The Sustainability of rice in a macro view

Sustainability is a topic of interest for science and organizations, an emerging area of research in the field of agri-food and business management. This area aims to investigate the processes that lead organizations to sustainability and those that lead to organizational learning and consequent continuous improvement. This investigation is part of the Doctoral Course in Agribusiness and Sustainability, offered by the consortium between the University of Évora and the University of Trás-os-Montes and Alto Douro, in partnership with other institutions and international I&D institutions and companies from the agroforestry and food sector.

Adonir Both
PhD Student
Universidade de Évora
profboth@gmail.com

Margarida Saraiva
Docente do Departamento de Gestão
Escola de Ciências Sociais da Universidade de Évora
msaraiva@uevora.pt

Manuel Tibério
Docente do Departamento de Economia, Sociologia e Gestão
Escola de Ciências Humanas e Sociais da Universidade de Trás-os-Montes e Alto Douro
mtiberio@utad.pt

This work seeks to understand the evolution and trend of studies on the sustainability of the rice value chain. In this sense, a bibliometric review of the literature in the Scopus database was carried out as a methodological procedure, in the years 2001 to 2021, to observe the publications on the theme of sustainability of the rice value chain existing over the 20 years of this century.

Among the results obtained, it was verified that the publications on the topic addressed had an exponential growth from the year 2015, that is, from 80 publications to more than 400 in 2019, and it can be observed that this theme has become of due importance, with a view to sustainability. As an essential result of this study, it is observed that in 2019 there were more than 200 publications on the theme of rice sustainability. All of this leads to the belief that there is an interest on the part of researchers and authors to deepen their research questions in this area, with different approaches to understand the value chain and the sustainability of rice.

There are two species of rice that are grown in the world. The scientific names are “Oryza sativa L” and “Oryza glaberrima Steud”, and according to Oka (1988) it belongs to the genus Oryza and has twenty species listed by Roschevicz in 1931, and 23 by Chatterjee, in 1948, based on in the reexamination of specimens in the main herbaria in the world.

Rice planting is one of the most important agricultural activities and is the third most produced agricultural commodity in the world, behind only sugarcane and corn, according to Abaide et al. (2019). And it infers that China is the biggest producer of rice (146 million tons), followed by India (103 million tons). These two countries are responsible for approximately 53% of global rice production. In a global context, Brazil is the largest rice producer outside the Asian continent. In the 2015/2016 harvest, the rice cultivated area in Brazil was approximately 2 million hectares and production was approximately 12 million tons (Abaide et al., 2019).

The European Union's rice sector represents 0.6% of world production and the Common Agricultural Policy (PAC) gives producers direct payments, which provide basic support for producers' income, stabilizing their income and also benefiting from aid from rural development policy. The average public support for the gross income of rice producers in the Organization for Economic Cooperation and Development (OECD) in 2004 was 75%.

According to Chen et al. (2019) for the better socio-economic performance of the circular rice supply chain, new developments are needed, such as the development of technology to reduce the unit's production cost and the development of infrastructure to support the production of biofertilizers. For Custódio et al. (2019) rice consumers are heterogeneous about the perceived differentiation of rice quality between regions, countries, cities and levels of urbanization.

The results of this research show that the ideal investment portfolio for improving the value chain is a function of the final market, which limits the distance from the port and the cultural function of rice.

Sustainable development can be achieved through a new vision attributed to industrial processes, concerning the control of gas collection, reuse, and recycling of waste, types, and quantities of environmental resources, among others. This view is not considered an easy task to achieve, as it involves high levels of corporate management, production, and consumption by society.

Furthermore, sustainability indicators must be identified and selected by observing desirable qualities and essential characteristics. Methods with several criteria, such as the Analytical Network Process, must be seriously considered to improve the use of sustainability analysis, for the

SUSTAINABLE DEVELOPMENT CAN BE ACHIEVED THROUGH A NEW VISION ATTRIBUTED TO INDUSTRIAL PROCESSES, CONCERNING THE CONTROL OF GAS COLLECTION, REUSE, AND RECYCLING OF WASTE, TYPES, AND QUANTITIES OF ENVIRONMENTAL RESOURCES.

Premium quality is defined by the nutritional benefits, softness, and aroma in Southeast Asia and the physical appearance of the grains (uniformity, whiteness, slimness), satiety and aroma in South Asia, as these trends are consistent with the perceptions of the industry and have important implications for regional and national breeding programs in terms of adapting germplasm for regions and rice varieties for specific segments of the local market. As rice is traded internationally, it is necessary for technologists to standardize definitions of classes and measures, quality indicators and routines, as well as to implement descriptive profiles of rice, in order to obtain worldwide unanimity in this production (Custódio et al., 2019).

inclusion of agricultural and agri-environmental policies, because they give due attention to the multiple facets of the concept of sustainability and reinforce their related practice (Reig et al., 2010).

Sustainable industrial systems within the company's sustainability and continuous improvement perspectives constitute a green innovation and sustainability is considered indispensable. Green and lean, in the Plan, Do, Check, Action (PDCA) cycle and, specifically, the application of Value Stream Mapping (VSM) are tools to improve sustainability. Sustainability has its antecedents, which is performance. To achieve performance, the involvement of leadership and the organization

Table 1 ALL DOCUMENTS BY YEAR

Ano	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total of 1481 documents
Doc.	1	1	1	1	5	1	6	6	1	20	27	
Ano	-	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Doc.	-	34	53	63	72	117	134	198	228	415	97	

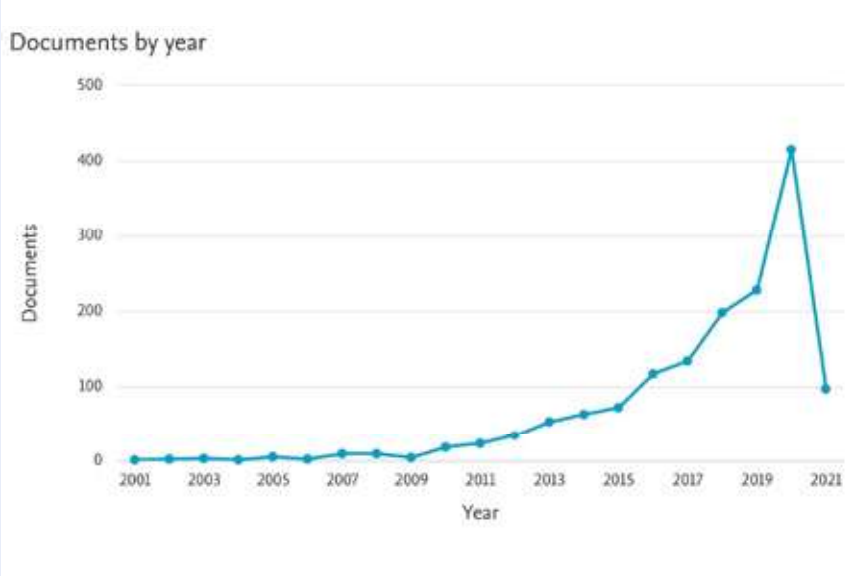
Source: Scopus and Autors, 2021

is necessary, in addition to performance as a mediating variable. The generation of ideas and divergent thinking are central creative components of problem-solving. Problems in the rice value chain incorporate adaptable transport, advertising, and marketing, and this is well demonstrated by the shift to the rice-based agri-food system, with the rice value chain transforming into several compatible biological responses and possible (Ngamcharoenmongkol et al., 2019; Nkuba et al., 2016).

Value Chain Analysis (VCA) can expose strategic and operational misalignments within the chains and the consequent displacement of resources and, therefore, opportunities for improvements that create value and economic sustainability. It is necessary to develop VCA variants that incorporate the three pillars of sustainability and identify consistent business opportunities for value chains to create value shared between business and society. A new type of Value Stream Mapping or supply chain, of seven maps, is based on the different residues inherent to value flows.

The use of the various tools, individually or in combination, is therefore driven by the types of waste to be removed and provides a simple mechanism for choosing which is the most appropriate for contingent situations. An organization's value chain consists of primary and secondary activities, which are divided into several subparts. The technology involved in the primary activities includes support activities, inbound logistics technology, etc. Competitive advantage activities were divided into advantage and cost differentiation, which have several cost and differentiation factors. In the strategic management literature, the analysis of the value chain is considered an essential analytical tool, therefore, its value cannot be compromised, it just needs to be developed and practiced.

Figure 1 DOCUMENTS BY YEAR



Source: Scopus and Publishiny, 2021

The results of the analysis of data obtained on the sustainability trend of the rice value chain, the annual scientific production, the most cited sources, and the most relevant to our study are presented, as well as the countries with the largest number of research. A total of 1481 articles comprised the collection of bibliometric research obtained from the Scopus database, one of the most complete and worldwide known and used, as shown in the figure below. Articles have been distributed in the period from 2001 to the present. It is noticed that in 2010 the trend of increasing articles began, culminating with the year 2020, when the largest number of articles published on the rice chain, as well as its sustainability, was seen, consequently it was the year that most contributed to the study, with 415 articles.

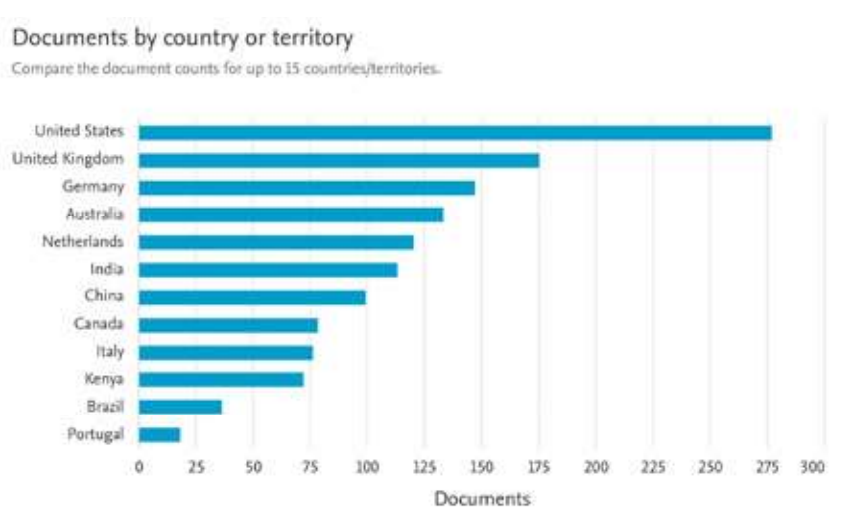
There is an increase in publications that show this trend on sustainability motivated by the concern of countries, as cited by the UN (2020) whose goal of sustainable

development in relation to the "Sustainable consumption and production means doing more and better with less" and also means decoupling economic growth from environmental degradation, increasing resource efficiency and promoting sustainable lifestyles. Since then, the authors have dedicated themselves to studies for this sustainable development of productions and productive means. The chart below shows this. This bibliometric study aimed to identify publications on the Scopus platform that reports on rice; collect published data on rice this century; and treat this data bibliometrically to provide dynamic trends on the sustainability of the rice value chain. This bibliometric survey allowed us to find the main trends in the rice value chain in terms of sustainability, where we analyzed the existing documents on the Scopus platform from 2001 to 2021 (February). In the first 9 years, 23 articles were published. From 2010 to 2015, that is, over 6 years, 269 articles were published. And to confirm the interest in the theme of rice sustainability, over the next five years (2016 to 2020) 1,092 articles were published.

After the year 2016, a substantial increase in publications is evident, confirming the trend towards sustainability in organizations and in the rice value chain. It is qualitative research, but of such relevance, as it is an original work that opens the discussion to others on the same topic by involving sustainability issues in the rice chain. The countries that produced the most scientific literature on the sustainability of rice were, according to the graph below.

We also verified that the documents removed from the Scopus platform are treated in their entirety in a crude way, that is, we do not carry out a specific treatment on each publication, which will be for other work in this regard, such as a more in-depth work on the subject, considered one of the limitations of the work. Future research suggests a deepening of this study so that the value chain, continuous improvement, and global or local sustainability of rice can be observed.

Figure 2 DOCUMENTS BY COUNTRY OR TERRITORY



Source: Scopus and Publishiny, 2021

References

Abaide, E. R., Tres, M. V., Zabot, G. L., & Mazutti, M. A. (2019). Reasons for processing of rice coproducts: Reality and expectations. *Biomass and Bioenergy*, 120, 240-256.

Chen, W., Oldfield, T. L., Katsantonis, D., Kadoglidou, K., Wood, R., & Holden, N. M. (2019). The socio-economic impacts of introducing circular economy into Mediterranean rice production. *Journal of Cleaner Production*, 218, 273-283.

Custodio, M. C., Cuevas, R. P., Ynion, J., Laborte, A. G., Velasco, M. L., & Demont, M. (2019). Rice quality: How is it defined by consumers, industry, food scientists, and geneticists? *Trends in food science & technology*, 92, 122-137.

Ngamcharoenmongkol, P., Sen, S. K., & Ongsakul, V. (2019). Sustainability intent transforming staple food in the Greater Mekong Sub-region: Qualitative study of Low Input and Niche Rice Value Chain. *Journal of Business and Retail Management Research*, 13(3).

Nkuba, J., Ndunguru, A., Madulu, R., Lwezaura, D., Kajiru, G., Babu, A., & Ley, G. (2016). Rice value chain analysis in Tanzania: identification of constraints, opportunities and upgrading strategies. *African Crop Science Journal*, 24(1), 73-87.

Oka, H. I. (1988). *Origin of cultivated rice*. Tokyo: Elsevier.

Reig, E., Aznar, J., & Estruch, V. (2010). A comparative analysis of the sustainability of rice cultivation technologies using the analytic network process. *Spanish Journal of Agricultural Research*, (2), 273-284.