

## MATHEMATICAL ASPECTS REGARDING THE EVOLUTION OF THE SALE OF AGRI-FOOD PRODUCTS IN THE ALMĂJ VALLEY IN A PANDEMIC CONTEXT

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*Abstract: The study's primary purpose is to determine the existing or non-existent differences in terms of the opinion of the persons who accepted the invitation to complete the questionnaires. Agriculture is one of the strategic priority sectors of a country, a sector that must maintain its position and ensure food security. There is a growing demand for agri-food products, particularly as organic and traditional products can be highlighted.*

*Key words: agri-food, pandemic, questionnaire*

### INTRODUCTION

The land of Almăj dates back eight centuries ago and is one of the "country" regions in Romania, notable for its uniqueness. This is distinguished by the individuality and mentality of the community, by the fact that they have kept the traditional occupations while reflecting on the contemporary ones.[14]

The name Almăj comes from the Hungarian language - "almási-medence," which translates to "The apple orchard". This part of the country is an area of intramontane depression located along the Nera Valley. Almăj County consists of 15 rural settlements, with a number of 16,000 inhabitants, approximately.[14]

The distribution strategy of an agricultural or agri-food product reflects the marketing decisions regarding the specification of the distribution channels, the choice of intermediaries, and the specific forms of distribution for each product category by the producing enterprise, although, in the practical activity, several independent enterprises participate. [8, 9,]

In the current context of the pandemic, the situation of the agri-food sector has become uncertain. Still, the European Union has developed several solutions and actions that can be taken to balance the case. Thus, a plan was created to provide direct support to the farmers, but also for the whole rural areas. Solutions such as: making the use of financial instruments dedicated to rural development more flexible, providing support of up to EUR 7.000 per farmer and EUR 50.000 per small and medium-sized enterprise, if the county in question, has these rural development funds. [5] Another solution is to increase advance payments and, last but not least, to increase state aid that can be granted to farmers and food processing companies. [13, 15]

The study's primary purpose is to determine the existing or non-existent differences in terms of the opinion of the individuals who accepted the invitation to complete the questionnaires. The period that determines these possible differences is the one before and after March 2020, which has led to many changes in the whole process of marketing agri-food products.

## MATERIALS AND METHODS

The following materials and methods were used in order to achieve the purpose of the paper - Mathematical aspects regarding the evolution of the sale of agri-food products in the Almăj valley in a pandemic context;

- Collecting data
- Grouping the data
- Analysing and interpreting the collected data
- Predictions on the development of these data in the future.

To test the opinion of people selling agri-food products in the Almăj Valley, the online Microsoft Forms application was used, available at <https://forms.office.com>. The questionnaire was kept anonymous in order to increase the truth index. A statistical software called "ANOVA" was used for the statistical processing of the experimental data.

## RESEARCH RESULTS

The crisis caused by the COVID-19 pandemic cannot be estimated in time. Some of the most pessimistic forecasts indicate five years. The estimates are that the pandemic will periodically sharpen its manifestation, which will generate new intervals of social distancing, traffic restrictions, new shocks for economic activity.

What remains a universal constant, however, is that people must eat. Thus, agriculture is one of the strategic priority sectors of a country, a sector that must maintain its position and ensure food security and to provide affordable food for all citizens [16].

The pandemic has put substantial pressure on the entire agri-food sector in the European Union, especially small farmers. [2] In Romania, out of 3.422,030 agricultural holdings, almost 2.5 million work less than 2 ha, and approximately 823.000 have less than 50 ha. The above numbers represent the pylons of support for Romania's food security from two points of view: [6,7,10]

- Of self-consumption, which supports the rural population in times of crisis.
- Of the potential, they show in the integration in the sales chains to sell the surplus on the market, in a new form, or to the processing industry. [3,4]

Thus, small farmers and medium-sized farmers can be suppliers of healthy food for both villages and cities. The best action plan is to start a company to support farmers in adapting to the consumption patterns of the current century. Thus, they will know new ways to sell, such as online sales of the "vegetable basket" type or food hubs or even delivery to larger retailers through agricultural cooperatives. [11,12]

Table 1.

**Statistical descriptors of the size of the differences related to the paired questions regarding the satisfaction of person marketing agri-food products, in terms of sales volume, before and after March 2020**

t-Test: Paired Two Sample for Means

	Appreciate your satisfaction with the volume of sales of agri-food products that you made them before March 2020	Appreciate your satisfaction with the volume of sales of agri-food products you have made since March 2020
<b>Mediate</b>	3.919118	3.279412
<b>Dispersion</b>	0.860076	1.595425
<b>Number of valid comments</b>	136	136
<b>Pearson correlation coefficient</b>	0.468406	
<b>The hypothesis tested</b>	0	
<b>df</b>	135	
<b>t (statistical value)</b>	6.401496	
<b>p (unilateral)</b>	1.18E-09	
<b>t unilateral criticism</b>	1.656219	
<b>p (bilateral)</b>	2.35E-09	
<b>t bilateral criticism</b>	1.977692	

\* Source: Processing statistical data resulting from the applied questionnaires, using Microsoft Excel

The values presented in the table above represent the average value of the answers regarding the respondents' satisfaction related to the volume of sales of agri-food products before March 2020. For the period after March 2020, the average response was about 3.3, so a lower value.

Practically, the satisfaction of the persons who sell agri-food products in Valea Almăjului, regarding the sales volume, decreased after the outbreak of the pandemic on the Romanian territory.

**Table 2.**

**Statistical descriptors of the size of the differences related to the paired questions regarding the satisfaction of person marketing agri-food products for the price of the products marketed, before and after March 2020**

t-Test: Paired Two Sample for Means

	Appreciate your satisfaction with the price of agri-food products that you practiced before March 2020	Appreciate your satisfaction with the price of agri-food products you have practiced since March 2020
<b>Mediate</b>	3.661654	3.165414
<b>Dispersion</b>	1.104352	1.502734
<b>Number of valid comments</b>	133	133
<b>Pearson correlation coefficient</b>	0.420141	
<b>The hypothesis tested</b>	0	
<b>df</b>	132	
<b>t (statistical value)</b>	4.634887	
<b>p (unilateral)</b>	4.23E-06	
<b>t unilateral criticism</b>	1,656479	
<b>p (bilateral)</b>	8.47E-06	
<b>t bilateral criticism</b>	1.978099	

\* Source: Processing statistical data resulting from the applied questionnaires, using Microsoft Excel

The table above refers to the price of marketed agri-food products, where the average response was around 3.7 for the period before March 2020 compared to 3.2 after March 2020.

Satisfaction of people decreased, the differences being statistically significant,  $t = 4.6$  with  $p \ll 0.001$ .

Thus, the pandemic context negatively affected the respondents' satisfaction to the questionnaire on the selling price of agri-food products.

**Table 3.**

**Statistical descriptors of the size of the differences in the case of paired questions on the perception of person marketing agri-food products, for all steps related to marketing, before and after March 2020**

t-Test: Paired Two Sample for Means

	Appreciate the difficulty of all steps (documents, transport, space sales, etc.) regarding the marketing of these products before March 2020 (1 = impossible, 2 = very difficult, 3 = difficult, 4 = easy, 5 = very easy)	Appreciate the difficulty of all steps (documents, transport, space sales, etc.) regarding the marketing of these products after March 2020 (1 = impossible, 2 = very difficult, 3 = difficult, 4 = easy, 5 = very easy)
<b>Mediate</b>	3,478,261	3
<b>Dispersion</b>	0.791495	0.788321
<b>Number of valid comments</b>	138	138
<b>Pearson correlation coefficient</b>	0.388108	
<b>The hypothesis tested</b>	0	
<b>df</b>	137	
<b>t (statistical value)</b>	5.714308	
<b>p (unilateral)</b>	3.29E-08	
<b>t unilateral criticism</b>	1.656052	
<b>p (bilateral)</b>	6.59E-08	
<b>t bilateral criticism</b>	1.977431	

\* Source: Processing statistical data resulting from the applied questionnaires, using Microsoft Excel

The third set of paired questions, represented by the table above, was about the difficulty of all steps (documents, transport, space sales, etc.) on the marketing of agri-food products.

This time, the average of the answers decreased from about 3.5 for the period before March 2020 to about 3 after March 2020.

## CONCLUSIONS

In general, following the results of the questionnaires we can conclude the following:

- Practically, the satisfaction of the persons who sell agri-food products in Valea Almăjului, regarding the sales volume, decreased after the outbreak of the pandemic on the Romanian territory.
- One of the statistical parameters concerning the degrees of freedom analysed shows a certain dissatisfaction with the restrictions on mobility and supply arrangements imposed by legislative regulations.
- The Almajului Valley area is geographically a hilly area, which lends itself to the cultivation of fruit trees, which is reflected in the indicator of sales of both fresh and processed fruit for juices, but also vegetables, dairy products and bakery products.
- The implementation of projects with European funds by producers has also generated an increase in the sale of vegetables (pumpkin, beans, etc.) and beekeeping products, especially in Bozovici and Prigor.
- The opinions of the people interviewed are different, some even from the same families by age group, because the younger people, who have more experience with computer systems, are involved in the online sale of products, thus developing family businesses.

We recommend a technological development of the area by reopening factories for processing agricultural products and as an encouragement for the livestock sector where we have observed a decline due to the low demand for meat products.

Both the fairly strict rules and the difficulty of marketing excisable products also prevent the market supply for alcoholic beverages which, although of high quality and with a reputation, cannot be promoted.

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