

Green competitiveness: the evolution of concept formation

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Abstract. The modern tendencies confirmed the necessity to consider the environmental factors in companies' effectiveness. The goal of the article is to investigate the structural and functional environment of the development of the green competitiveness concept. In the paper were used the methods of bibliometric analysis for determining vectors of green competitiveness concept development. The hypothesis of the study is the growing tendency of analysing sustainable competitiveness by scientists. In this order, a bibliometric analysis of the spread of the concept of «green competitiveness» in scientific articles indexed by the Scopus database was performed. The authors reviewed about 30000 papers from Scopus base in the period from 1996 till 2019. The Scopus screening tools showed that in 2004 the number of articles that focused on green competitiveness began to increase. On the international level, the investigated area was represented by the next countries: the United States, China, India, Great Britain, Taiwan. Using the VOS viewer program were identified the main clusters of the scientific papers, which have investigated green competitiveness with the interconnection of such categories: green marketing, green innovation and sustainable development. The findings could be used for improving the basis for the creation of the strategies for green competitiveness promotion.

1 Introduction

The development of the business sector today is described by the tendency of many enterprises to promote environmentally friendly strategies, to implement of sustainable development goals, which will help to solve the global and local environmental problems, to reduce anthropogenic pressure on the environment, to save resources, to form competitive development of the country and business sector as a whole.

Building the conceptual foundations for the development of green competitiveness in the context of the green economy and the use of appropriate marketing tools and promotion requires, above all, research and formation of its terminological basis.

Current development trends are characterised by increasing consumption of green products and services, implementation more than one of the distribution channels for green products promotion [1-4]. The key indicators which determine the efficiency of countries and enterprises are: economic, social, environmental, technological, managerial, marketing, innovative etc. [5-11]. The authors in the papers [12-20] investigated the influence of different modern economic instruments on companies' sustainability. Some of the papers [21-28] analysed the interconnection between macroeconomic and environmental indicators. The researches [29-32]

justified why marketing factors of the competitive strengths' formation have a significant value for creating marketing strategies for different economic levels. At the same time, many scientific articles describe linkages between environment and economic indicators [33-37].

The paper [39] concluded that the competitiveness indicator is determined mainly by the social and ecological determinants. Their authors emphasise that population health creates the ability to perform work effectively, to receive adequate cultural and social security, and to live in an environmentally friendly environment.

Nonetheless, the market positioning today determined by the company's relation to environment problem, resource efficiency, production and promotion green goods and services [40-43]. Thus, it is essential to study the development of the concept of green competitiveness in the context of creating the theoretical background of their strengthening.

2 Methodology

For the analysis were chosen the following keywords: "competitiveness", "greening", "policy". The research process was divided into two steps: were defined the basic clusters and their scale; was analysed the central cluster with the dynamics of scientific publications, their

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affiliation and contribution of countries and individual scientists. The analysing process was done by providing the software of VOSviewer using the dates from the Scopus, which allowed to allocate and visualise the network of definitions and co-citation during the investigation of the development green competitiveness concept.

3 Research results

The necessity for the correct use of appropriate terms and determination of cross-sector areas of research has led to the using methods of bibliometric analysis. The international scient metric database Scopus was chosen as the information base of the study. In order to understand the context of scientific development of the topic of greening competitiveness, we analysed the connections between the key categories "competitiveness", "greening", "policy". For the corresponding analysis were analysed the scientific publications of the Scopus database from 1996 to 2019 (Fig. 1). The paper analysed about 30,000 scientific papers during the identified period.

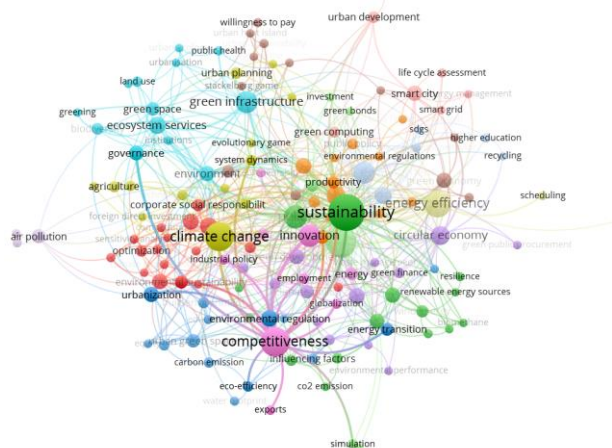


Fig. 1. The results of network relationships analysis of the key categories in scientific publications on the greening of competitiveness
 Source: composed by the authors using VOSviewer 1.6.13

The main purpose of the analysis is to investigate the linking between the categories: competitiveness and the concepts associated with the processes of greening. Thus, the analysis showed the existence of the three most important conditional clusters related to the categories "competition", "climate change", "sustainability". The basic first cluster "competition" includes the following concepts: "environmental regulation", "environmental efficiency", "sustainability", "climate change", "productivity", "management", "industrial policy". The second cluster "climate change" includes such basic concepts as "economic growth", "environment", "ecosystem services", "green infrastructure", "green finance", "green bonds", "energy policy", "green information systems". The third cluster "sustainability" combines the following categories: "climate change", "sustainable development", "alternative energy",

"competition", "efficiency", "environmental policy", "energy efficiency", "green infrastructure" and so on.

The relevant results of the analysis indicate a close correlation between the category of competitiveness, sustainable development, environmental regulation, climate change, etc. It stated a similar trend associated with the greening of management and production processes, the formation of a global market space focused on the functioning of a competitive environment based on the principles of sustainable development.

Accordingly, it determined the relevance of the analysis of the features and specifics of using in scientific publications the category "green competitiveness" to verify the ways of future research.

The study of relevant trends was conducted in the following sequence:

- monitoring of articles in the scientometric database Scopus by keywords "green competitiveness", "green marketing", "green innovations";
- the obtained data were grouped for further systematisation according to the criteria of chronology, affiliation, areas of use;
- the analysis of citation of scientific articles in the corresponding subject to determine authoritative scientists in the relevant branch;
- formed the system of co-citation of authors, identified the key categories which are the most used, interconnected with researches of green competitiveness;
- clustering of terms according to the chronology of publications, their network visualisation of terms (frequency of use and relationship);
- performed a network analysis, which results allow to identify the relationship between green competitiveness and other areas of research, that confirmed the hypothesis of the relationship between competitiveness and green growth and sustainable development.

Thus, the corresponding request in the Scopus database confirmed the existence of scientific interest in the relevant topics in recent years (Fig. 2).

In total, the paper studied about 2,000 academic documents for the period from 1995 to 2019. The findings showed that the number of publications on the greening of marketing and competitiveness has grown since 1998.

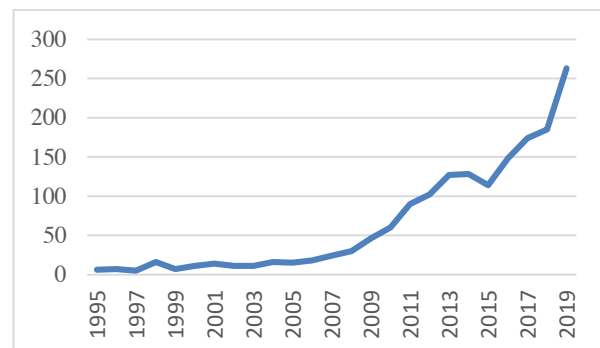


Fig. 2. Dynamics of scientific publications in the field of green competitiveness
 Source: composed by the authors, based on the Scopus database

At the same time, in 2016, part of the research moved to the study of green competitiveness. It could be explained by the actualisation of environmental issues (signing in December 2015 of the Paris Agreement "On Climate Change"), the expansion of research in the field of environmental degradation, natural resources depletion, increasing inequality, increasing climate change and more. Besides, in 2019, compared to 2000, the number of scientists who studied the greening of competitiveness increased more than 20 times. Further analysis of scientific publications on the topic of green competitiveness allowed us to identify areas of research where there are relevant academic developments (Fig. 3).

The diagram in Figure 3 describes the corresponding cross-sector study of the greening competitiveness processes. Thus, the main areas of research are business and management - 29%; environmental sciences - 15%; social sciences - 14%, engineering sciences - 11%; economics - 9% and others (energy, computer, decision making, biological, materials science) - 22%.

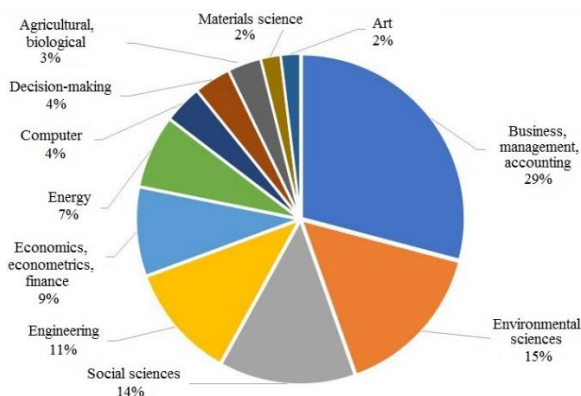


Fig. 3. Fields of green competitiveness research
 Source: composed by the authors, based on the Scopus database

Cross-country analysis shows that reliable researches are concentrated in the United States, China, India and the United Kingdom (Fig. 4).

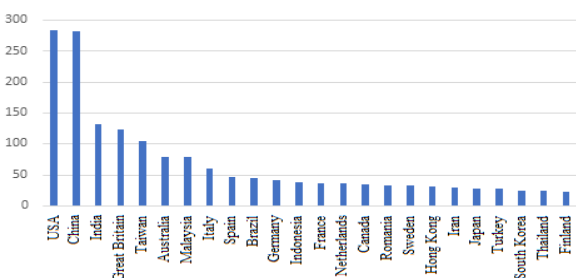


Fig. 4. International affiliation of green competitiveness research
 Source: composed by the authors, based on the Scopus database

Thus, a significant share of research is devoted to the topic of green competitiveness. Namely, determining the role of perception of green products, environmental risk assessment and increasing green confidence. Innovative are studies on the green organisational identity of companies, the development of proactive and reactive

innovations, the expansion of the market for green certificates [46, 47]. Noteworthy are scientific publications on sectoral aspects of the development and promotion of green marketing.

Figure 5 shows the contribution of individual researchers in the field of green competitiveness research.

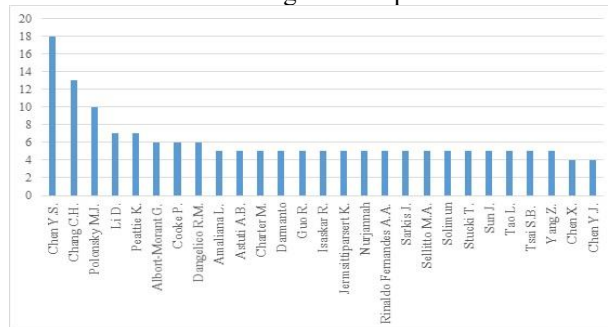


Fig. 5. Contribution of individual scientists in the field of green competitiveness research
 Source: composed by the authors, based on the Scopus database

Scientists from Harbin University (China) [48, 49] explore the features of the green innovation promotion in the context of green competitiveness development.

Analysis of the contribution of authors (Fig. 5) showed that the leading positions belong to scientists from Taiwan [50, 51] in third place are scientists from Australia.

The formation of the methodological basis and theoretical foundations of the chosen topic requires the study of publication features. It is interesting to analyse the TOP-5 scientific journals with published scientific articles on environmental marketing and green competitiveness (Table 1).

Table 1. Ranking of the most productive scientific journals by the number of articles on the green competitiveness topic

	Journal title	Cite score 2018	SJR 2018	SNIP 2018	Number of articles
1	Journal of Cleaner Production	7,32	1,620	2,308	78
2	Sustainability	3,01	0,549	1,169	58
3	Business Strategy and the Environment	7,93	2,166	2,488	47
4	Journal of Business Ethics	4,46	1,860	2,006	21
5	Journal of Consumer Marketing	2,17	0,653	0,967	18
6	Top Conference Series Earth and Environmental Science	0,44	0,170	0,536	17
7	Journal of Business Research	5,32	1,684	1,920	17
8	Advanced Materials Research	0,08	0,121	0,179	13
9	Marketing Intelligence and Planning	2,49	0,580	1,033	13
10	International Journal of Consumer Studies	2,11	0,595	0,973	11

Source: composed by the authors, based on the Scopus database

Thus, high-ranking journals such as Cleaner Production, Sustainability, Business Strategy and the Environment, etc. were analysed. Relevant journals have high citation rates and are in high demand in the scientific community. According to the combination of two characteristics (number of articles and rating of the journal), the most influential in terms of the number of published articles on the green competitiveness topic is Journal of Cleaner Production, Sustainability.

The analysis of the most productive world universities, which study the relevant topics, showed that Chinese scientific institutions provide active dynamic publishing activity: China Science Foundation, Fundamental Science Funds of Central Universities, Humanities and Social Science Foundation of the Ministry of Education of China, Doctoral Science Foundation, National Aerospace Science Foundation (Table 2).

Table 2. Ranking of universities by the number of articles devoted to the study of green competitiveness

	Scientific institution	Country	Number of publications
1	Natural Sciences Foundation	China	85
2	Fundamental research funds of central universities	China	19
3	Humanitarian and Social Science Foundation of the Ministry of Education	China	14
4	Doctoral Research Foundation	China	11
5	National Aerospace Science Foundation	China	11

Source: composed by the authors based on the Scopus database

Thus, the most cited publications are presented by scientists working in scientific institutions in China.

A thorough study of the links between related concepts of green competitiveness, the analysis of the thematic focus of research, the authorship of publications, required the using of appropriate software VOSviewer. With the help of the corresponding program, we carried out the analysis of thematic vectors of scientific papers, which allowed building a terminological map based on the joint appearance of terms in the titles and annotations of articles. The analysis allowed determining the system of clusters of scientific publications, which are devoted to the issue of green competitiveness (Fig. 6).

Thus, the largest cluster (red cluster) related to the category of environmental marketing includes the following concepts: green marketing strategies, green consumer, circular economy, green development, green technologies, renewable energy, environmental policy, corporate social responsibility, green management supply chain, consumer behaviour, green goods, innovation, marketing strategies.

The second-largest cluster related to the category of

green innovation includes the following concepts: efficiency of green innovation, corporate sustainability, recycling, green supply chain, energy efficiency, environmental regulation, green product, climate change. The third cluster related to the concept of sustainable development and includes the following categories: environment, innovation, green demand, ecological consumption, green economy, green competitiveness, environmental awareness, environmental responsibility, etc. It should be noted that all three clusters are close to each other and are primarily related. The appropriate location of the primary clusters determines the close systemic relationships between the main determinants of clusters. It proves that green competitiveness is a category of green marketing and determine the level of development and promotion of green innovations in society.

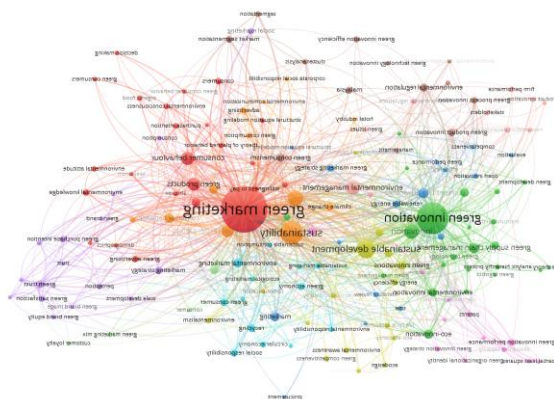


Fig. 6. Terminology map of the most common categories in publications on green competitiveness

Source: composed by the authors using VOSviewer 1.6.13

Besides, the results of the visualisation proved that a wide range of authors had studied the category of green marketing. At the same time, green competitiveness, environmental awareness, environmental responsibility are new relevant areas of research. Figure 7 shows the relationship between green competitiveness, green marketing and eco-innovation.

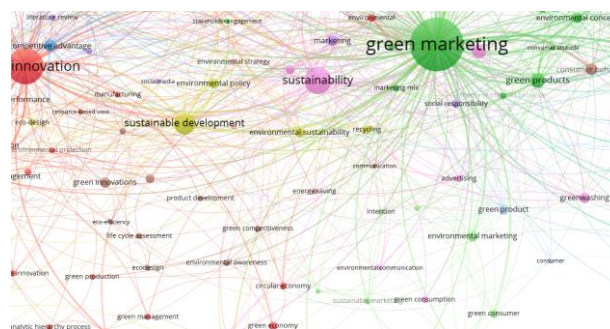


Fig. 7. Visualisation of mutual citation of scientific publications on the topic of green competitiveness with the nearest areas of research

Source: composed by the authors using VOSviewer 1.6.13

Besides, VOSviewer software also provides the ability to display the time horizon of the appearance of the studied categories, which are more common in scientific

publications of the Scopus database (Fig. 8).

Thus, the approximation to the blue colour in the figure indicates a greater "maturity" of the publication, and respectively, scientific articles close to the "yellow colour" are more modern. Based on the results of visual reflection of the time actualisation of the categories of green competitiveness, it concludes that the first studies were devoted to the topic of green marketing, and then the orientation shifted to the field of green innovation. At the same time, publications devoted directly to green competitiveness have been appearing since 2017.

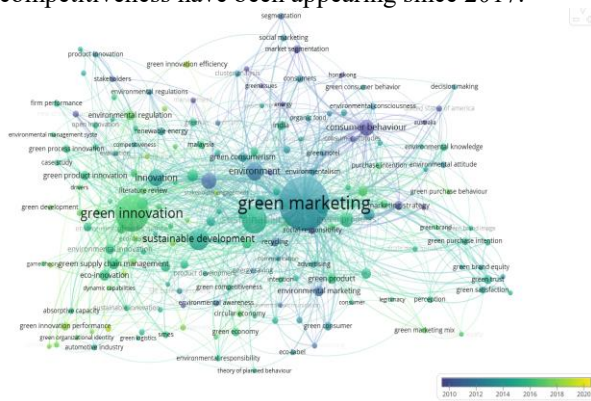


Fig. 8. Terminological map of the categories that are most common in publications on green competitiveness in the period from 2010 to 2019

Source: composed by the authors using VOSviewer 1.6.13

At the same time, terminological visualisation allows us to explore the features of citation between scientists in the relevant field of research. Figure 9 identifies five clusters. In the first cluster, the most authoritative authors are from the National University of Taipei (Taiwan) – Chen Y. His scientific publications [44, 45] are devoted to issues of environmentally friendly consumer behaviour, environmental trust and green brand management.

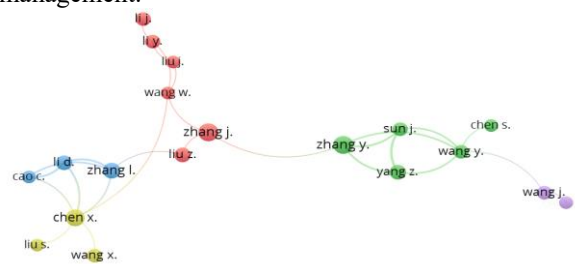


Fig. 9. Visualisation of the network of the most cited scientists in the field of green competitiveness

Source: composed by the authors using VOSviewer 1.6.13

In the second cluster, the most cited is the author Li D. from the Central Southern University (China), whose research papers [46, 47] are devoted to green innovations and assessing their profitability for corporations. In the third cluster, scientific articles by Zhang D. [48, 49] are devoted to regulating green innovations and assessing the side effects of green consumer integration. In the fourth cluster, the works of scientist Chen S. [50, 51] from the International Finance Institute of Guangzhou University (China) are noticeable, where the issues of financing green innovations are studied. The author Wang D. from

the fifth cluster devoted his work [52] to determine the impact of green marketing on the performance of companies.

4 Conclusions

Thus, the content analysis of the most cited works, the generalisation of the results of data processing by VOSviewer 1.6.13 allowed to draw the following conclusions. The analysed scientific publications on the topic of green competitiveness testify to the cross-sector and multidisciplinary nature of existing research. The essential category is primarily related to the concepts of environmental marketing, green innovation and sustainable development. Besides, they also explore select areas such as behavioural economics, ecological trust management, social responsibility, mix marketing, stakeholder theory, cycle theory, and others. Research in the field of green competitiveness has become widespread over the past five years. The increasing dynamism explains the intensity of relevant research. At the same time, related industries that can become supportive in the formation of green competitiveness are digital and social marketing, development of social networks, stakeholder theories, environmental management and audit, information and Internet technologies. The analysis of geographical affiliation showed the concentration of a significant amount of research on green competitiveness in scientific institutions in China.

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