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Evaluation of Criteria for Communication with Consumers of Agricultural Products

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Abstract. *Consumers of agricultural products represent a sensitive category of society, therefore communication with them is particularly important. Communication is influenced by a large number of factors, and in this regard, making the right decision about the way to communicate is an extremely complex job. In previous research, the emphasis was placed mostly on the entire supply chain, much more than on the method of choosing communication with end consumers of agricultural products. Therefore, this research represents an attempt to make an additional contribution to rational decision-making in this part of the agricultural supply chain. In this paper, the selection of criteria used in the process of communicating with consumers in a country was carried out by applying expert fuzzy multi-criteria decision-making. The innovative fuzzy method SiWeC (Simple Weight Calculation) was applied to evaluate ten given criteria with the aim of their selection. The subject of the research were several agricultural companies and the experts were six experts from the marketing department of the companies in question. The results show that the method of communication itself is the best evaluated criterion, as well as the delivery time, i.e. the impact of delivery speed on the demand for a particular agricultural product. Uncertainty in decision-making is reduced by applying fuzzy decision-making logic, and the results provide the basis for future research that should be directed at selecting the most favorable methods of communication when products of this type are in question, as well as the development of the existing methodology, which in this case has proven to be adequate.*

Keywords: Communication, agriculture, consumers, multi-criteria decision making, SiWeC method.

Introduction

Communicating with end consumers is a complex and demanding job, especially when the object of service to agriculture is a product. The goal is to perform the service in a high-quality and reliable manner while meeting all the standards of good practice. The revolution in information technology (IT) and communication has changed the way people conduct business. The dynamics of today's business requires the connection of all participants in business processes and an immediate reaction to market events. Business becomes, in the true sense of the word, business in real time. The use of the Internet and electronic business provides greater interactivity, connectivity, flexibility, cheaper and faster business compared to the traditional way of doing business (Kotler, 2001). According to Nedeljković et al. (2024) one of the key goals of business is reliable and profitable delivery of the final product to end users (customers). As market

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conditions constantly change, so do the requirements and habits of the users themselves, as well as their way of communicating. Therefore, Siddharta et al. (2017) conclude that all products must be distributed using certain methods and on realistic grounds. Communication between producers and consumers is a continuous process. The ways in which they communicate are variable and conditioned by various things, from current needs, habits, trends, opportunities and more. Đalić et al. (2020) recommends constant monitoring of all factors that influence this process in a particular business entity (company). Particular attention should be paid to agricultural products, or communication channels that have as their subject supply of end users with these types of goods. The agriculture and food sector is not fully competitive in terms of the use of new information technologies. For this reason, new information technologies, and especially the Internet, have the potential to improve the economic characteristics of the agricultural sector (Leko-Šimić, 2002).

It should not be forgotten that one of the important elements of the competitiveness of every company in agriculture and agribusiness is precisely distribution, i.e. the way of communicating with end users. Some of the characteristics of distribution are highlighted by Milanović et al. (2020), which are: regional characteristics, characteristics of dispersion of product distribution links, specific distribution facilities, integrative characteristics of deliveries and trade. In the past, many researchers have tried to determine the relationship between the adopted distribution channel and the potential benefits for farmers as providers/suppliers of products. (Miljković and Alačković, 2015; Milanović et al., 2020; Michelson, 2013; La Torbe, 2001) Also, many authors have analyzed sales channels and ways of communicating with users, i.e. trying to find the best communication methods that would facilitate the path to consumers. (Dent, 2011; Rosenbloom, 2012; Sigh, 2012; Thakran and Verma, 2013) Therefore, Stević et al. (2023) point out that in the prevailing market environment, production is increasingly driven by consumer demand. Products only gain their utility for consumers when they become available.

In accordance with the above, it is necessary to choose the best communication channel, taking into account all the factors that affect its functioning. For this purpose, it is useful to use the method of multi-criteria analysis, which offers the possibility of choosing communication and assessing each individual factor of importance to it. Today's concept of the development of modern agriculture and agribusiness involves the application of modern methods of supporting business decision-making. Everyday changes in market conditions have imposed the obligation of a serious approach to planning and organizing all segments of business in agriculture and agribusiness, and decision-making has become something of crucial importance for every manager or business organizer. (Nedeljković et al., 2017)

In previous research, we find the use of these methods by many authors. Thus, Nedeljković et al. (2023) select sales channels in an agricultural company using the TOPSIS method, while Stevanović-Tošović et al. (2020) analyze the characteristics of distribution channels of communication in small farmers using the AHP methodology. Stević and et al. (2023) use the FUCOM-MARCOS multi-criteria decision-making model to select a distribution channel in a sales company. Hatami et al. (2020) uses the TOPSIS model to select distribution channels in marketing.

Given the above, the aim of the paper would be to determine the importance of certain given factors that have an impact on existing channels of communication with consumers when agricultural products are in focus.

Methodology

In addition to the part concerning the study of previous scientific and professional literature, the research process went through the following phases:

- Initial phase,
- Defining research criteria,
- Forming a research model,
- Expert selection,
- Evaluation of criteria,
- Ranking the weights of criteria,
- Drawing the necessary conclusions.

The initial phase of the research concerned defining the problem of the research in question and the need to establish the importance of the influence of certain factors on the development of communication with product consumers.

The criteria selected for the research were determined from previous similar studies and their tabular overview (Table 1) and an explanation is given below.

Table 1. Evaluation criteria

ID	Criteria	Explanation
1	Price	The impact of product price on product demand and communication methods.
2	Method of communication	The influence of the type of communication between the provider and the user (TV, radio, internet (social networks), personal visit, indirect sales...).
3	Delivery time	The impact of delivery speed on product demand and the range of communication methods.
4	Payment terms	The impact of product payment method on the communication channel.
5	Product quality	The influence of product quality on the choice of communication methods and product demand.
6	Product range	The influence of product assortment on the choice of communication methods and product demand.
7	Location	The influence of geographic location on the choice of communication methods and product demand.
8	Level of communication service	The impact of service quality on the choice of communication method and product demand.
9	Brand	The influence of past behavior on the choice of communication methods and product demand
10	Additional services	The existence of additional services that would have an impact on communication and sales.

Source: Authors.

After selecting the selection criteria, a research model was formed, where the evaluation was carried out through a questionnaire. Six experts from the subject area answered the questionnaire by rating the given criteria with grades from 1 (worst) to 7 (best). Given that this was an expert opinion, it was necessary to get the most realistic answers possible, and this was only possible from selected experts with many years of experience in the field. They were made up of people from the marketing department of certain agricultural companies in the city of Belgrade. The companies were small to medium-sized and were engaged in the production and processing of agricultural products for the local and regional market.

This was followed by the evaluation (selection) of the given criteria, achieved using an innovative fuzzy method of multi-criteria decision-making, which will be explained later in the

paper. The use of fuzzy logic imposes the application of the linguistic scale given in Table 2. It contains the corresponding fuzzy numbers for each linguistic item that the experts use in assessing the weight of the given criteria. The final part of the research provides the necessary conclusions and suggestions.

Table 2. Linguistic evaluations and fuzzy membership functions

Linguistic Values	Fuzzy numbers
Very low (VL)	(1, 1, 2)
Low (L)	(1, 2, 4)
Medium low (ML)	(2, 4, 6)
Medium (M)	(3, 5, 7)
Medium good (MG)	(5, 7, 9)
Good (G)	(7, 9, 10)
Very good (VG)	(9, 10, 10)

Source: Puška et al., 2024.

Different methods are used to determine the importance of criteria (Stević et al., 2022). All of these methods can be divided into subjective and objective methods. In subjective methods, the importance of criteria is determined based on the assessment of the decision maker (DM), while objective methods use an initial decision matrix to determine the importance of criteria. In this research, a new method is developed for determining the importance of criteria based on the subjective assessments of DM, so the focus will be on these methods. (Puska et al., 2024)

The calculation of the importance of criteria according to subjective methods is done in such a way that DMs determine how important a certain criterion is in their opinion. (Phulara et al., 2024)

However, using different methods they have to determine their opinion differently. Thus, using AHP (Analytic hierarchy process) and ANP (Analytic Network Process) methods, the DM has to compare each criterion with each other and determine how much better or worse each individual criterion is than another criterion. With the SWARA (Stepwise Weight Assessment Ratio Analysis) and FUCOM (Full consistency method) methods, it is necessary to first rank the criteria and then determine their importance, BWM (Best Worst Method) and PIPRECIA (PIvot Pairwise RElative Criteria Importance Assessment) it is necessary to compare all criteria with the first and last criterion, respectively. Using these methods, the DM's job is made more difficult. (Asif et al., 2024) Newer methods try to simply determine the importance of criteria so that the DM does not have to compare or rank methods. (Nedeljković et al., 2024a; Wang et al., 2023)

The innovative fuzzy SiWeC method of multi-criteria decision-making developed by Puška et al. (2024) was applied to this work. It belongs to the subjective methods and is characterized by its simplicity of calculation. The method was developed in two directions as a regular SiWeC method and as a fuzzy SiWeC method which we will apply in this work. Its steps for the necessary calculation are given below:

Step 1. Experts determine the importance of each criterion.

Step 2. Linguistic values are transformed into fuzzy numbers, represented as:

$$\tilde{x}_{ij} = \left(x_{ij}^{l}, x_{ij}^{m}, x_{ij}^{u}\right)$$

where $\mathbf{x_{ij}^{l}}$represents first, $\mathbf{x_{ij}^{m}}$second, and x_{ij}^{u}third fuzzy number.

Step 3. The fuzzy numbers are normalized as:

$$\tilde{n}_{ij} = \frac{x_{ij}^{l}}{max\ x_{ij}^{u}}, \frac{x_{ij}^{m}}{max\ x_{ij}^{u}}, \frac{x_{ij}^{u}}{max\ x_{ij}^{u}}$$

where $max\ x_{ij}^{u}$ is the maximum value across all criteria.

Step 4. Calculation of standard deviation ($st.dev_j$).

Step 5. The normalized ratings are weighted using the standard deviation values:

$$\tilde{v}_{ij} = \tilde{n}_{ij} \times st.dev_j$$

Step 6. The sum of the weighted values for each criterion is calculated:

$$\tilde{s}_{ij} = \sum_{j=1}^{n} \tilde{v}_j$$

Step 7. The fuzzy values of the criteria weights are computed as:

$$\tilde{w}_{ij} = \frac{s_{ij}^{l}}{\sum_{j=1}^{n} s_{ij}^{u}}, \frac{s_{ij}^{m}}{\sum_{j=1}^{n} s_{ij}^{m}}, \frac{s_{ij}^{u}}{\sum_{j=1}^{n} s_{ij}^{l}}$$

Step 8. Defuzzification of the weights criteria

$$w_{j_{def}} = \frac{w_{ij}^{l} + 4 \times w_{ij}^{m} + w_{ij}^{l}}{6}$$

Results and discussion

After conducting the survey, we obtained the results of the expert assessment of the criteria, which are presented in the following table 3 using a linguistic scale, and then converted into the corresponding fuzzy numbers given in table 4.

Table 3. Experts' evaluations of the criteria importance

Expert	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Expert 1 (E1)	VG	VG	MG	MG	G	MG	M	G	MG	MG
Expert 2 (E2)	G	VG	VG	G	M	M	ML	G	M	M
Expert 3 (E3)	MG	VG	G	MG	G	M	ML	G	M	MG
Expert 4 (E4)	G	G	VG	MG	MG	ML	ML	MG	M	M
Expert 5 (E5)	G	G	MG	M	M	ML	L	MG	M	MG
Expert 6 (E6)	G	VG	VG	VG	MG	M	M	G	ML	M

Source: Authors.

Table 4. Fuzzy decision matrix

	C1	C2	C3	C4	C5…	C10
E1	9,10,10	9,10,10	5,7,9	5,7,9	7,9,10	5,7,9
E2	7,9,10	9,10,10	9,10,10	7,9,10	3,5,7	3,5,7
E3	5,7,9	9,10,10	7,9,10	5,7,9	7,9,10	5,7,9
E4	7,9,10	7,9,10	9,10,10	5,7,9	5,7,9	3,5,7
E5	7,9,10	7,9,10	5,7,9	3,5,7	3,5,7	5,7,9
E6	7,9,10	9,10,10	9,10,10	9,10,10	5,7,9	3,5,7
$w_{j_{def}}$	0,129	0,14	0,131	0,112	0,103	0,09

Source: Authors.

From the ratings obtained after the research, we can see that criterion 2 (method of communication) has the highest rating, that is, it is the best rated criterion. Considering that we

live in an era of rapid development of digitalization, this result is not too surprising. The method of communication (type of communication) sublimates all other necessary criteria that are necessary for a positive outcome of communication between the provider and the recipient of the service. This is certainly contributed by the development of many applications that use the Internet and social networks that can be used for the purpose of promoting and selling certain agricultural products. True, for some services in agriculture, conventional methods of communication (TV and radio) still dominate, as well as indirect knowledge about a product and even personal contacts between sellers and buyers. (passive rural areas, underdeveloped places)

Immediately behind the leading criterion are the rated criteria "delivery time" and "price". This result somewhat coincides with earlier research conducted by Tošović-Stevanović et al. (2020), where price as a criterion and delivery time play a dominant role when it comes to their significance in the sale of agricultural products. The worst rated criterion was "location", i.e. the influence of geographical location on the choice of communication method and product demand. Given the importance of the rating of the criterion "method of communication", this is somewhat understandable. In this case, the location of the supplier, or user of agricultural products, is not important insofar as the type, or method of communication is well developed, especially when it comes to the internet, social networks or some other form of digital communication.

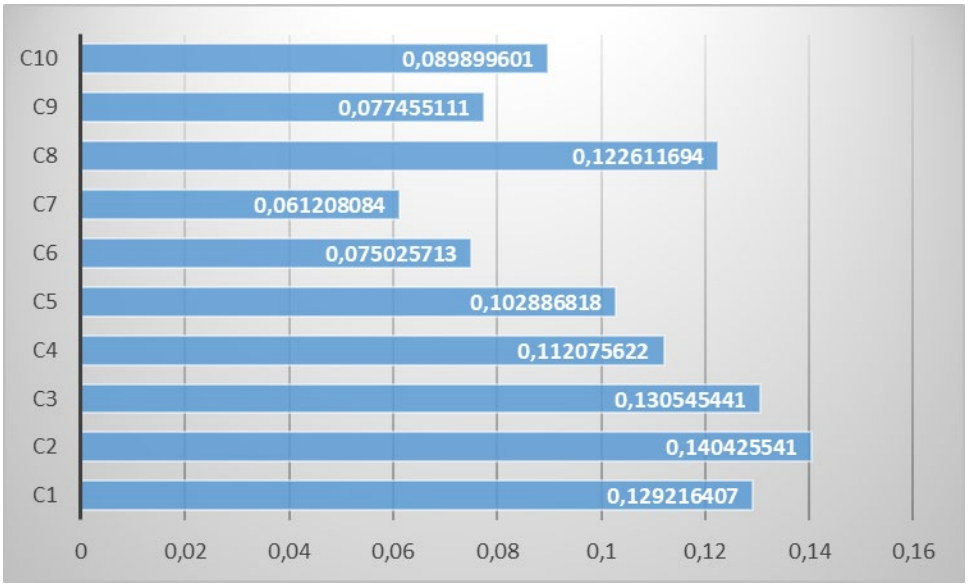

Chart 1. Ranking of criteria

Source: Authors.

Conclusion

Based on all of the above, we can conclude that the process of communicating with consumers is a very complex and demanding job, especially when it comes to strategic products, which include certain agricultural products. The greatest role, or rather the importance shown in this paper, is in the manner of communicating with consumers. This is a criterion that has been particularly relevant in the past decade, given the great development of the channels themselves and the possibilities of communication. An important criterion that experts highly rated is the delivery time, or rather its impact on the demand for a particular agricultural product. The criterion "price" was also rated no less highly, which we can say falls into the category of traditional decision-

making factors, while the criterion "location" received the worst rating. What is also important to conclude is that the innovative fuzzy subjective multi-criteria method SiWeC was successfully applied for expert assessment of criteria. In the coming period, attention should be focused on further development of the method, as well as on taking a wider range of criteria that would be taken into consideration when assessing their impact on communication with end consumers of agricultural products.

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Appendix

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