# Strategies for Increasing the Resilience of Agroecosystems through the Implementation of a Quality Management System

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**Abstract**

*In the context of an increasingly competitive global market and the recognition of the vulnerabilities generated by the impact of the agricultural sector on the environment, the application of specific principles of a coherent quality management system is important to ensure long-term sustainable development. In this study, by means of bibliometric analysis, specific quality management principles are analyzed, with a focus on highlighting the links between them and the economic, social and environmental sustainability of the agricultural sector. Another point of interest is the determination of the impediments, in antithesis to the advantages of implementing quality standards, for achieving sustainable economic growth objectives. The outcome of this research validates the desirability of implementing quality management principles in the agricultural sector as the main direction of evolution towards responsible, efficient and sustainable agriculture.*

**Key words:** agriculture, sustainable development, quality management, bibliometric analysis
**J.E.L. classification:** M21, M11, O13, Q01

## 1. Introduction

Under the impact of climate change, in correlation with the need to conserve natural resources globally, the agricultural sector is undergoing a process of structural transformation, with the main objective of ensuring the prerequisites for resilient and sustainable development. Global population growth, increasing world demand for food, growing urbanization, increasing scarcity of natural resources and the intensification of agricultural technologies are factors that generate the need for a coherent strategic vision at national, European and global level, oriented towards sustainable socio-economic development. According to the latest statistics, it is predicted that globally the demand for food will increase by 70% by 2050 Food and Agriculture Organization 2011). Analysis of global demographic trends shows an upward trend, with an estimated increase from 8 billion today to 10 billion by the middle of this century. Increased urbanization, coupled with accelerated economic growth in countries with large populations (e.g. Brazil, China, India and Russia), will increase pressure on natural resources. For the agri-food sector, these issues constitute both an opportunity and a challenge.

Agriculture plays an important role in Romania in terms of rural population size and employment. About 45.7% of the population in Romania lives in rural areas, compared to about 23.6% in the EU Member States. About 30% of the population is employed in the agricultural sector, compared to about 2% in the old Member States (EU-15) and 3-14% in the new Member States (EU-8) (MADR, 2015).

Romania's accession to the European Union (EU) 17 years ago, on January 1, 2007, marked the beginning of a new stage of economic development, centered on the principle of economic and social cohesion, emphasizing the promotion of conditions for economic growth, the reduction of regional development disparities, the assurance of a high level of employment and balanced and sustainable development. The allocation of financial resources through Community agricultural policies aims at the sustainable development of Romanian agriculture in the context of harmonization with the European model by increasing its compatibility and convergence with international quality standards, using strategies related to the reduction of the impact on the ecosystem and biodiversity conservation.

In this paper, we will use bibliometric analysis to study the influence of quality management in the agricultural sector, with the main objective of identifying the interdependence between the two concepts, highlighting their applicability and visibility in the scientific literature.

As a branch of information science, bibliometrics studies the quantitative measurement and analysis of scientific publications and other academic literature. Statistical indicators are used to assess research trends, relationships between authors, the value and impact of scientific research. By analyzing the number of publications, citations and co-authorship networks, researchers can uncover topical themes while identifying less studied aspects, thus generating opportunities for future research.

The aim of this paper is to identify and evaluate the impact generated by the implementation of a quality management system on the agricultural sector as a whole and to identify coherent and innovative strategies that facilitate the sustainable development of this sector. The influence of quality management in the agricultural sector is very complex and integrates concepts of food safety, sustainable development and economic performance. The implementation of international quality management standards increases the competitiveness of the agricultural sector in direct correlation with environmental and consumer responsibility. In the current context, characterized by a sharp increase in demand for food products, against the backdrop of increased urbanization, in contrast with the changing approach to responsible management of natural resources, quality management has an essential role to play in maintaining sustainability and food security at the global level.

## 2. Literature review

The concept of sustainable development implies the identification of directions and strategies to continuously improve the quality of life for present and future generations, with the aim of establishing viable communities capable of using natural resources responsibly and harnessing the capacity for ecological innovation, in order to ensure food security, biodiversity protection and social cohesion.

Addressing the quality of agricultural products and food in the current context in Romania requires an intense and long-lasting process, aimed at changing individual and collective mentality towards nutrition (Chira, 2010, p.5).

Standardization within an organization is very important nowadays, as to achieve this the organization has to manage different resources correctly on a daily basis. These resources include manpower, information, equipment and materials. Standards become an integrated part of an effective management practiced by organizations and provide the basis for the daily improvement of the company's business in all aspects (Dogaru, 2016, p.13)

In carrying out the present study, we have documented reference works in the literature, synthesizing the essential aspects related to sustainable development and the implications for the agricultural sector. Altieri's vision - sustainable agriculture is a method of agricultural production that aims to maintain long-term productivity by conserving natural resources, reducing pollution and integrating biodiversity (Altieri, 2018, p.23), emphasizes the need to harmonize production with environmental protection principles. Analyzing the innovation potential in the agricultural sector in relation traditional farming practices, Pretty describes agriculture as a process of transforming natural resources to produce goods and services, integrating traditional knowledge with modern innovations (Pretty, 2018, p.17)

In the research of the issue addressed, we also took into account the notions related to quality management, which is a concept of particular importance in various economic sectors, especially in the agricultural sector, where ensuring quality and food safety is important. According to the International Organization for Standardization, quality management is a set of principles and coordinated activities to direct and control an organization in terms of quality. According to Juran, quality management in agriculture means the application of standards and norms in the production processes in order to ensure an end product that meets the requirements of consumers while also respecting environmental regulations (Juran, 2023, p.45).Regarding the cohesion between sustainability and quality management, Deming describes Total Quality Management as a management philosophy that involves the entire organization with the aim of improving quality and reducing defects through continuous participation and learning process (Deming, 1982, p. 11).

## 3. Research methodology

The term "bibliometrics" was first used in 1969 by Alan Pritchard. Bibliometrics is defined as the application of mathematical and statistical methods to books and other media (Pritchard 1981, p.6). Bibliometrics is the quantitative analysis of written publications, such as books or articles, to analyze their impact, usage or dissemination patterns (Egghe L et al, 1990, p.8) As a research method, bibliometric analysis is the use of quantitative methods to identify correlations, assess the impact and emerging trends in scientific publications. The importance of bibliometrics as a research method lies in its ability to assess the performance of research in different fields, as well as to identify new directions of research. Currently, bibliometric analysis is an essential tool in promoting research performance and understanding the evolution of research in different fields of interest.

In the realization of this work, we used bibliometric analysis as a research method, in order to support a strategic study of the selected concepts and their visibility in the specialized literature. We used the Scopus database, recognized as one of the largest bibliographic and bibliometric databases in the world, constituting an indispensable tool in academic research. Scopus is an online bibliographic and bibliometric database of scholarly literature: scientific journals, books and international conference papers. Providing an overview of worldwide research results in scientific fields, Scopus offers intelligent tools to track, analyze and visualize research.

Taking into account the analytical nature of this paper, we applied a detailed methodology of querying and selecting information by identifying relevant publications, books, articles and papers in the field of agriculture and quality assurance. In more precise terms, we used as search keywords: "agriculture" , "quality management" and "sustainable development", to identify relevant articles, books and publications indexed in the Scopus database.

*Table no.1 Analysis of variables*

| **Variable** | **Value** |
|---|---|
| Sources (articles) | 207 |
| Keywords | 3474 |
| Minimum number of occurrences of a keyword | 20 |
| *Threshold* | *29* |

*Source: Authors' own processing using VOSviewer*

In addition to the bibliometric analysis, we used the VOSviewer software tool to identify the interdependencies and connections between scientific publications related to agriculture, quality management and sustainable development. This software offers possibility to visualize bibliometric maps, revealing the interconnections between the keywords identified in the selected publications and the correspondence between the analyzed concepts.

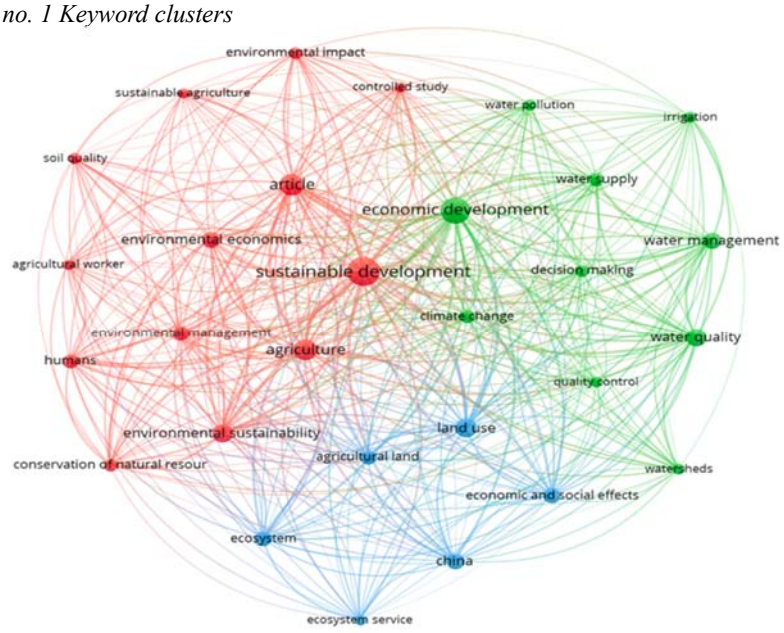
In order to deepen the analysis, we used a series of filters consisting of inclusion criteria - articles in English, articles in the final stage of publication, in direct correlation with exclusion criteria - review articles. The final data selection consisted of 207 articles, which were subjected

to bibliometric analysis using VOSviewer software. In the table 1 below, we have realized a presentation of the components of the selected sample.

## 4. Findings

In performing this bibliometric analysis, we used VOSviewer Visualization of Similarities Viewer) version 1.6.20 as a software tool for visualization and analysis of graphical maps based on scientific literature using data exported from the Scopus database. As a result of combining the notions of "quality management", "sustainable development" and "agriculture", we obtained a selection of 29 keywords through Vos Viewer. As a preliminary step, we carried out a filtering operation on the data obtained, by eliminating identical terms, i.e. adapting the terminology of the words used. We thus obtained three clusters grouping the selected terms, as can be seen in figure 1.

*Figure no. 1 Keyword clusters*




*Source:* Authors' own processing using VOSviewer

The first cluster (red) groups 13 keywords and focuses on the relationship between the sustainable development of the agricultural sector and environmental impacts. The theme of this cluster is represented by the concept of sustainability, with the central term "sustainable development", which is directly linked to terms such as "agriculture", "environmental impact", "conservation of natural resources". The connection between the terms "agriculture|" and "environmental impact ", "soil quality" reflects the interdependence between the functionality of the agro-ecosystem ensured through the responsible use of natural resources and the economic activities carried out in the agricultural sector. The complexity of the concept of sustainability and its broad scope of manifestation is highlighted by the interconnection between economic development and the environmental impact of agricultural activities, a relationship that places sustainable agriculture at the center of strategies to conserve biodiversity and ensure food security at the global level.

Analyzing the link between the terms "environmental impact", "agriculture" and "economic sustainability", we conclude that agriculture is a primary economic sector, closely dependent on environmental health and agro-ecosystem conservation.

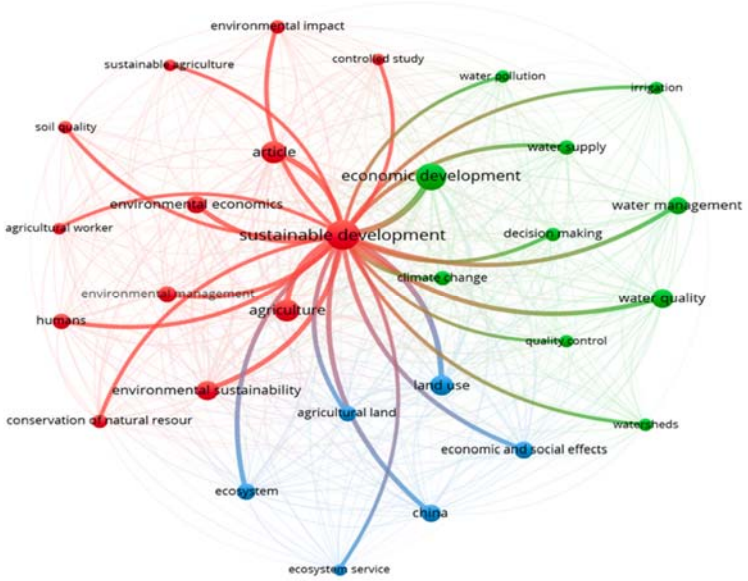
The sustainability of the agricultural sector implies the optimization of applied technologies and practices for the conservation and responsible use of natural resources. Through the implementation of a quality management system in the agricultural sector, these practices are incorporated into a set of agricultural production methods based on minimizing environmental

impact. The main objective is focused on sustainably increasing agricultural production, protecting natural resources, and ensuring safe and healthy food for consumers.
By analyzing the connections between the terms, the red cluster highlights the shortcomings and development opportunities related to sustainable agriculture and minimizing environmental impacts.

Sustainable agriculture, seen as a lever of sustainable development, encompasses the full range of scientific (observations, measurements and experiments) and applied (analysis, design, management) activities in agriculture and other economic branches that processš and commercialize agricultural and agro-industrial products and places particular emphasis on the valorization and conservation or restoration of natural, technical, financial and human resources specific to local and zonal agro-ecosystems (Ion Toncea et al. p 18, 2017).

The major challenge that the agricultural sector will face in the coming period is to identify and implement a quality management model that will allow organizations to focus simultaneously on both economic development and on meeting resilience and sustainability standards.

*Figure no. 2 Cluster 1 (red)*

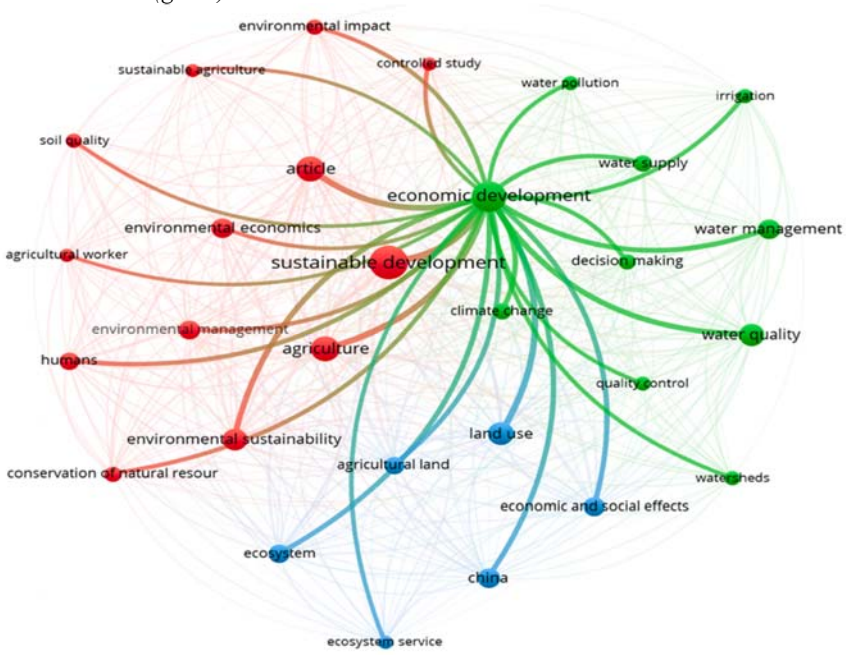



*Source:* Authors' own processing using VOSviewer

The second cluster (green) groups 10 terms in the field of the links between natural resource management, water resources management and quality and sustainable economic development. The specificity of this cluster is emphasized by its focus on the concept of "economic development", in direct correlation with terms in the field of responsible management of water resources - "water supply", "irrigation", "water pollution", "water management", in the conditions generated by the impact of climate change. As emphasized also in the interference between the clusters, the vital role of water in the agricultural sector, as an enhancer of production factors, defines the imperative need to implement a responsible management of this resource. Conserving agro-ecosystems and increasing their resilience to climate change, requires the preservation of water resources as the main means of ensuring sustainable development. The relationships between the terms "water management" and "economic and social effects" emphasize the importance and limiting character of water as a vital resource in sustainable economic development, suggesting the importance of concerns for ensuring water sustainability in the context of climate change. This approach is an integral part of a quality management system based on clear policies and accurate information in the decision-making process, which is emphasized by the connection between the terms "decision making" and "water management". The indirect connection between the terms "economic development" and "water management", respectively "water quality", reflects how the sustainability of water resources is influenced by the solutions

applied to water quality problems as part of the decision-making process. Therefore, the configuration of a quality management system that provides strategic directions for action to integrate sustainability as a priority action in water resources management is essential for the analysis and quantification of sustainable development indicators. The analysis of this cluster highlights the importance of knowing the interactions between sustainable development and natural water resources. At the center of the balance between economic needs and biodiversity conservation, water plays a crucial role in building global sustainability.

*Figure no. 3 Cluster 2 (green)*

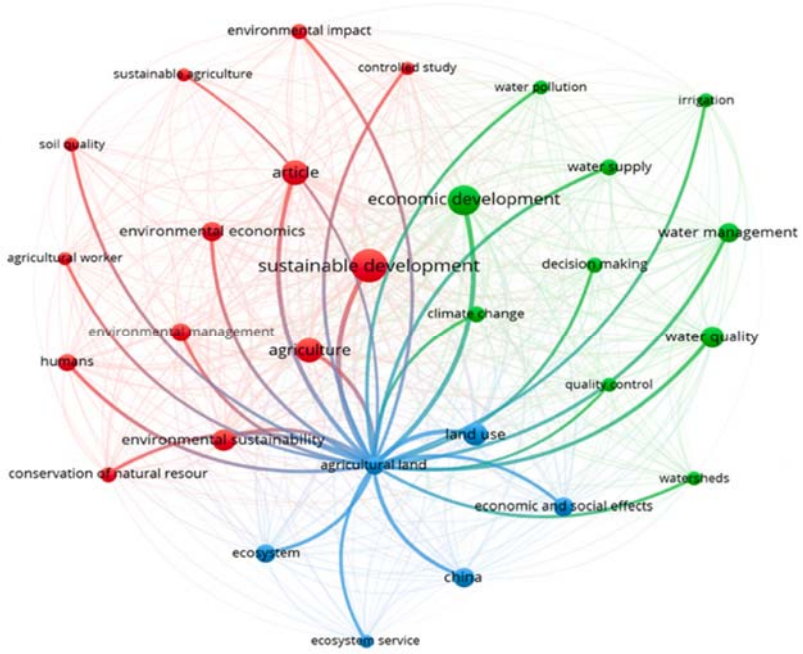



*Source:* Authors' own processing using VOSviewer

The third cluster emphasizes the opportunity of implementing a quality management system as an essential tool for planning and monitoring the sustainable use of agricultural land as the main production resource. The key words are represented by the terms "agricultural land", "land use", "ecosystem" and emphasize the need for a responsible and complex approach to agricultural activities, by ensuring the right premises for a sustainable economic and social development, in line with the objectives of ecosystem protection and biodiversity conservation. The term "land use" emphasizes the fact that the notions in the cluster quantify the impact of agricultural activities on land, generated by the intensification of production processes and the pressure induced by the accentuated dynamics of urban development. In conclusion, the implementation of a quality management system in the agricultural sector ensures the quantification of the economic value and ecosystem services generated, the assessment of the impact of climate change on land use and the analysis of the efficiency of environmental policies in ecosystem conservation.

The analysis of the three clusters, illustrates the complex nature of the concept of sustainable development and highlights the connections between: proper management of natural resources - "agricultural land", "water management", socio-economic impact - "economic and social effects" generated by the agricultural sector, correlated with monitoring the degree of achievement of biodiversity conservation objectives - "environmental impact" and increasing the resilience of agro-ecosystems "ecosystem service".

*Figure no. 4 Cluster 3 (blue)*




*Source:* Authors' own processing using VOSviewer

## 5. Conclusions

This paper studies the synthesis of specialized scientific literature, using bibliometric analysis as a research method, in order to identify the impact of scientific publications, emerging research trends and to determine future research directions in the field of quality management influence on the agricultural system

At the same time, the current study reflects the valuable resources generated by existing research, and the results of the present bibliometric analysis highlight as a future research direction the quantification of the benefits generated by the implementation of a quality management system in the agricultural sector, in terms of sustainable economic development, in direct correlation with the objectives of agro-ecosystems biodiversity conservation.

In conclusion, this paper illustrates a complex picture of the concept of sustainable development, emphasizing that economic emergence, equity and social welfare are the result of a complex system of natural resource management, starting from the basic principles of quality management in the agricultural sector. The economic efficiency of the agricultural sector and the responsible management of natural resources are converging directions of action to generate the prerequisites for sustainable development. It is necessary to re-evaluate the perspectives in the sphere of concrete actions to optimize the connections between the sectors involved, by setting clear objectives that ensure the equitable and simultaneous satisfaction of the environmental, economic and social needs of the community.

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