Key stakeholder groups for digital innovation of agriculture in Croatia

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ORIGINAL SCIENTIFIC PAPER

Key stakeholder groups for digital innovation of agriculture in Croatia

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Abstract

The current readiness of the agricultural sector in Croatia to transform is limited. Creating and using an open data ecosystem in which data truly is the main force of the innovation process offers an opportunity to strengthen cooperation in this sector. The stakeholders of the agricultural data ecosystem in Croatia were not investigated until now. The main goal of this paper was to identify key stakeholder groups in the Croatian agricultural data ecosystem using a complex query. Five groups of stakeholders with different roles were identified. Their needs are focused on greater cooperation in the sector and they all strive for the economic, environmental, and social sustainability.

Key words: innovation trends, agricultural ecosystem, stakeholder groups, open data

Introduction

The agricultural sector faces significant challenges that require drastic changes in the sector's everyday operations. One of the most significant challenges is related to climate change and global warming. A second challenge are the daily varying market conditions, and rapidly changing consumer preferences and expectations. Third, new environmental policies and recommendations, as well as food quality and safety, affect the way agricultural systems can and should be managed (Meinke, 2019). The roles and responsibilities of agricultural stakeholders expanded significantly in terms of expectations in response to successfully facing these complex challenges, and digital disruptors stand out as the main force, i.e. innovations based on digital technologies and new concepts (Trivelli et al., 2019). Innovations in the agriculture sector can be classified into three categories, namely (1) political issues and forces aimed at creating and adopting innovations, (2) distinguishing between innovations of products and innovation of processes, and (3) their impact on economic operators, the market (Bucci et al., 2019), and ultimately on society.

In Croatia, the share of agriculture, forestry and fisheries in total GDP has declined in recent years and amounts to slightly less than 3 % (Croatian Bureau of Statistics, 2019). This might be the result of a minimal readiness of the agricultural sector in Croatia to transform, due to a lack of investments in infrastructure capacity, the adoption of new technologies and forms of business and competitiveness of local products on the European market. The establishment of "smart agriculture" in Croatia should increase the innovation readiness of the sector. Smart agriculture is based on the incorporation of digital technologies into machinery, equipment, and sensors in agricultural production systems, and enables the collection of large amounts of data and information generated by the gradual application of process automation (Orsini et al., 2019). Use and re-use of open data in agriculture has the

potential to improve production efficiency. However, the issue of creating a single information space for agriculture remains open (Shamin et al., 2019; European Commission, 2020). The implementation of the common data space depends on the extent to which different stakeholders provide support using relevant data collected from heterogeneous data sources (Aydin and Aydin, 2020). Therefore, open data in agriculture, generated in the agricultural production also on the basis of implemented digital technologies, are most important in innovation processes in the sector. In order to create an ecosystem in which data is truly the main force of the innovation process, the cooperation and collaboration of all stakeholders in the agriculture data ecosystem is needed. For this reason, the main goal of this paper is to present key stakeholder groups in the agricultural data ecosystem, map these stakeholder groups onto the Croatian ecosystem, and explore and define, for each stakeholder group, the basic features, roles and needs, considering the underlying data usage and management in the agricultural sector.

Material and methods

In order to obtain a generic categorisation of stakeholders in agriculture we searched the Scopus and the Web of Science platforms using the following complex query: "stakeholder" OR "persons" OR "actors" AND "agriculture" OR "agriculture business" OR "farms" OR "agriculture sector" OR "agriculture area" OR "agriculture field" AND "open data". This complex query was searched by topic: the title, abstract, and keywords were included in the search. Given the results obtained, i.e. the number of articles on the topic and the year of publication, there were no special restrictions in this search. Based on the analysis of the literature, stakeholders' groups in the agricultural data ecosystem were identified. After that, based on the union of all stakeholders, stakeholder groups in the agricultural data ecosystem of Croatia were defined and their roles and needs were presented.

Results and discussion

In the Scopus database we found 17 articles, and 15 articles were available for analysis. The same search of the WoS platform resulted in 3 articles. After reviewing the articles found on the WoS, there are referenced also in Scopus. This resulted in a total of 17 articles for further analysis, of which 15 were available.

The stakeholders within the literature were identified as follows (Table 1). Based on the literature analysis, the union of all identified stakeholders has given stakeholder groups defined as follows: agricultural producers/ farmers, management and support organisations, consumer organisations/ consumers, researchers and scientists and suppliers.

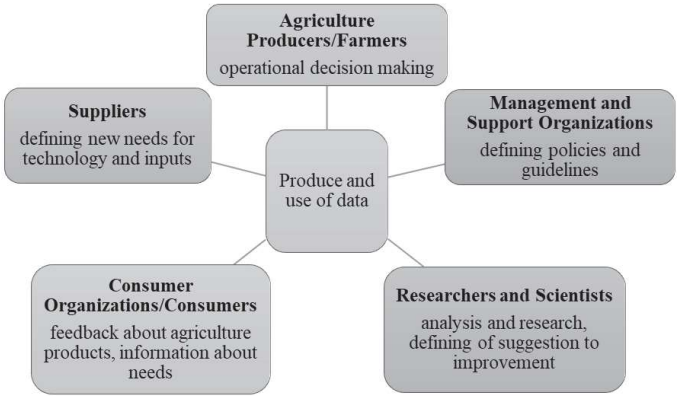
Table 1. Identified stakeholder within the literature

Stakeholders	Source
Public administration, Farmers and companies, Environmentalist group	Gautreau and Vélez, 2011
Contractors, Advisers, Industry, Research, Government, Business Associates and other Service Providers	Pesonen et al., 2013
Farmers, Researchers, Policy makers, Businesses, Advisors	Charvat et al., 2014
Agri-food industry, Consumers, Public administrations and Communities	Reznik et al., 2015
Community of data providers, Partners, Users	Celli et al., 2015
Farmers, Input and Technology Suppliers, Government, Participants in supply chains	Wolfert et al., 2017
Scientists and Societal actors	Ardila et al., 2018
Governments, Researchers, Farmers, International Organizations, Smallholder Farmers, Citizens, Service providers, SMEs, Multinationals	Musker and Schaap, 2018
Academic and Research Community, Industry, Standardization Bodies	Vučinić et al., 2018

Farmers, Researchers, Businesses, Analysts, and Experts	Aydin et al., 2018
Government, Private sector, Civil society groups, Consumers	Yuyanto and Liawatimena, 2018
Managers, Agriculture Business, Society, Support Scientists, End Users	Caballero et al., 2019
Farmers, Experts, Researchers, Domain Experts, Analysts	Aydin and Aydin, 2020
Farmers, Researchers, Analysts, Domain Experts and Exporters	Aydin and Aydin, 2020
Farmers, Extension agents, Researchers	Tonnang et al., 2020

Stakeholder groups roles and needs in the agriculture ecosystem of Croatia

In order for the agricultural economy to sustainably operate, the ecosystem needs to be based on knowledge, new business concepts, and technological innovations, and key stakeholders in the agricultural sector need to be strengthened around their sphere of activity. Identifying stakeholders (Picture 1) is the first step in understanding the needs and quality of the sector, and the second step is to determine the relevance of their role and needs and the cooperative and incentive role in the sector. For identification of roles and needs, a blueprint of the national Strategy of the agriculture in Croatia was used (Ministry of Agriculture, 2020), given its detailed view of past, current and future needs of the agricultural sector, considering thereby only those related to data usage and management in the agricultural sector.



Picture 1. Key stakeholder groups for use of open data in the agricultural sector

Agricultural producers/ farmers simultaneously act as suppliers who offer their products, but also as members of the local community, procuring raw materials and supplies from other companies. These stakeholders are the main investors in their own rural community and play a vital role in the sustainability of the community itself, but also in the sustainability of the value chain and food system. They are expected to produce a sufficient amount of healthy, tasty, and fresh food that meets the prescribed quality standards. Data needs of agricultural producers/farmers are related to business investment, infrastructure and work capacity, business support through policies and recommendations, and most importantly, the availability of data for operational decisions and fair competition in the market.

Management and support organizations should strengthen farmers to invest responsibly, and improve their access to inputs, advisory, specialized financial services, special education, targeted training, and access to final consumers. The roles of the identified stakeholders of this group are somewhat different, however, their activities are aimed at encouraging the development and growth of the agricultural sector through policies, professional assistance, and financial support. Data needs of this group are aimed at building a business culture focused on sustainable development, encouraging all other stakeholders to cooperate and develop the sector through compliance with recommendations and policies, and support in building transparent business models through the availability of information by other stakeholders.

Researchers and scientists are important for performing different research analyses and for suggesting improvements. This group of stakeholders plays an important role in the implementation of scientific, professional, and project research, where the results of the research are input for the development of the agricultural sector through guidelines, recommendations, proposals, discovery of new methods, models, concepts, or products. The needs of this group in the ecosystem are related to greater involvement and cooperation in agricultural practice, availability of data necessary for conducting quality research, and a better understanding of the needs of all stakeholders in the agricultural ecosystem in Croatia and accordingly greater scientific contribution through research results. Consumers are buyers and users of finished agricultural products, and consumer organizations buy agricultural products for further production. The needs of consumers are related to the purchase of healthy and fresh food at reasonable prices and appropriate availability, while the needs of consumer organizations relate to the procurement of inputs needed in food processing and production. Suppliers of input raw materials and technology must play a role in providing appropriate production and technological inputs to farmers. Their need for data is significant due to the discovery of hidden needs in the market and the development of new, quality solutions tailored to the production needs of farmers.

Conclusions

Five groups of stakeholders have been identified in the agricultural ecosystem: agricultural producers/ farmers, management and support organisations, consumer organisations/ consumers, researchers and scientists and suppliers. Their roles generally differ, but they all strive for the economic, environmental, and social sustainability of the agricultural sector. Their needs are focused on greater cooperation of all the stakeholders in the ecosystem. The presented overview will serve for further research on the introduction of new concepts for ecosystem development in the agricultural sector. A limitation in this paper is the search based on a complex query conducted in the Scopus and WoS database, which should be extended to additional professional databases in the field of agriculture and national databases as this article explores the open data agricultural ecosystem in Croatia. Future research will focus on additional and detailed search of stakeholders in professional and national databases, so additional categorization of stakeholders and analysis of their needs for open data can be made.

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