic of green competitiveness made it possible to identify the areas of scientific research in which there are relevant academic studies, which characterizes the appropriate cross-sectoral nature of the research on the processes of competitiveness greening.

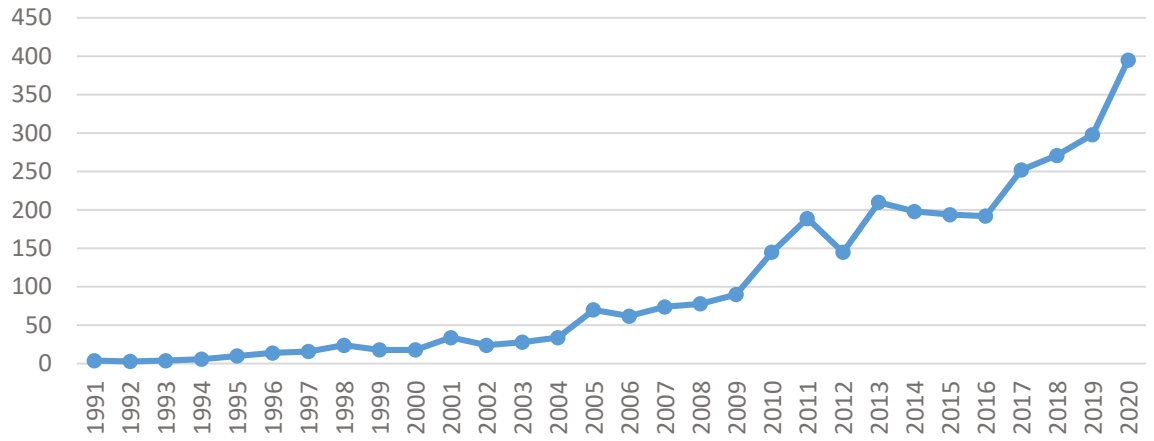

Figure 10. Dynamics of scientific publications devoted to green competitiveness
Source: compiled by the authors based on the Scopus database.

The main areas of the research evolution are:

- business and management – 29%;
- environmental sciences – 15%;
- social sciences – 14%, engineering sciences – 11%;
- economy – 9%;
- others (energy, computer, decision-making, biological, materials science) – 22%.

Figure 11 visualises a time dimension map of the research on green competitiveness and its determinants related to forming the concept of green competitiveness (2016 - until now).

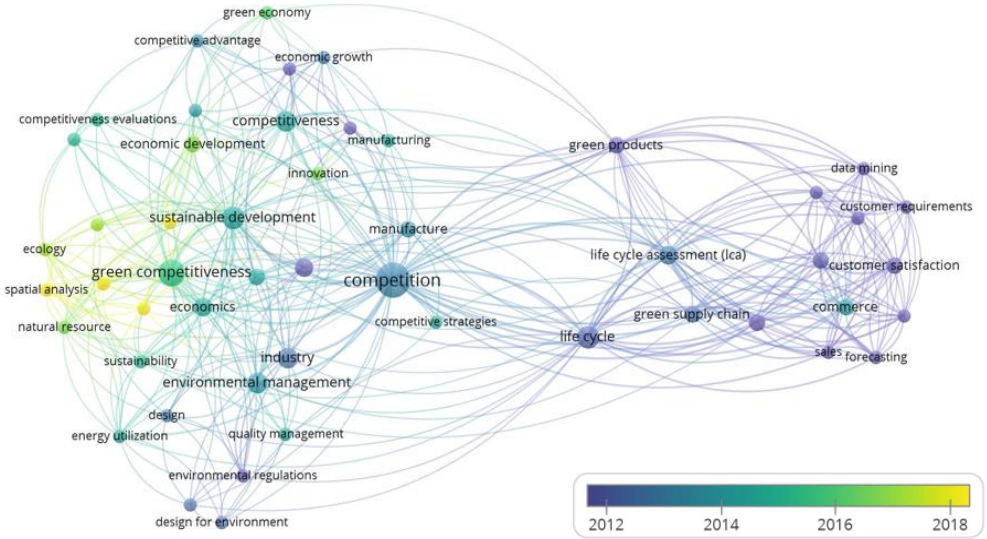

Figure 11. The visualization map of the time dimension of green competitiveness research and its determinants
Source: compiled by the author using the VOSViewer software

The cluster directly related to green competitiveness includes the following categories: sustainable development, environmental management, and economic development. Table 2 presents the TOP-10 most cited authors on the topic of the formation of green competitive advantages.

Table 2. TOP-10 most cited authors on the topic of green competitiveness

Author	Country	Documents by author	Citations	h-index
Tsai Sangbing	China	238	2750	31
Chen Hong	China	210	3158	34
Long Ruyin	China	207	5113	39
Hsu Chihhung	China	28	267	8
Afum Ebenezer	China	28	372	10
Agyabeng-Mensah Yaw	China	27	380	10
Kuo Huiming	Taiwan	26	306	9
Baah Charles	Australia	23	214	8
Lai Chienjung	China	21	182	7
Cheng Xiu	China	11	155	6

Source: compiled by the authors based on the Scopus database.

A significant number of publications belong to authors from China. The conducted research to understand the essence of green competitiveness formed a theoretical basis for clarifying the content of this concept as the ability of an enterprise to form and effectively use green competitive advantages (greening of business processes, green marketing and management tools, a regulatory framework that regulates the environmental activities of enterprises, the inclusion of stakeholders, green infrastructure), their convergent and complementary effects, which ensure the sustainable development of enterprises, the expansion of the competitive positions of the enterprise on the market, the increase of investment attractiveness and capitalization, and the formation of an ecological brand.

5. Conclusion

A retrospective analysis of the evolutionary time dimension and the identification of the close relationship of key patterns of scientific research made it possible to identify the four most significant stages of the evolution of the green competitiveness theory:

- the first stage (2004–2012) is related to the transformation of approaches to the interpretation of the concept of “competitiveness”: 2004–2006 – a classical approach (main patterns: resources, technologies, personnel, management, marketing); 2006-2010 – a global approach (main patterns: economic growth, globalization, benchmarking, international trade"); 2010–2012 – an ecologically oriented approach (main patterns: environmental protection, resource conservation, renewable energy sources, energy policy, sustainable development);
- the second stage (2012–2014) is related to the emergence and dominance in cross-sectoral studies of two new patterns that reflect the development of the green economy and determine the competitive advantages of enterprises through using ecopolitics tools,

implementing resource-saving technologies, developing green production and green innovations. It was established that from 2012 to 2014, scientific research concentrated on the processes of greening the business sector, where attention is focused on the following concepts: renewable energy sources, bioenergetics, waste management, biotechnologies, etc.;

– the third stage (2014–2016) is related to the development of the green marketing concept and the implementation of its tools as a determinant of ensuring the competitiveness of enterprises. The dominant keywords in articles published in 2014 are environmental policy, energy efficiency; in 2015 – green marketing strategies, green purchases; in 2016 – the competitiveness of the enterprise is considered in relation to the tools of the green economy (environmental regulation, recycling, environmental planning, environmental taxes, greenwashing, green advertising, environmental labelling, green logistics, etc.) at the macro and micro levels;
- the fourth stage (2016 - until now) is related to the formation of the concept of ZKP, which systematically integrates the evolutionary stages of the development of competitiveness in combination with scientific research on sustainable development, green economy, and green marketing, which outlines the structural and functional environment of the theory of green competitiveness.

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