

Journal of EcoAgriTourism

Bulletin of Agri-ecology, Agri-food, Bioengineering and Agritourism

Vol. 19 (2023), No 2 (47)



Journal of EcoAgriTourism
ISSN: 1844-8577

Journal of EcoAgriTourism is a follow up, by translation in
English of "Revista de EcoAgroTurism"
ISSN 1841-642X, first issued in 2005

ISSN: 1844-8577



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Published by:

Transilvania University Press
500091 Brasov, B-dul Iuliu Maniu 41 A
Tel: 0268-476050
Fax: 0268-476051
E-mail: editura@unitbv.ro
Co-editor: Romanian Society for Information Technology in Agriculture, Food, Environment and Tourism
www.rosita.ro/jeat
ISSN: 1844-8577



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In the cycle "Systemic framework of EcoAgriTourism":

CIVILIZATIONAL METAMORPHOSIS TOWARDS "DE-CIVILIZATION"

There are too many indications that we are gradually sliding towards school apocalypse and educational precariousness, towards superficiality and self-sufficiency, towards the evasion of human values. The major danger is the idea of 'de-civilisation' converging with the 'new obscurantism'.

The concept of civilisation is polysemantic, i.e. it is so nuanced and interpretable (in everyone's mind) and often overlaps with the notion of 'culture', so that instead of a definition (practically impossible and useless at the same time), a broader approach is preferable, starting from the etymological aspects.

The term 'civilisation' derives from classical Latin, where the adjective civilis and the noun civitas designate the general qualities of the citizen (civis) in relations with other citizens: politeness, courtesy. Cultural and ethical values are what make a civilisation flourish.

Cultural values include: respect for nature, friendship, reading, freedom, art, education, knowledge, childhood, family, travel. The best-known moral values are kindness, courage, altruism, perseverance and empathy. Ethical values include: honesty, fairness, responsibility and respect for others.

In ancient times, Greek and Roman citizenship was synonymous with civilised behaviour. They considered their own state of social organisation to be the perfect and supreme model of humanity. Anything outside their world was identified with 'barbarism', an inferior state in relation to their civilised world. Then the world evolved continuously, culminating in the urban revolution, the formation of states and political development and the emergence of ruling elites, and in the plane of knowledge with the trend towards a global mind and quantum consciousness.

From the above we also see the idea that civilisation concentrates power, extending human control over nature, including other human beings. From this point begins the danger of the loss of cultural, moral and ethical values, i.e. DE-CIVILISATION.

In today's society (including the Romanian one), starting from the highest social levels, values are starting to be lost, their loss and replacement with de-civilizing non-values is unfortunately encouraged: lack of politeness, lack of honor, lack of empathy and "love of neighbor" etc., so that the behavior of the individual is no longer regulated by such values and a healthy education as a whole. Hence, by multiplication, there is a drift in the "civilised" course of society towards DE-civilisation. Physical and verbal violence becomes "normality" (!), as does lying, thievery, corruption, i.e. the removal of justice, freedom, respect, responsibility, integrity, loyalty, honesty, fairness and the like. All these "removals" are nothing but an erosion of the present civilization, i.e. a DE-CIVILIZATION.

The causes are multiple and diffuse, making them difficult to identify and address. But the effect is catastrophic, especially if the drift is accompanied by a lack of education and knowledge, i.e. when it is coupled with "perverse 21st century obscurantism". It's sad, but let's not be surprised that more and more people are choosing to believe more and more in pseudo-science, crappy spiritualism, dactoptic mythologies, astrology and numerology, and all the propaganda lies of the far right.

The way today's schools look (without teaching them to think freely, stuffed with religious dogma, without the disciplines of sociology, philosophy, psychology, logic, etc.), i.e. a society that is beginning to take pride in obscurantism as a model of knowledge, with its minds washed out as an effect of education and its successful illiterates promoted to ministers, let us not be surprised when we realize that we live in a world of de-civilization.

Instead of conclusions:

Being cut off from nature, culture, morals and ethics means alienation, idiotizing and robotization, in short, an artificial society proliferates (clearly justifying the necessary aid of artificial intelligence), while the common-sense society dies a slow and sad death. In this sense, paraphrasing the idea "Le Roi Est Mort, Vive Le Roi!" we can sadly think of the sequence: "Natural Civilization Is Dead, Long Live Artificial Civilization!"

The context described is NOT apocalyptic, but expresses today's reality... Let's realize that we are at the crossroads between the Knowledge Society and the Barbie Society!

Director of the publication,
Prof. Romulus GRUIA, PhD,
PhD supervisor, Scientific Leader

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ASPECTS REGARDING SHELF LIFE OF MARINE BIOMASS PRODUCTS

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Abstract: The paper addresses issues related to the shelf life of some snacks type food products developed within the SUMAFOOD project, with the addition of *Saccharina Latissima* algae powder, respectively hydrolyzed fish protein. The replacement coefficients of wheat flour in the recipe varied between 1.5% and 6%. The results show a good stability of the products, but in the case of using hydrolyzed fish protein, there is the phenomenon of lipid oxidation due to their high content of unsaturated fatty acids. Oxidation leads to rancidity and the production of undesirable volatile compounds due to the secondary level of oxidation that negatively affects the nutritional value and sensory characteristics of the products. Therefore, it is important to investigate different preservation techniques, mainly by using natural antioxidants (i.e. rosemary extract) to extend the stability of biomass powders.

Keywords: biomass, shelf life, bakery products

1. Introduction

The complementary activities of the partners in the SUMAFOOD consortium led to the supply of UNITBV of 2 types of powdered materials, respectively: algae powder from the "*Saccharina Latissima*" species and hydrolyzed fish protein [1, 2].

Starting from these powdery raw materials, 14 snack and pasta products were developed, which were tested for stability and shelf life [3-6].

As for products with added hydrolysed fish protein, based on a high content of hydrolysed fish protein, they are prone to lipid oxidation due to their high content of unsaturated fatty acids. Oxidation leads to rancidity and the production of undesirable volatile compounds due to the secondary level of oxidation that negatively affects the nutritional value and sensory characteristics of the products.

Therefore, it is important to investigate different preservation techniques, mainly by using natural antioxidants to extend the stability of biomass powders. Antioxidants can be used either as ingredients during product formulation or in active packaging materials. In this case, rosemary extract was used, approved as food additive E392, according to European directives 67 and 69/2010. The use of rosemary antioxidant during

the formulation of the product was achieved at the established concentration of 150 mg/kg of fatty acids, which is the maximum amount allowed according to the European Food Safety Authority. Lipid oxidation is the predominant factor affecting the shelf life of products. This phenomenon is highlighted by values of peroxide and p-anisidine representing the primary and secondary oxidation, respectively, for the tested samples [7-9]. Based on the "Peroxide Value" indicator, one can mathematically model the results and calculate the oxidation rate constants, which is a valuable tool to predict the shelf life under real dynamic conditions.

2. Research methodology

The development of snacks type products was carried out starting from the classic recipes, which were partially replaced with percentages between 1.5...6% of wheat flour with algae powder, respectively hydrolyzed fish protein powder. With the help of sensory tests, the recipes were improved to a satisfactory grade from a hedonic point of view. An important role in the development of the products was played by the consumer himself, who introduced permanent feedback in the finalization of the recipes. Water activity was determined in triplicate using the

Novosina LabTouch-aw device, the average values being centralized [12-15, 17].

3. Results

In the stage of development and evaluation of the shelf life for multi-ingredient powdered

products, a number of 8 snack products were made from mixtures of hydrolyzed fish protein powder and other powdered raw materials, briefly presented in table 1.

Table 1. Powdered multi-ingredient snack products based on hydrolyzed fish protein

Sample 1P. Product name: Salty crackers with Cheddar cheese and hydrolyzed fish protein	
Nutritional value: Energy value: 265.06 Kcal Protein: 14.02g Fats: 11.43g Carbohydrates: 21.32g Fibers: 0.77g Carbohydrates: 0.36g	
Sample 2P. Product name: Pretzels with wine, rosemary and hydrolyzed fish protein	
Nutritional value: Energy value: 368.26 Kcal Protein: 11.71g Fats: 8.4g Carbohydrates: 58.05g Fibre: 3.28g Carbs: 0.51g	
3P sample. Product name: Crackers with yogurt and hydrolyzed fish protein	
Nutritional value: Energy value: 239.35 Kcal Protein: 9.9g Fats: 3.18g Carbohydrates: 35.88g Fibre: 1.16g Carbs: 3.75g	
Sample 4P. Product name: Sweet biscuits with hydrolyzed fish protein and lemon juice	
Nutritional value: Energy value: 244.22 Kcal Protein: 9.53g Fats: 2.5g Carbohydrates: 40.68g Fibre: 1.5g Carbs: 13.85g	

Sample 5P. Product name: Nachos with hydrolyzed fish protein	
Nutritional value: Energy value: 260.24 Kcal Protein: 7.03g Fat: 5.79g Carbohydrates: 33.24g Fibre: 2.64g Carbs: 0.47g	
Sample 6P. Product name: Grissini with hydrolyzed fish protein	
Nutritional value: Energy value: 367.85 Kcal Protein: 12.96g Fats: 6.1g Carbohydrates: 64.4g Fibre: 3.16g Carbs: 1.95g	
Sample 7P. Product name: Croutons with 1.5% hydrolyzed fish protein	
Nutritional value: Energy value: 367.85 Kcal Protein: 12.96g Fats: 6.1g Carbohydrates: 64.4g Fibre: 3.16g Carbs: 1.95g	
Sample 8P. Product name: Croutons with 3% hydrolyzed fish protein	
Nutritional value: Energy value: 372.57 Kcal Protein: 12.08g Fats: 6.17g Carbohydrates: 65.23g Fiber: 3.2g Carbs: 1.98g	

At the same stage of development and evaluation of the shelf life for multi-ingredient powdered products, a number of 6 snacks and pasta-type

products were made from mixtures of seaweed powder and other powdered raw materials, briefly presented in table 2.

Table 2. Powdered multi-ingredient snack-type products based on seaweed powder

Sample 1 A. Product name: Pasta with algae and natural pigments (spinach, beetroot, carrot)	
Nutritional value: Energy value: 272.78 Kcal Protein: 10.49g Fats: 0.76g Carbohydrates: 52.36g Fibers: 1.95g Carbohydrates: 0.2g	
Sample 2A. Product name: Salty snacks with algae and mixture of seeds	
Nutritional value: Energy value: 365.45 Kcal Protein: 11.89g Fats: 8.22g Carbohydrates: 58.97g Fibers: 3.36g Carbs: 0.43g	
Sample 3A. Product name: Biscuits with cheese and seaweed	
Nutritional value: Energy value: 277.15 Kcal Protein: 8.46g Fat: 7.59g Carbohydrates: 41.4g Fibers: 1.55g Carbs: 0.05g	
Sample 4A. Product name: Bake rolls with algae powder	
Nutritional value: Energy value: 358.14 Kcal Protein: 10.77g Fat: 5.29g Carbohydrates: 63.98g Fibre: 3.09g Carbs: 4.5g	

Sample 5A. Product name: Salty snacks with caraway seeds - 1.5% algae	
Nutritional value: Energy value: 266.22 Kcal Protein: 7.16g Fats: 1.9g Carbohydrates: 47.12g Fibre: 1.72g Carbs: 0.05g	
Sample 6A. Product name: Salty snacks with caraway seeds - 3% algae	
Nutritional value: Energy value: 263.79 Kcal Protein: 7.22g Fats: 1.89g Carbohydrates: 46.69g Fibre: 1.76g Carbs: 0.04g	

To establish the validity period, the samples to be developed were subjected to microbiological analyzes according to Order no. 27 of 2011 of ANSVA for matrices of simple bakery products.

The parameters determined were "Yeasts and molds" and "Water activity" [11, 16, 18, 19].

The results of the microbiological analyzes of the snacks and pasta samples are presented in table 3.

Table 3. Microbiological indicators of snacks / pasta samples

Sample	Yeasts and molds cfu/g	Water activity aw
Initial analysis		
1P	< 10	0.978
2P	< 10	0.973
3P	< 10	0.972
4P	< 10	0.971
5P	< 10	0.972
6P	< 10	0.975
7P	< 10	0.976
8P	< 10	0.975
1A	< 10	0.975
2A	< 10	0.974

3A	< 10	0.972
4A	< 10	0.971
5A	< 10	0.972
6A	< 10	0.970
Analysis at 48 h		
1P	< 10	0.972
2P	< 10	0.968
3P	< 10	0.967
4P	< 10	0.969
5P	< 10	0.965
6P	< 10	0.966
7P	< 10	0.970
8P	< 10	0.968
1A	< 10	0.968
2A	< 10	0.965
3A	< 10	0.967
4A	< 10	0.962
5A	< 10	0.966
6A	< 10	0.967
Analysis at 72 h		
1P	5.0×10^{-1}	0.962
2P	4.0×10^{-1}	0.957
3P	4.0×10^{-1}	0.958
4P	3.0×10^{-1}	0.953
5P	5.0×10^{-1}	0.955
6P	4.0×10^{-1}	0.959
7P	3.0×10^{-1}	0.957
8P	3.0×10^{-1}	0.954
1A	3.0×10^{-1}	0.956
2A	4.0×10^{-1}	0.953
3A	5.0×10^{-1}	0.956
4A	3.0×10^{-1}	0.954
5A	3.0×10^{-1}	0.955
6A	3.0×10^{-1}	0.952

It can be concluded that samples developed with the addition of algae or hydrolyzed fish protein are within the limits of the current regulations, from a microbiological point of view for at least 96 hours, stored at room temperature and packed in a paper bag. From the point of view of the values obtained for the Water Activity parameter, during storage, it decreases slightly in all samples.

4. Conclusions

The 14 snack products developed within the SUMAFOOD project have benefited permanently from feedback from the consumer,

even from the development side, in order to reduce the optimization phase by evaluation on the hedonic scale.

Microbiological activity and water activity found in the shelf-life analysis after 96 hours of operation are within the parameters of the current regulations. According to a textural analysis, the samples' firmness and gumminess increased over time as the amount of algae and protein added increased. European Blue Bioeconomy initiatives state that depending on the nutrient deficiencies of the customer in question, experimental research on baked samples offers intriguing possibilities for the use of findings in medical gastronomy or customized gastronomy.

Acknowledgment:

This work was supported by a grant of the Ministry of Research, Innovation and Digitization CNCS/CCDDI–UEFISCDI, contract no. 245/2021, ERANET-BLUEBIO–SuMaFood, within PNCDI III. The authors acknowledge the financial support for this project provided by transnational funding bodies, partners of ERANET BLUE-BIO.

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APPLICABLE CONCEPTS FOR DEVELOPMENT AGRICULTURAL AND RURAL MOUNTAIN AREAS

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Abstract: As part of the mountain area development mission, the work addresses the problem of the mountain profile in relation to agro-zootechnical production and its importance for the beneficial evolution of the localities in this area. As a first step in this endeavor, the study analyzes a series of original concepts with potential application to the issue of mountain agro-zootechnics. The aim is to improve the living conditions of rural populations in mountainous areas, by taking into account three technical-organizational components aimed at: sustainable management of natural resources, adaptation to climate change and the diversification of agri-rural attractors, the development and promotion of agri-food and, above all, mountain gastronomy. The analyzed concepts have the potential to offer general and specific solutions, which can be found in various specific programs for agro-rural development of the Romanian mountain area.

Keywords: agro-zootechnics, concepts, development, mountain, rural.

1. Introduction

In the context where the mountain area is the area marked by specificity, ecological fragility and economic-social disadvantage due to natural causes, a specific approach, both theoretical and pragmatic, becomes appropriate.

Taking into account the severe natural constraints, the forms of economic activity and human life are marked by deep specificity, unassimilable to plain and hilly areas, especially in the basic field, the agro-zootechnical one.

Taking into account the real situation of the agri-rural dimension in the mountains of Romania, as well as the regulations of the European Union regarding agriculture and rural development, it is necessary to find solutions for the revitalization of localities and especially the mountain village, both in terms of the production of goods and and rural services, to define a series of "attractors" for mountain areas.

A first aspect is that of adapting and optimizing mountain agro-zootechnical activities to current requirements and crises. Therefore, especially for the mountain area suitable for food production, rules must be applied regarding alternative agriculture (especially organic), adapted to production in the mountain area:

- strengthening the control system, to increase consumer confidence in the agro-zootechnical system of high quality mountain products.;
- new rules for mountain producers, which will facilitate the transition of smaller farmers from traditional non-productive methods to modernized ones, but in line with quality and ecological production;
- new rules regarding eco/bio products to guarantee that all mountain products sold in Romania or EU countries comply with the same standard;
- diversification through several types of products and assortments that can be marketed under the name "mountain product", in order to meet the demand of consumers for healthy and tasty products, in which they can trust and, at the same time, to ensure a market fair for producers, distributors and traders.

In this context, the general objective of the study is to contribute by means of new concepts, both to finding adaptation elements for the mountain area, and to their application in specific programs. The aim would be, in short, to reduce poverty (by 30% by 2030, for example) and to improve the living conditions of rural populations in mountain areas, taking into account three technical components: - sustainable management

of natural resources, adaptation to climate change and diversification of agri-rural attractors; - development and promotion of the agri-food sectors; - development of mountain gastrotourism.

2. Working Method

The work has as its conceptual basis the Theory of bio-harmonism [20, 21], as well as a series of comparative analyses, economic, social and informational statistics. Elements of multi-criteria analysis are addressed and a managerial and legal diagnosis is used with emphasis on the socio-economic aspects of the components of the integrated montano-logical system.

The principles, techniques and regulations specific to sustainable development regarding the development of mountain areas on multiple levels (local, national, regional, continental, global) are considered.

3. Results and Discussions

The applicability of smart growth concepts has an increased yield for rethinking the mountain profile in the coming decades, through complementarity with another group of concepts that support the "Farm to Fork / F2F" Strategy and have a direct impact on the development future of the food profile of the mountain.

It is important that the application of principles and mechanisms are first anchored in a comprehensive theoretical base and with elements that can be directed and applied to the evolution of mountain areas and implicitly in the development of public policies and concrete strategies.

In the sense of the mentioned, in the present study we will analyze a series of original concepts that, along with other theoretical aspects, can support the objectives proposed for the agricultural and rural development of the Romanian mountain area (and not only), concepts that are listed in the table 1.

Table 1. *Original Support Concepts a Mountain Agri-rural Development*

No. crt.	NAME OF THE CONCEPT	SPECIFICATION REGARDING ADAPTATION OF THE MOUNTAIN AREA
1	The concept of Ecosanogenesis	- An activity model based on the principle of ecosystem bioharmony for human and environmental health is described, highlighting aspects of food quality through healthy agri-food products, along the lines of producing mountain products of high nutritional, sensory and hygienic quality.
2	The concept of Animal Husbandry Bioeconomy	- The new zootechnical paradigm is described in which the environment enters the economic equation, with the prediction of strategies based on "eco/bio" zoo-food technologies and the role of eco-farms in bioeconomic zootechnics applied to the specific mountain geoclimatic conditions.
3	The concept of Integronic Nutrition through Gastronomic Engineering	- An optimization path is described through the dynamics of multiple integrations of the food act based on the principles and methodologies of the gastronomic engineering approach, with the emphasis on strategies based on the development techniques of mountain gastrotourism.

3.1. Reorienting the food profile of the mountain in the coming decades

According to the Mountain Convergence Principle an important step for the agricultural and rural development of high or medium altitude areas, it represents the food profile of the mountain in the dynamics of the direction of

refuge and resilience regarding biodiversity and agro-zootechnical production gradually adapted to changes and potential crises, so impactful in fragile areas such as mountain ones.

A significant support for the reorientation of the food profile of the mountain area, with all its components, constitutes the theoretical basis

necessary to support the valorization of biodiversity and the technical applicability for the production of mountain products, traditional products, "eco-bio" type products, that is, high-quality agri-food products, so demanded by more and more consumers. We refer to the mountain offer "from Farm to Fork", i.e. agro-zootechnical production in eco-farms, to manufacturing food processing, to specialized culinary production, as well as to the valorization of high-quality mountain products through responsible tourism, all of which have the potential of integrated rural development in the space of the Carpathian Mountains.

Thus, an interacting concept is the **SYSTEMIC CONCEPT OF ECOSANOGENESIS** (Gruia, R., 1998), i.e. a concept of bioharmonization of systemic health at all levels of mountain ecosystems and anthroposystems (and not only). Therefore, ecological sanogenesis (here, mountain) is the concept of integrating food security on the "health-environment-bioeconomy" axis. In short, the idea refers to the dynamics of generating or preserving the health of living species, regardless of the biological hierarchy and ecological organization (especially with increasing degrees of anthropization), having as a methodological basis the bioharmonization of economic efficiency with systemic effectiveness, axis expressed simply by the pragmatic phrase: "Man - Product - Nature".

It should be noted that unlike the concept of pathological analysis and the convergence of human and animal health, i.e. the well-promoted concept at the international level called "One Health" (the complementarity of human and veterinary medicine), the idea of general ecological sanogenesis, i.e. the concept of "ecosanogenesis", emphasizes the generation of health, or the non-impairment, of it at all biological kingdoms and levels (including micro-organisms, plants, fungi and, of course, the Animalia kingdom) beyond biological ailments and diseases, into the realm of prevention and balance.

We are basically referring to the level of imbalances with an impact on health due to the impact of technologies (see technopathies) and the avoidance of prevention and environmental protection. Many causes are due to wrong actions from the socio-economic perspective, or counterproductive political decisions at the level of "life" (biodiversity) in ecosystems and anthroposystems.

Methodologically, ecosanogenesis is based on processes of multiple integration (integron dynamics) and bioharmonization of all ecosystem components, expressed through the existential triad (substance, energy, information) based on the analysis of Information (I) with all its types of flow.

Detailing the conceptual analysis at the specific level of the food method and, implicitly, of the production of agro-food products, the **CONCEPT OF BIOECONOMIC LIVESTOCK** (Gruia, R., 2016) becomes useful as a theoretical applicability. In essence, it is the approach that supports the reorientation of animal production activity on the principles and methodologies of the bioeconomy, with the objective of paradigmatic and technological renewal so that animal husbandry enters a state of balance and bioharmony of the production and food of animal origin in convergence with the environment environment, with health and with the requirements of today's society. The applicability of this approach is extremely useful in fragile ecosystems such as mountain range.

Technically, the idea highlights the elements of optimizing yields and systemic effectiveness by solving energy bioconversion and biotechnological transformations.

The approach is based on the paradigmatic change of principle regarding the introduction of the environment into the economic equation in thermodynamic expression, thus generating the processes of sustainability and, implicitly, of eco-development (fig.1).

Methodologically, the concept actually integrates the actions at the level of anthroposystems or zoo-productive ecosystems based on the management of eco-farms, the approach of genetics of biocenoses, on the flow of information and cybernetic regulations, as well as on the parameterization of the system in the new paradigm based on the e-Mergetic indicators of the incorporated solar energy.

Through the new interpretation, it is practically possible to realize the remodeling of animal production from the singularity of economic efficiency, to the holism of systemic effectiveness bio-harmonized with the creation of animal products with superior qualities, not only nutritional and sensory, but also with sanogenic capacity and reduced environmental impact, resulting in the emergence, that is, the emergence of the new higher order expressed by sustainability and food security and safety in the agri-rural environment, both at the level of the

entire country and at the level of the Romanian mountain area.



Fig.1. Directions of biotechnology and bioeconomy in future agri-rural development

3.2. Emphasis on catering activities and mountain gastronomy

As a completion of the food profile of the mountain areas is the activity regarding the realization of complex foods, i.e. specific high-quality foods and drinks as a serious attractive offer for agro-rural development in the mountain area. Culinary production, as an expression of the food profile, takes place practically based on the CONCEPT OF INTEGRATED FOOD THROUGH GASTRONOMIC ENGINEERING (Gruia, R., 2008). Thus CONCEPTUALLY, "gastronomic engineering" is the approach that treats on engineering principles the third step of the food act (after agriculture, based on agro-zootechnical engineering and the food industry expressed through food engineering), respectively the final step of gastronomy and related culinary production, i.e. the sector distinct from the gastro industry, with scientific, technological and managerial developments expressed through gastronomic engineering.

Methodologically, it is an approach based on optimization, efficiency and multiple technical-scientific and organizational integration, which brings together complementary components of gastronomy, gastrotechnics, food sciences and technologies, practically resulting in a new

discipline in itself, the study of activities specific to the restaurant industry and of the restoration system as a whole. The activity includes all public catering units, as well as culinary production structures within tourist reception units. Pragmatic - gastronomic engineering represents the field with the highest added value in the branch of agri-food production, because in principle, the professional kitchen in the restaurant industry or in agri-tourism and tourist guesthouses, brings value being directly linked to the QUALITY of the culinary preparations, which cumulatively benefits from the quality agricultural production and food processing. Basically, we are talking about a complex and concerning field for humanity, with major targets in terms of health and longevity. In this sense, we specify, for example, some scientific directions of the field: molecular gastronomy, nutrigenomics, gastronomic robotics, culinary sanogenesis and pathogenesis, culinary constructivism and personalized gastronomy.

Basically, we are talking about the last part of the cycle "from farm to fork" by highlighting the industrial gastro sector and preventive responsibility taking into account the direct impact of food on the body of consumers. What is specific to the eloquent development of gastronomic activity in mountain regions are the quality foods used as ingredients in culinary

recipes. These have as their origin the activity of mountain agro-zootechnical production, food processing and obtaining diversified assortments of increasingly original culinary preparations, on every Romanian mountain massif.

4. Conclusions

The future development of the food profile of the mountain, supporting the well-known European strategy "from farm to fork", is first anchored in a comprehensive theoretical basis and with elements that can be directed and applied to the evolution of mountain areas and implicitly in the development of public policies and concrete strategies.

The reorientation of the food profile of the mountain in the coming decades is based on the concepts related to eco-sanogenesis, bioeconomic animal husbandry and gastronomic engineering, all of which have the potential to be applied in the mountain and pre-mountain space of Romania, through methods and techniques of biotechnology and bioeconomy.

The three technical components for mountain agri-rural development are, in summary, those related to the sustainable management of natural resources, adaptation to climate change and the diversification of agri-rural attractors, then the development and promotion of the agri-food sectors, as well as the development diversified gastrotourism on every Romanian mountain massif.

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EVALUATION ON COVID-19 IMPACT TO VISITORS INTERESTED IN ROMANIAN CAR RENTAL SERVICES USING ONLINE COMPUTER ASSISTED GRAPHICAL INTERFACE

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Abstract: The paper presents the impact of the COVID 19 pandemic on the demand for rental transport services (rent a car) in Romania. With the help of the graphic interface provided by Google Analytics, the data resulted from the traffic analysis of a reference website www.eurocars.ro is obtained, analyzed and compared. The information obtained reflects the global and national trend of losses generated by Covid 19 pandemic.

Keywords: Covid 19, rent a car, visitors, Google Analytics, traffic, services

1. Introduction

January 2020 marked the spread of SARS-CoV 2 virus across the globe .The authorities in each country have been obliged to take measures to protect the health of the population, to diminish the effects of the pandemic [8].

The restrictions troubled people's behavior and changed the life style, forcing them to stay home and work from home or to lose their jobs . The economy of all the countries were affected depending on the expansion of the pandemic. Also tourism the most dynamic branches of the world economy during the last decades, has been deeply affected [2,8].

The negative impact of the covid 19 pandemic on tourism in general and car rental services in particular was significant. The travel restrictions imposed by this situation have determined the significant reduction of flights and implicitly the demand for rent a car services. The examples of renowned companies in the field such as Hertz and Avis are worth mentioning in this context, the first starting the bankruptcy procedure in Canada and the second registering losses of \$158 million in 2020 [9].

The Covid pandemic also strongly negatively influenced Romanian tourism in 2020. Thus, the number of arrivals decreased by 50.6% in total in the first nine months of this year.

According to the data of the National Institute of Statistics, the number of arrivals of Romanian tourists decreased by 42.8%, and that of foreign tourists decreased by 81.3% [10]. Regarding the

number of overnight stays of Romanian, tourists staying in tourist reception structures with accommodation functions, they represented 92.9% of the total overnight stays.

In total, the number of overnight stays decreased by 49.5%, the overnight stays of Romanian tourists registering a decrease of 43.3%, and that of foreign tourists a decrease of 79.3%. Also, according to Eurostat data, in July, Romania recorded the largest decrease in the arrivals of foreign tourists from the European Union. Thus, there was an 88.9% decline in nights spent by foreigners in accommodation units compared to the same month last year, while in the first seven months the decrease was 76.1% compared to the same period in 2019 [10].

At the global level, the car rental market had a very large decrease. According to some estimates at the level of 2020, the field of car rentals fell below 30% of its potential.

A similar trend was maintained in Romania. In the cities of Bucharest and Otopeni, car rental services were used at less than 30% capacity. Because of this huge drop, car rental companies had nothing to cover their expenses. Suddenly, a market that was valued at a global level at the amount of 84 billion dollars, was worth less than 30 billion [11].

At the level of 2022, the Romanian car rental market has recovered strongly with the relaunch of domestic and international air travel.

A problem that arose with the pandemic was the bankruptcy of many car rental companies, which led to a decrease in the number of cars on

the market. For this reason, the market could no longer reach the level of 2019 in conditions of high demand. Rent car companies are now more cautious and prefer not to repeat the situation of two years ago when they had car loan installments and had no customers [11,1].

2. Google analytics as visitors interests measuring tool

Google Analytic application is a tool provided by Google, which monitors the entire activity of the web page [13]. The site owners use this method to track traffic on the pages they own, as well as other types of data. They also use Google Analytics' integration with Google AdWords to review online advertising campaigns by tracking entrance pages and goals.

User-defined goals include views of the reason visitors leave the site without taking the desired action. [13,3,4].

Reports from Google Analytics specific pages or downloading Google Analytics tracks visitor information from all referrers including search

engines, advertisements, email marketing and other websites [5,6].

In the same time with this measuring tool can give an answer about which online ad or advertisement is the most effective. Another answer important for the web developers is about the reason visitors leave the site without taking the desired action. Are the website design elements that keep visitors away? What is the content of the site that visitors are most interested in? Google Analytics can answer to all this questions [6,7].

Reports from Google Analytics can show how many unique users visited the site in a defined time period, how many times, from what type of device (desktop, mobile or tablet), from which cities or countries they accessed the page, from which browser (Opera, Firefox, Chrome, etc.) (fig 1).

The possibility to divide visitors into reports according to demographic criteria such as: age, sex, region or interests is also offered by Google Analytics.

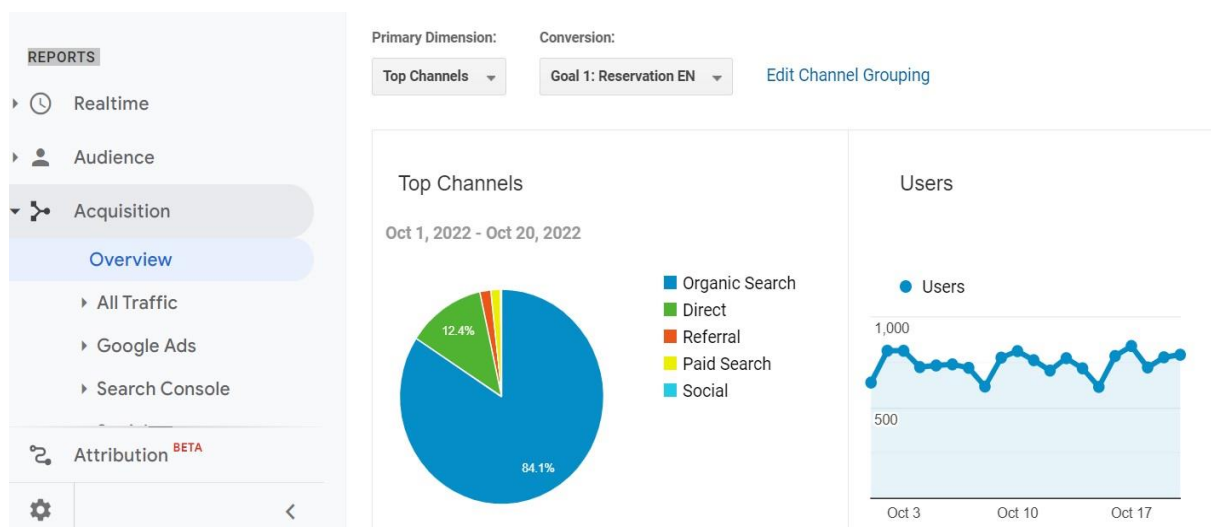


Fig. 1. The Report sections

3. Evaluation on Covid 19 impact Using Google Analytics tool

Eurocars is a well-known brand on the market of rent a car service in Romania, where it has been active for 20 years [12].

Since its establishment, it has proposed to offer online rental services through the website www.eurocars.ro, especially to foreign tourists who rent cars from the main Romanian airports.

Due to the superior position in the Google Search Engine (occupies the first places on the first page on the most important keyword combinations), the traffic of visitors is significant.

This website offers clients to a large number of car rental companies, from most of the country's important cities. Practically this portal www.eurocars.ro is a portal with national coverage.

For this reason, the information obtained by monitoring visitor traffic is relevant to draw conclusions about the evolution of the car rental market in Romania.

In the present study, the evolution of the demand for rent a car service will be revealed in

order to highlight the impact of the COVID 19 pandemic on this demand. In this sense, the following graph shows a comparison between tourists' interest in car rental in the first six months of 2019 compared to the first 9 months of 2020.

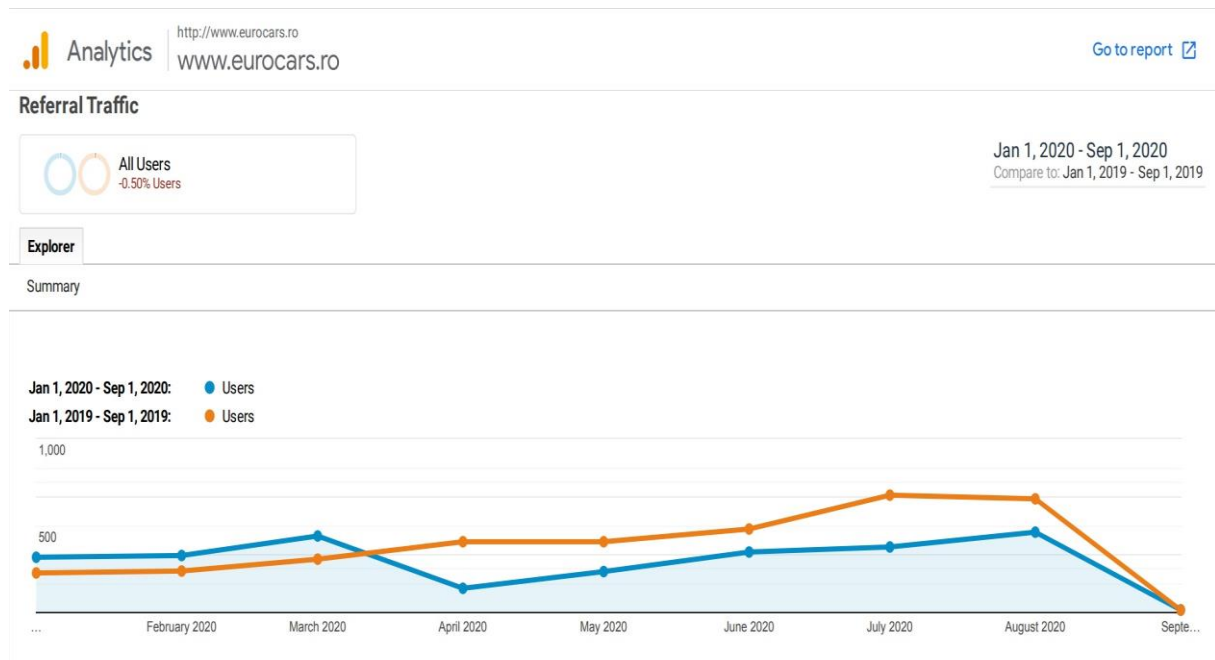


Fig. 2. The first comparison of visitor's interest in car rental services during Covid 19 pandemic

The graph from figure 2 shows the first comparison between the number of the www.eurocars.ro visitors in 2019 and 2020 years.

The graph reveals a 50% drop in the number of visitors, potential customers for the rent a car service in 2020 (practically the first year of the Covid pandemic) comparing with the previous year 2019.

The graph from the following figure 3, shows the second comparison between 2020 and 2021 pandemic years. There is a 10% increase in the number of visitors, but there remains a 40% decrease compared to 2019. The comparison was made for the first 9 months of each year.

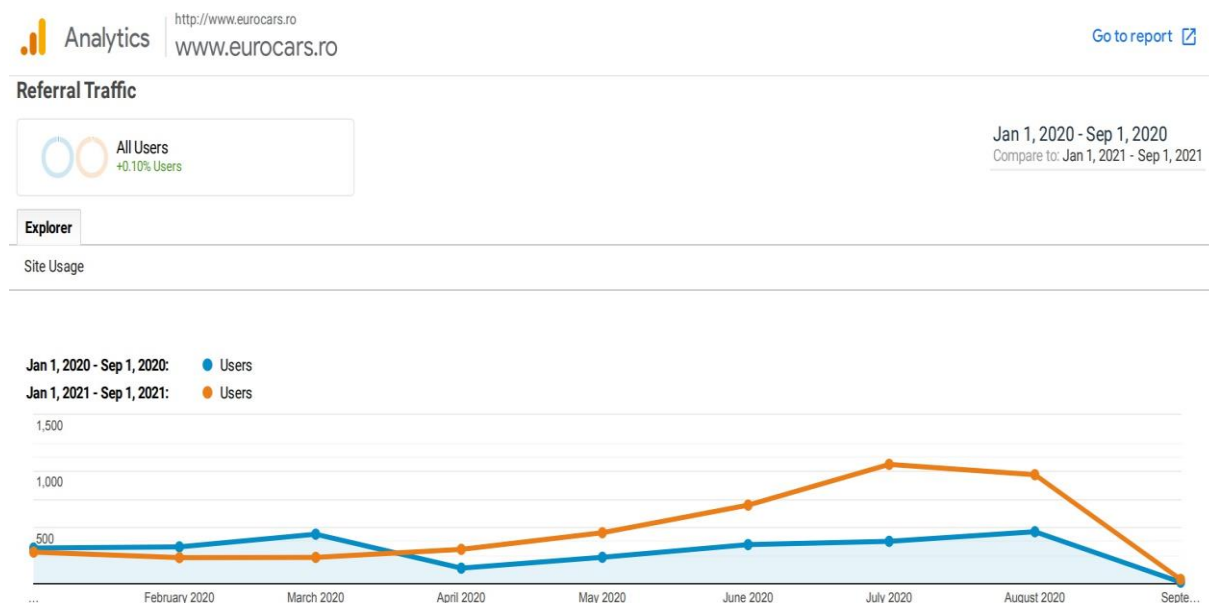


Fig. 3. The second comparison of visitor's interest in car rental services during Covid 19 pandemic

Both graphs show an increase in the number of visitors from January until July, when a peak is reached, after which there are further declines. The months of June, July and August are seasonal months, which explains the increase in the number of visitors during this period.

4. Conclusions

The present study proves that Google analytics is a useful tool for monitoring the interest of future customers in using rent a car services.

Moreover, the information obtained regarding the traffic on the website during the two years of the pandemic and their comparison with the similar period of 2019, provides valuable data regarding the impact of the COVID 19 pandemic on Romanian tourism in general and the rent a car service in special.

The period between January and September was compared for each year. This period includes the off-season months such as January, March, April, May, June and September, but also two months of the season: July and August.

The spring period also includes the Easter holidays when there is an increase in demand for car rental services.

It is interesting that if the global car rental market fell below 30% of its potential in 2020, the present study shows that the interest of potential customers in this market in Romania fell by 50% compared to 2019. Also, the same 50% decrease in visitors on the www.eurocars.ro

website is identical to the decrease in arrivals in Romania. The arrivals decreased by 50.6% in total in the first nine months of this year 2020. This is explained by the direct connection between the rent a car and air transport services.

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THE IMPORTANCE OF USING WOODY BIOMASS AS FUEL

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Abstract: The importance of using woody biomass in the field of obtaining heat is due to the fact that this raw material is an ecological material and carbon dioxide emissions are neutral at the time of combustion. In the coming years, there will be an important increase in final suppliers from the Middle East, a fact caused by the decline in production from the North Sea and other OPEC (Organisation of Petroleum Exporting Countries) areas. An alternative in energy production is highlighted by the exploitation of renewable sources (solar, wind, geothermal, hydro and biomass). The contribution of biomass to energy production at the level of the European Union was ninety million tons of oil equivalent (Mtoe) from solid biomass exploited in 2022.

Keywords: ash content, Berthelot calorimeter, calorific value, biomass

1. Introduction

Renewable energy resources represent a new opportunity in Romania, with prospects for future development. Energy is produced from fossil fuels, which are unevenly distributed on the globe. Fuels are found in three forms: fossil, nuclear and renewable fuels. Fossil and nuclear fuels, according to research carried out by the European Union, seriously damage the environment. The government committee since 2022 is trying to implement strategies to produce energy from renewable sources. The states of the European Union are largely dependent on the import of fuels. The biggest danger posed by fossil fuels is the harmful emissions that destroy the atmosphere.

The extraction and processing of fossil fuels emit approximately 98% of carbon dioxide the atmosphere, which negatively influences both the evolution of living microorganism and human lives. The production and consumption of material that ensure the quality of life necessary for people is determined by energy consumption. By exploring renewable energy sources, each state can offer the population a final product that will provide them with a high standard of living.

It is desired that by 2030 the consumption threshold of 20% the energy produced by alternative energy sources will be reached. Biomass can be found into the following forms: forest biomass, agricultural biomass, municipal waste, animal waste, aquatic waste.

Wood biomass reserves differ throughout the territory of the European Union, as well as worldwide. The forest area varies from 27.6 million hectares in Sweden to 117 hectares in Cyprus. Worldwide, the forest fund occupies approximately for billion hectares, the largest amount being distributed on the territory of Brazil, 478 million hectare, Canada, 310 million hectares, China 197 million hectares. In table 1 shows area of the forest fund by countries.

Table 1. The forest fund of European Union (ISN, 2021)

Country	The forest fund (thousands of hectares)
Romania	6519
Belgium	678
Denmark	544
Finland	2215
Germany	1107
Italy	914

Poland	933
Spain	181
Hungary	202
Netherlands	365
Greece	390
Estonia	221
Swedish	282
Lithuania	216

The equipment used to find out the caloric power of the wood biomass from the composite materials is the explosive burning is Berthelot Calorimeter.

The calorimeter is composed of the following component parts: C-cylindrical vessel, T2-thermometer which is inserted into vessel C; A-agitator.

2. Materials and method

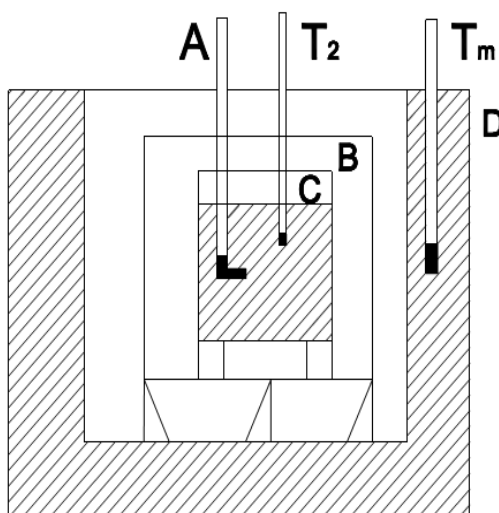


Fig. 1. Berthelot Calorimeter

Before performing the proper essay, the calibration of the calorimetric bomb is made with benzoic acid (with a known caloric power of 26463 KJ/kg), in order to determine the caloric coefficient of the calorimeter. The procedure to determine the caloric power of wood refers firstly to preparing the raw material (briquettes and pellets) and the installation, then the proper determination of the caloric power, and finally obtaining the results.

The preparation of the wooden material for the testing consists in processing a small part of approximately 0.6-0.8 grams of briquettes and pellets, samples weighted with a precision of 0,001 grams. This sample is put in a metallic pot and is introduced in a laboratory stove, in order to be dried at a temperature of $103 \pm 2^{\circ}\text{C}$. The final result of burning the lignocellulose briquettes and pellets is expressed by the caloric power, notion through which one understands the heat quantity obtained by burning a mass unit. The proper test contains 3 distinct periods.

The initial period ("fore") which has as purpose the determination of the temperature variations of water in the calorimetric basin due

to the heat exchange with the exterior before burning. In this period, usually 5 minutes, the temperature is read once at 1 minute with a precision thermocouple. The last temperature in the initial period is the first temperature in the main period.

The registered values in this period are generally six and are registered once every 1 minute. After registering, the sixth value the ignition of the material takes place and indicating it in the menu bar under the name (Burning time).

The main period ("main"), starts by igniting the sample and has as consequence the raise of water temperature in the calorimetric basin due to the burning of the briquette and pellets particle and heat releasing. The final temperature is given by the maximum value of the temperature, because after it's decreasing, that means that the calorimetric basin doesn't receive heat from the bomb. The values number may vary between 19-42 values of the registered temperature in this period.

The final period ("after") has as purpose the determination of the average water temperature variation in the calorimetric basin, due to the heat

exchange from the bomb with its exterior (water in the calorimetric basin) after burning.

In order to determine the ash content of briquettes and pellets, the general method of standardized determination (ASTM D2866-11, 2012) was used. According to this method, the ground and dried material to 0% moisture content is calcined at a temperature of 650°C in a lab stove, for at least 3 hours.

When determining the ash content, it will be taken into consideration that the ash content is completely dried and the pot is clean and empty:

$$AC_b = \frac{(m_{cs} - m_{ec}) - (m_{cba} - m_{ec})}{m_{cs} - m_{ec}} [\%]$$

where:

m_{cs} – mass of the crucible with the dried sample (kg);

m_{ec} – mass of the empty crucible (kg);

m_{cba} – mass of the crucible with the black (kg).

In fig.2 the calcination stove to determine the ash content of wood chip boards.

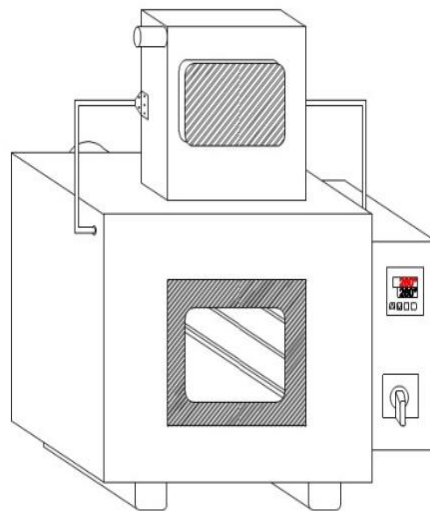


Fig. 2. Calcination stove to determine the ash content

For the wood chip boards, at U= 0%, m= 0.7970 g, higher caloric power= 19196 kJ/kg, lower caloric power= 18555 kJ/kg, energy density= 13.68 kJ/cm³, burning speed= 640 kJ/min, at U= 10%, m= 0.8710 g, higher caloric power= 16855 kJ/kg, lower caloric power= 16245 kJ/kg, energy density= 12.86 kJ/kg, burning speed= 481 kJ/min, at U= 20%, m= 1 g,

higher caloric power= 14895 kJ/kg, lower caloric power= 13615 kJ/kg, energy density= 12.49 kJ/cm³, burning speed= 440 kJ/min, at U=50%, m= 0.9190, higher caloric power= 8925 kJ/kg, lower caloric power= 5725 kJ/kg, energy density= 4,78 kJ/cm³, burning speed= 94 kJ/min.

The variation of the energy efficiency for the wood chip boards is shown in fig.3.

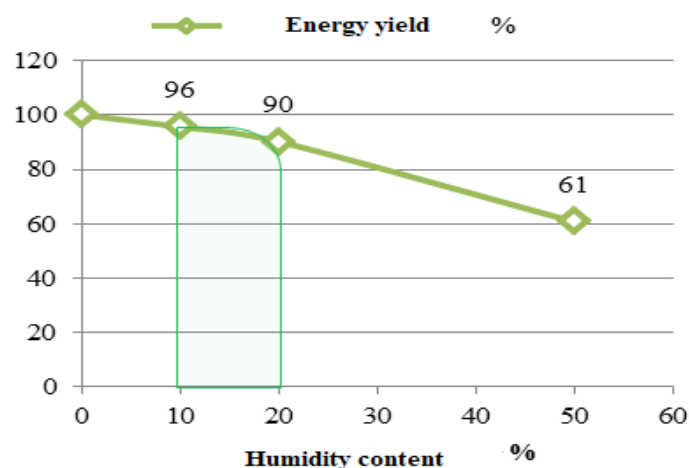


Fig. 3. The variation of the energy efficiency for the wood chip boards

The ash content for wood chip boards was 3.8%.

3. Conclusions

Measures that are considered for the promotion of renewable energy sources are following:

- increasing the degree of capitalization in conditions of economic efficiency of renewable energy resources for the production of electrical and thermal energy;
- strengthening the role of the green certificate market, for the promotion of private capital in investments in the field of renewable resources;
- promoting mechanisms to support the use of renewable energy resources in the production of thermal energy and domestic hot water.

The most convenient renewable resources used for the production of electricity are micro power plants, wind turbines and cogeneration plants that use biomass, and for the production of thermal energy.

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PRINCIPLES OF POLICY AND STRATEGY DEVELOPMENT FOR THE REALISATION FRAMEWORK MODEL OF THE INTEGRATED MOUNTAIN DEVELOPMENT

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Abstract: In the context of the current challenges, it is well known that mountain areas are highly exposed and have serious problems to solve, which makes work on integrated mountain development timely. In this sense, the paper aims to deepen the conceptual understanding of the problem by applying some necessary principles (in particular the Mountain Convergence Principle) and by laying the foundations for the implementation of public policies and strategies in order to develop a framework model of integrated mountain development applied in the Romanian mountain area for the next decades. The high impact development directions, such as gastronomy and mountain tourism, as well as the integration based on the multifaceted factors and action in engineering, management and cultural-spiritual areas specific to mountain and foothill areas are highlighted. The study describes a framework model of integrated mountain development, addressing a series of structural and functional aspects at a systemic level, with theoretical and practical applications for the evolution of mountain areas.

Keywords: development, framework model, mountain, policies, strategies

1. Introduction

If in the long term for the European Union things seem to be in order, with a number of guidelines to be achieved for rural development in general by 2030, for the development of the mountain area there are at least four specific targets to be considered, namely: (1) - Integrated strategies using collaborative and participatory approaches; (2) - Sustainable management of natural resources; (3) - Widespread digital literacy and opportunities to acquire more advanced skills; (4) - Enterprising, innovative and skilled people who together create technological, environmental and social progress [41, 42].

Adapting to the situation for the Romanian mountains we have in mind several considerations that make it appropriate for the future to achieve an integrated development framework. Thus, in general we observe that science is in a continuous search for concepts, principles and new directions of action, especially for mountain areas because the mountain reality is extremely complex. It is

becoming increasingly evident that mountain areas are becoming fragile both as a set of millennial chains on life cycles and in the relationship between mountain people and nature, underpinned by historical deficits in technologies, investments, skills, energy and raw material consumption and costs [1, 2, 6, 10, 15, 25]. We note that traditional agro-silvo-pastoral activities are less and less present in our mountains, especially under climate change [3, 7, 40].

To solve the problems, we must start from the diagnosis of the challenges for the mountain area [16, 19, 35, 36] : - in this area it must be decided whether this area can enter as a partner, together with upland agriculture, in solving the FAO objectives of feeding the planet; - then it must be decided whether the upland area remains with the same poorly productive technologies or introduces innovation and improvement on a large scale; - it must also be decided whether upland areas will be able to integrate productivity goals into policies to provide compensatory payments for the significantly higher costs of production; - last but not least, it must be decided

whether an intensive skills acquisition policy for high productivity farming practices (the whole educational chain: secondary, high school, vocational, higher education).

In view of all this, the present study attempts to find solutions to the complicated problems of the mountain area, through a few specific objectives necessary to develop an integrated mountain development model. We refer to the highlighting of some reference principles, then to the specific characteristics for mountain policies and strategies, as well as to the analysis of the necessary elements of the integration process regarding the evolution and development of Romanian mountain areas.

2. Working Method

The study is conceptually based on Theory of Bioharmonism [20, 21], as well as a series of comparative, economic, social and informational statistical analyses. Elements of multi-criteria analysis are addressed and a managerial and legal diagnosis with emphasis on the socio-economic aspects of the components of the integrated mountain system is used. Principles, techniques and regulations specific to sustainable development are considered in relation to the development of mountain areas on multiple levels (local, national, regional, continental, global).

3. Results and discussions

For the elaboration of the variant of a strategy for the development of mountain areas, based on the principles of techno-economic balances, smart growth and societal bio-harmony, it is necessary to take into account mountain diversity, sustainable development, economic evolution and policy decisions of mountain areas, and not only [9,13,14,23,28,31].

The natural geographical, climatic and pedological diversity of the mountains and, implicitly, biological diversity through genetic variability, are undeniable elements of reality and societal development. For these reasons, economic and social vision, engineering and management, science and technology, in addition to the principles of mountain science, will highlight the need for yield, optimization and maximization of evolution and sustainable development that will take into account the altitude gradient and the specificity of each mountain area.

Unfortunately, political decisions at the level of Romanian mountain areas and related public policies, in too many respects, do NOT converge with science and knowledge, and the dilettantism and ignorance of the present are counterproductive to the future requirements of the mountain area (see deserted localities, low investment, unused resources, poor infrastructure, etc.).

3.1. Mountain Policies and Strategies

A first step towards a strategic solution to the mountain's difficult problems is to consider the Mountain Convergence Principle (MCP), which shows that the mountain can become an entity in its own right when the convergence of resources with technology and management will lead to emergence and sustainability on mountain massif profiles, becoming de facto balanced, bio-harmonized, self-sustaining and independent areas of refuge and social resilience.

The application of the principle will lead to finding the complementary elements necessary for the elaboration of the necessary and preliminary DOCUMENTS for the short- and medium-term mountain policy, i.e. the elaboration of Territorial Integrated Mountain Programs (TIMP), as well as the realization of the Rural Mountain and Mountain Product Code (RMMPC). Basically, we are talking about a certain managerial conduct [17,18,29,38,39,43,44].

The established legal system is implemented by the main element in mountain development represented by HUMAN RESOURCE, i.e. the people living in the mountains, those who work and are adapted to this fragile and difficult area. From this perspective, mountain programs are needed to identify high-profile "attractors" in order to maintain and perpetuate the population of the mountain area demographically, but also for those willing to settle in this area. We consider the idea of remote working in mountain areas, supported by the necessary infrastructure, to be a forward-looking aspect, which can make "remote mountain work" possible and in good conditions.

As a result, a series of specific strategic guidelines can be issued, for example on the main themes of general mountain science and specific guidelines on food and tourism [4,5,8,12,22,24,26,34,37].

Other activities considered as "attractors" for human resources are the fields of agri-tourism,

with emphasis on gastronomy and mountain tourism, which have a real potential for the Romanian Carpathians, i.e. for the profile of high-quality food and tourism with great health potential.

The application of specific Programs and Projects, as well as the principles of mountain science (such as mountain convergence), scientific solutions and recommended technologies, makes it possible to analyze and apply the "Farm to Fork Strategy" for the Carpathian Mountains in a coherent way.

As points of reference, we are talking about the "mountain product" found on the "farm to fork" axis, i.e. high-quality mountain agro-zootechnical foods and the resulting culinary preparations, which make possible the solid genesis of Romanian mountain gastronomy. These aspects are the very strategic lines of general mountain gastronomy and, implicitly, of the evolution of mountain gastronomy (Table 1).

Table 1. Recommendations in the mountain gastronomy development strategy
In the conceptual direction of the new cuisine (*la Nouvelle Cuisine*)

Gastronomic models applicable in mountain areas	CULINARY TECHNOLOGICAL TYPOLOGIES	OBS. On the development of mountain gastronomy
CUISINE OF EXCELLENCE	Deep Innovation Technique (complementary assimilation of various types of modern cuisines - nutritious, sensory and generating health - in order to achieve exceptional culinary experiences based on new food attributes).	Is a strategic direction to follow in mountain gastronomy of gastronomy: <i>- mountain food should not be just a consumer item, but a unique personal experience!</i>
	♦ Creative cuisine (molecular gastronomy; culinary constructivism; abstract cuisine; modern culinology etc.)	
	♦ Health generating cuisine (preventive cuisine, principles of validated traditionalism, trophology, etc.)	
FUSION (the combination of gastronomic cultures)	Mixing / blending technique (unexpected ingredients and styles practiced around the globe)	NOT recommended (is lost originality)
	♦ Local fusion cuisine (between provinces of a state)	
	♦ Regional fusion cuisine (between countries of continents)	
	♦ Intercontinental fusion cuisine (combinations of cultures from different continents)	
FAST-FOOD / SLOW-FOOD	Simplified cooking technique (fast food, limited number of products NOT requiring preparation laborious preparation, with on-the-spot or take-away)	NOT recommended (is lost high quality)
CUSTOMISED KITCHEN	Kitchen technique - laboratory (Innovative technologies based on principles of excellence and tradition)	IS a strategic direction to follow in gastronomy of the future
	♦ Innovative technologies based on scientific principles and artificiality (biocellular food, synthetic food, automated and/or robotic cooking machines)	NOT recommended (is lost manufacturing quality)

The next step, useful for mountain agro-rural development, is linked to the valorisation of mountain products of local communities through tourism in mountain areas with the valorisation

of landscape and genetic resources of mountain areas (fig. 1).

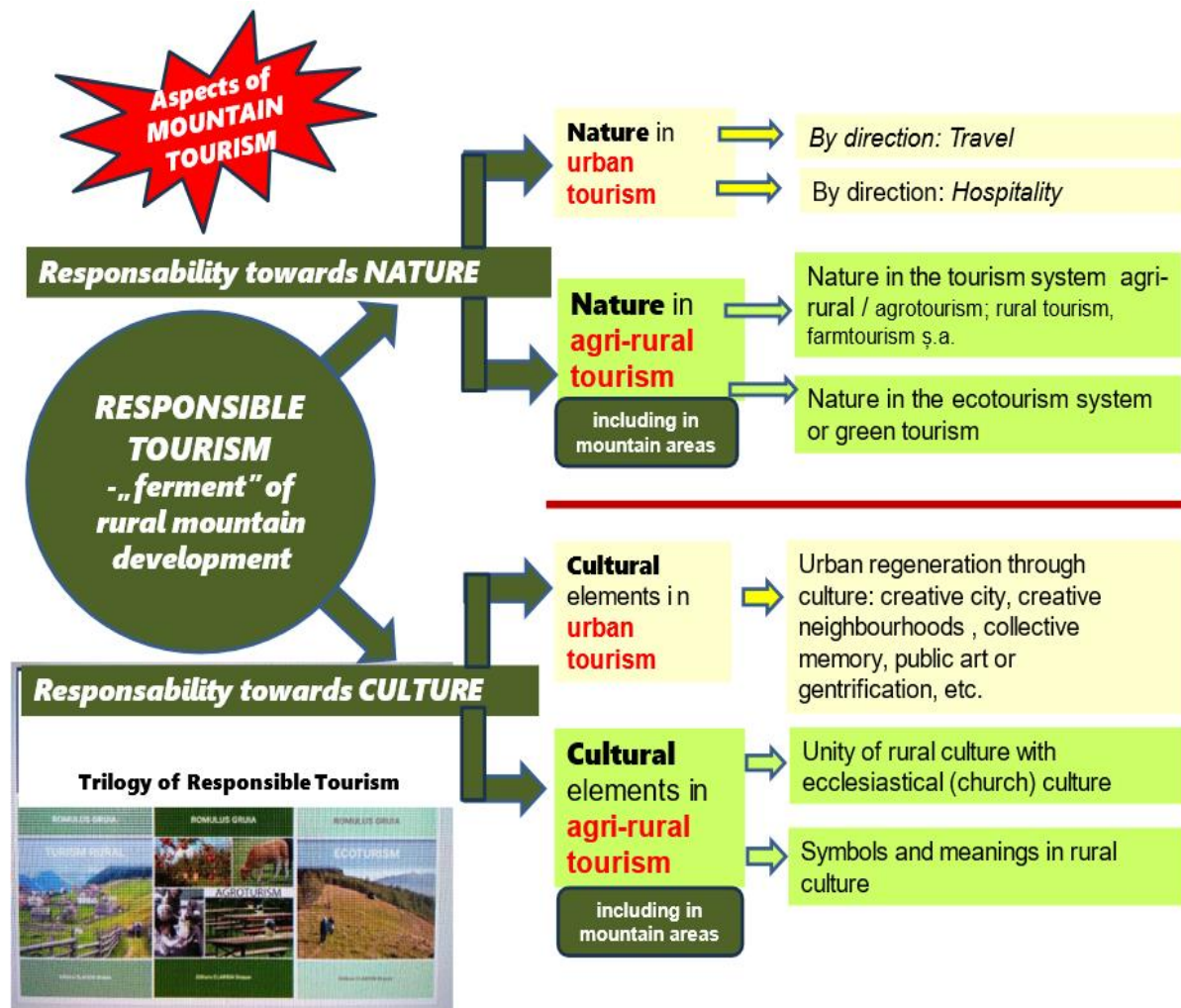


Fig. 1. Basic structural components of mountain tourism, part of tourism responsible for the agro-sylvo-pastoral landscape, protected areas and intangible heritage of the Romanian

3.2. Elements for developing the framework model for integrated mountain development

Addressing these issues opens a window of opportunity for the principled analysis needed to create an integrated mountain development model. The multitude of factors relating to

sustainable development, both tangible and intangible [11,27,30,32,33,45], are taken into account. At this stage, it is necessary to select, group and develop the key strategic directions (fig.2).



Fig. 2. Benchmark components on the strategic directions of bioharmonised development of the Romanian mountain area

• **Strategic directions and risk factors of mountain policies**

As mountain policy is a complex issue that requires a special approach, we consider it useful to specify some aspects that are disruptive factors that must be taken into account for a correct solution through mountain public policies

Thus, in order to achieve coherence in decision making, we mention that Romanian mountain policies, being directly linked to global mountain development strategies, will have to take into account the three types of problems common in many mountains of the planet, i.e. those that limit the room for manoeuvre in defining a mountain policy to be economically efficient and with real systemic effectiveness. We

refer briefly to the following factors : (a) The place given to mountainology in state accumulation, employment policy and balance of payments equilibrium, as well as in demographic policy; (b) The rate of growth of the number of mountain area dependents; (c) The coalition of social forces supporting the incumbent regimes and influencing the way the state proceeds in social arbitration (see the conflicting interests between the components of the mountain area system, marketing manipulations and false information in the standardisation and labelling of the mountain product).

The integration of the presented strategic directions can generate the idea of an integrated mountain development framework model (fig.3).

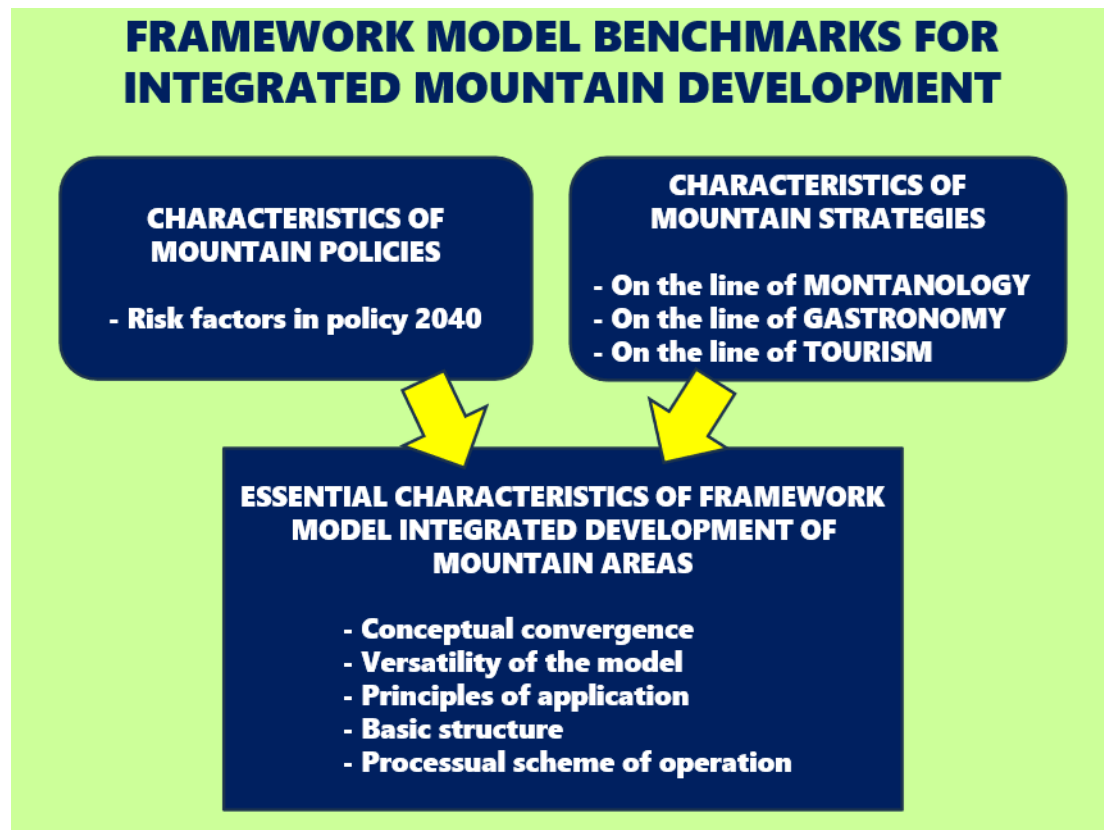


Fig. 3. *Convergence of policies and strategies in the dynamics of developing the framework model for the evolution and development of the Romanian mountain area*

It can be seen how the policies and strategies characteristic of the high and medium altitude area lead to the development of the integrated mountain development framework model based on conceptual convergence, polyvalence, application of specific principles, all strengthening the structure and functionality of the systemic model.

Beyond the correlations between the groups of elements mentioned above, a dynamic characterised by conceptual convergence can be observed, which aims at a good quality of mountain life by realising within the imagined model a theoretical reinterpretation supported by the process of conceptual synergy related to mountain issues:

- to analyse the dynamics of the theme in relation to public policies;
- to analyse the range of endorsements and techniques to the tough demands of the mountain;
- to identify the main milestones by combining approaches of academic perspectives with practical experience (convergence of science and technology with mountain policy).

- to avoid old practices so that new projects succeed in changing behavioural patterns, and that attempts are NOT just activities unusual eco-engineering activities, but rather a shift to a different conceptual level of systemic integration and bioharmonisation.

In this sense, in order to support the harmonization of **mountain bioariums**, the model aims to highlight the idea that the problems of analysis and design of mountain development, in addition to production issues, are equally important institutional considerations of distribution and equitable access to resources (an example is the pressing topicality of the regionalization of Romania), but also of interdisciplinarity, legislation and versatility of activity in a fragile area. (NB- **mountain bioariums** = the area of land that quantifies and values living organisms, i.e. the genetic resources needed mainly for food but also for mountain tourism). The polyvalence of the framework model for the development of mountain areas is based on: - balance in resources; - bioharmonisation of processes; - sustainability of mountain development. Three aspects of convergence can be defined in this relationship,

namely: (a) the "engineering" elements, (b) the "management" elements and (c) the "culture and spirituality" elements in mountain areas. Within

these groups the model foresees the following elements to be addressed (Table 2).

Table 2. *The versatility of the integrated development framework model of mountain areas and the main lines of action*

Crt.no.	COURSES OF ACTION	SPECIFY
1.	ENGINEERING aspects	- Infrastructure in mountain areas - integrated and adapted economic activity - mountain ecology and climatology
2.	Aspects of MANAGEMENT	- development of public policies to harmonise mountain identity with the dynamics of European integration - administrative organisation - financial taxonomy (especially on agriculture)
3.	Aspects of CULTURE and SPIRITUALITY	- elements of mountain anthropology - mountain folklore (customs, traditions, artistic creations) - elements of mountain education and ecclesiastical culture

By analysing this polyvalence, as a premise for the elaboration of a model as a reference for mountain development, one can actually realise

the structural basis of the mountain system under analysis (fig.4).

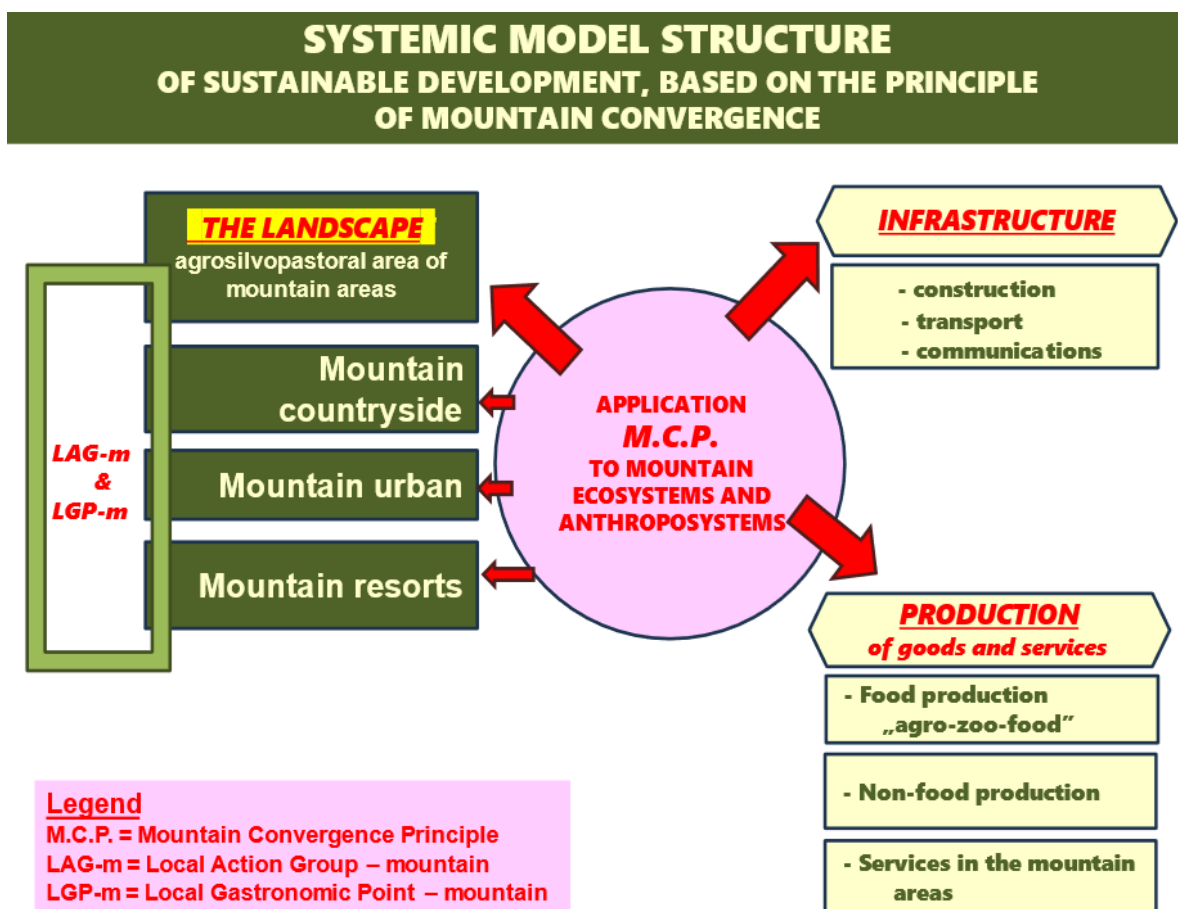


Fig. 4. *Convergent structure of the mountain development model*

Although it is a structure of development model syntheses, however, it is possible to see relatively

well the connections between elements having as a common point of analysis the Mountain

Convergence Principle. This makes it possible to interpret the 'framework model' in a processual

way, especially in the context of adaptation to climate change (Figure 5).

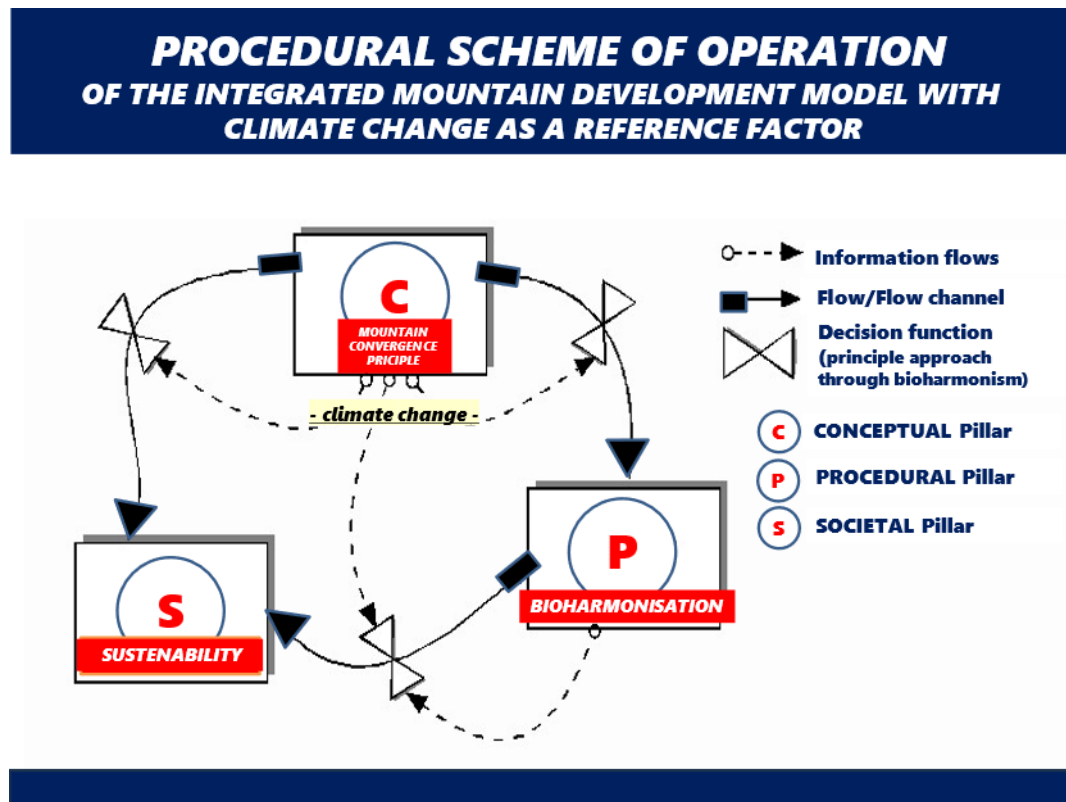


Fig. 5. Functioning based on multiple integration with emergent effect (integroneic dynamics) of processes specific to the mountain development model

Establishing the systemic benchmarks for the structure and functioning of the integrated mountain development model is the theoretical step needed to move on to the strategic implementation of this model. Sectoral and specific objectives can be set in a UNIFIED and CONSISTENT manner, which will be expressed through programs and projects covering all aspects of development in the mountain area and, above all, by finding working methodologies and ways of involving the existing players in this geographical area.

The proposed objectives of course involve both value issues and conflicts of interest, which makes it necessary for the public (individuals, mountain residents) to participate in the debate. It is therefore more than appropriate to involve all stakeholders (which has proved difficult over the years in our country), including the public sector, professional organizations and civil society, in order to establish, on the basis of the framework model, the options for a development strategy for upland areas and the impact of the various measures taken in individual mountain ranges and even at bioariums level.

Therefore, a far-reaching reform based on public policies, coherently framed in the FRAMEWORK MODEL with its new perspective on the problems and possible solutions with potential applicability for the protection of fragile areas such as mountain areas, is needed. And what is important to note is that all of this is funded, i.e. there is a real chance that knowing what needs to be done will lead to practical implementation in the coming decades.

We're talking about about €16 billion of European funds allocated for the development of agriculture and rural areas in Romania for the period 2023-2027 (of course including the one third of mountain areas in the total national area), through Romania's National Strategic Plan for Agriculture.

4. Conclusions

The real potential for the Romanian Carpathians is the profile of high-quality food and tourism with a high health generating potential, which indicates "mountain attractor" type activities such as: mountain agro-zootechnics, tourism and

gastronomy on mountain massif profiles, as well as remote mountain work.

Romanian mountain policies, being directly linked to global mountain development strategies, will have to consider the problems that limit the room for maneuver in defining an economically efficient mountain policy with real systemic effectiveness, namely: the place given to the "mountain" in state accumulation, employment policy, balance of payments and demographic policy; the rate of growth of the number of people dependent on the mountain area; the identification of the coalition of social forces that support the regimes in office and that influence the way the state proceeds in social arbitration.

Policies and strategies characteristic of mountain areas lead to the development of the systemic model as a new perspective of integrated mountain development based on conceptual convergence, the polyvalence of mountain areas, the application of specific principles, all of which reinforce the structure and functionality of the framework model.

The structure and functioning of the integrated mountain development model is the theoretical step needed to move on to the strategies for actually implementing this model in practice, by setting sectoral objectives and specific objectives, expressed through programs and projects covering all aspects of development in the mountain area and, above all, finding ways of involving the actors living in this geographical area.

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AN AGRO-TOURISM MODEL BASED ON MULTICRITERIAL ANALYSIS, WITH APPLICATIONS IN THE DOBROGEAN AREA

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Abstract: The study area is a plateau unit located in the South-East part of Romania, between the Danube and the Black Sea Coast, and it constitutes a well-defined territorial system. The aim of this study is to define the polyvalence of agro-tourism specifics of the Southern Dobrogea territorial system, through a diagnostic analysis of the natural and cultural heritage and through the opportunities for agro-tourism capitalization, with a view to the sustainability and socio-economic efficiency of local communities. In this study, the multi-criteria analysis is used to rank the ATUs, based on agro-tourism potential. Through the involvement of local authorities and the community, the agro-tourism development will contribute to the sustainable development of rural area from Southern Dobrogea.

Keywords: agriculture, criterion, Dobrogea, rural, sustainable, tourism.

1. Introduction

Southern Dobrogea is a plateau unit located in the South-East part of Romania, between the Danube and the Black Sea Coast, and it constitutes a well-defined territorial system with 50 administrative-territorial units (ATUs) - 46 rural, 4 smalls urban [13, 23].

The geographical analysis of the territorial system is essential in local and regional development, considering the achievement of cultural and socio-economic purposes, such as rural tourism and agro-tourism. The relationship between the natural resources of the territory and their exploitation is the basis of any approach aimed at development [12], including for agriculture and tourism purposes.

The territorial system of Southern Dobrogea benefits from a tourist potential represented by the seemingly monotonous natural landscape, but with specific elements in certain areas, where traditional folk art, historical and archaeological sites, villages with traditional Dobrogean characteristics attract tourists [1, 4, 13, 16, 19]. The efficient management of a territorial system contributes to a sustainable economic development of the area [9].

In this context, the integrated management of agro-rural activities [5, 9, 14] is an important factor that contributes to the sustainable development of tourism in the Southern Dobrogea territorial system. By supporting the

development of agro-tourism, it will sustain the development of local communities, a component of this territorial system [7, 15, 22].

The activities in the field of agro-tourism can economically revive the villages, can contribute to the modernization of the infrastructure, can attract different investors, if the inhabitants of the rural area adopt a favorable attitude, which is correctly received by the tourists who prefer this type of tourism and if the local authorities get involved enough much in the development of this profitable economic activity.

The aim of this study is to define the polyvalence of agro-tourism specifics of the Southern Dobrogea territorial system, through a diagnostic analysis of the natural and cultural heritage [8, 13, 23] and through the opportunities for agro-tourism capitalization, with a view to the sustainability and socio-economic efficiency of local communities in the rural area.

The specific objectives are related to the identification, structuring and optimization of tourist resources correlated with the traditional agricultural activities of the local population in order to highlight the polyvalence and increase the agro-tourism effectiveness of the study area.

2. Material and Method

The agro-tourism polyvalence is the result of the combination of several criteria for evaluating the agro-tourism potential of an ATU, and it can

constitute the support of the sustainability of a local rural community [3, 10, 17].

In this study, it was taken into account, 7 criteria, each other with 5 subordinate sub-criteria (indicators) [6, 20, 24, 25]. Each criterion was assigned a weight (between 10% and 30%), the value of the agro-tourism polyvalence will result from the sum of the weight of the 7 criteria [20]. The absolute model of agro-tourism polyvalence has a value of 100 and a heptagonal graphic representation. The table 1 shows criteria of agro-tourism polyvalence that were established for the elaboration of the agro-tourism development model. For each of the 50 ATUs in the Southern Dobrogea territorial system, an evaluation form was drawn up, which was the basis of the application of the multicriteria analysis method.

In this study, the multi-criteria analysis [2] is used to rank the ATUs, based on agro-tourism potential [11, 18, 21]. The multi-criteria analysis is in relation to the chosen criteria, an analysis that gives a very large proportion of an objective character to its results. The steps of the multi-criteria analysis are:

- establishing the criteria;
- determination of the weight of each criterion;
- identification of all variants (50 ATUs from the Southern Dobrogea territorial system);

- granting an N score;
- calculation of products between N scores and γ_i weighting coefficients [2].

By applying the multi-criteria analysis method, for each criterion the indicators (sub-criteria) were compared, the weight coefficient was calculated, and by multiplying it with the score given to each indicator a value was obtained, which by summing up with the values of the other indicators determined the final result of a criterion [2, 20]. For each criterion a weight was assigned (10%-30%), which by multiplying by the value of the result of the criterion and summing it with the similar data to the other criteria, it will obtain the final result - a weight reported to the absolute value of 100 [20].

All calculations were performed in a separate excel file, the final results being centralized represented, for all ATUs within the Southern Dobrogea territorial system. Subsequently, the 50 ATUs from the Southern Dobrogea territorial system were hierarchized in accordance to the value of agro-tourism polyvalence (on I-X values ranks) (table 2). Finally, the values of agro-tourism polyvalence of each ATU are mapped for the Southern Dobrogea territorial system [20].

Table 1. Criteria of agro-tourism potential

Criteria		Weight (%)
C₁	NATURAL GEOTOURIST RESOURCES (relief, climate, waters, biodiversity, natural landscape)	15
C₂	ETHNOCULTURAL HERITAGE (ethnic structure of inhabitants, folk costumes/folklore, traditional architecture, traditional techniques, traditional events/feasts)	15
C₃	TRADITIONAL FOOD PRODUCTS OF THE LOCAL COMMUNITY (agro-vegetable potential, agro-zootechnical potential, processing of vegetable products, processing of animal products, traditional cuisine)	30
C₄	ANTHROPIC SIGHTS AND LOCATIONS (archaeological sights, religious sights, museums, monuments, others)	10
C₅	TECHNICAL AND MATERIAL INFRASTRUCTURE (utilities, local services, accommodation, meals and catering, leisure infrastructure)	10
C₆	COMMUNICATIONS AND TRANSPORT INFRASTRUCTURE (telecommunications, roads, railways, airport, river transport)	10
C₇	TRADITIONAL CRAFT PRODUCTS OF THE LOCAL COMMUNITY (textile art, stone craft, wood craft, decorative arts, others)	10
Total		100

Source: own processing [20]

Table 2. Scale of evaluation of agro-tourism potential

Rank I	Rank II	Rank III	Rank IV	Rank V	Rank VI	Rank VII	Rank VIII	Rank IX	Rank X
≥90.00	89.99-80.00	79.99-70.00	69.99-60.00	59.99-50.00	49.99-40.00	39.99-30.00	29.99-20.00	19.99-10.00	<10.00
High		Medium-high		Medium		Medium-Low		Low	

Source: own processing [20]

3. Research Results

Analyzing the criterion *C₁-Natural geotourist resources*, the results were as follows:

- 21 ATUs (42%) fall into the I-st category, with reference values 15.00%-12.21%;
- 7 ATUs (14%) fall into the II-nd category, with reference values 11.79%-9.04%;
- 19 ATUs (38%) fall into the III-rd category, with reference values 9.00%-6.44%;
- 3 ATUs (6%) fall into the IV-th category, with reference values 6.00%.

Analyzing the criterion *C₂-Ethnocultural Heritage*, the results were as follows:

- 14 ATUs (28%) fall into the I-st category, with reference values 14.50%-12.31%;
- 24 ATUs (48%) fall into the II-nd category, with reference values 12.00%-9.56%;
- 12 ATUs (24%) fall into the III-rd category, with reference values 9.00%-6.21%.

Analyzing the criterion *C₃-Traditional food products of the local community*, the results were as follows:

- 25 ATUs (50%) fall into the I-st category, with reference values 30.00%-24.16%;
- 20 ATUs (40%) fall into the II-nd category, with reference values 24.00%-18.32%;
- 5 ATUs (10%) fall into the III-rd category, with reference values 18.00%-17.84%.

Analyzing the criterion *C₄-Anthropic sights and locations*, the results were as follows:

- 11 ATUs (22%) fall into the I-st category, with reference values 10.00%-8.39%;

- 16 ATUs (32%) fall into the II-nd category, with reference values 7.89%-6.22%;

- 23 ATUs (46%) fall into the III-rd category, with reference values 5.78%-4.30%.

Analyzing the criterion *C₅-Technical and material infrastructure*, the results were as follows:

- 10 ATUs (20%) fall into the I-st category, with reference values 10.00%-8.99%;
- 17 ATUs (34%) fall into the II-nd category, with reference values 7.89%-6.22%;
- 23 ATUs (46%) fall into the III-rd category, with reference values 5.78%-4.30%.

Analyzing the criterion *C₆-Communication and transport infrastructure*, the results were as follows:

- 34 ATUs (68%) fall into the I-st category, with reference values 10.00%-8.15%;
- 14 ATUs (28%) fall into the II-nd category, with reference values 7.31%-6.03%;
- 2 ATUs (4%) fall into the III-rd category, with reference values 6.00%.

Analyzing the criterion *C₇-Traditional craft products of the local community*, the results were as follows:

- 3 ATUs (6%) fall into the I-st category, with reference values 8.53%-8.56%;
- 30 ATUs (60%) fall into the II-nd category, with reference values 8.00%-6.23%;
- 17 ATUs (34%) fall into the III-rd category, with reference values 5.80%-5.02%.

Table 3. The ranking of ATUs according to agro-tourism potential

Rank I	(3)	Rank II	(17)	Rank III	(8)	Rank IV	(16)	Rank V	(6)
Ostrov	93.99	Topalu	87.20	Ovidiu	78.75	Saligny	69.58	Pecineaga	58.81
Limanu	90.77	Adamclisi	86.83	Valu lui Traian	78.38	N. Bălcescu	69.45	Chirnogeni	58.46
Murfatlar	90.73	Techirghiol	86.76	23 August ATU	77.36	Deleni	68.96	Bărăganu	55.58
		Ghindărești	86.63	Băneasa	75.47	Negru Vodă	68.80	Mereni	54.81
		Cobadin	86.63	Poarta Albă	74.60	Topraisar	66.10	Cuza Vodă	52.90
		Lipnița	85.42	Crucea	73.11	Dumbrăveni	66.04	Cerchezu	51.21
		Rasova	85.42	Peștera	70.54	Ciocârlia	65.81		
		Aliman	85.09	Mircea Vodă	70.47	Castelu	65.80		
		Agigea	84.96			Dobromir	63.36		
		Oltina	84.27			Albești	62.41		
		Ion Corvin	82.72			Amzacea	62.30		
		M. Kogălniceanu	82.54			Horia	61.33		
		Cumpăna	82.33			Siliștea	61.11		
		Seimeni	82.30			Tortoman	61.02		
		Tuzla	82.18			Independența	60.15		
		Costinești	80.23			Comana	60.04		
		Lumina	80.14						

Source: own processing [20]

By centralizing the values obtained for each of the 7 criteria, the results (table 3) were as follows:

- 3 ATUs (6%) were included in the I-st rank, with reference values 93.99%-90.73%;
- 17 ATUs (34%) were included in the II-nd rank, with reference values 87.20%-80.14%;
- 8 ATUs (16%) were included in the III-rd rank, with reference values 78.75%-70.47%;
- 16 ATUs (32%) were included in the IV-th rank, with reference values 69.58%-60.04%;
- 6 ATUs (12%) were included in the V-th rank, with reference values 58.81%-51.21%.

The graphic representation of the ideal agro-tourism model is heptagonal (fig. 1a) with an elongated semi-axis in the C_3 direction, 2 equal semi-axes (C_1 , C_2), respectively 4 equal semi-axes (C_4 , C_5 , C_6 , C_7).

From the 50 ATUs analyzed in this study, the graphs obtained are diverse. In some cases, the graphs are elongated along the ax of dominant criterion, such as: C_3 (traditional food products), C_1 (natural resources), C_5 (technical and material infrastructure), C_6 (communication potential), C_2 and C_4 (ethnocultural heritage and anthropic sights).

The 50 graphs of agro-tourism development models were elaborated for 46 rural ATUs and 4 urban ATUs (small towns with agrarian function) within the territorial system of Southern Dobrogea [13, 23].

The 50 graphs fall into 5 categories, as follows:

- 3 graphs of I-st rank, with weighted values of over 90.00%;
- 17 graphs of II-nd rank, with weighted values between 80.00% and 89.99%;
- 8 graphs of III-rd rank, with weighted values between 70.00% and 79.99%;
- 16 graphs of IV-th rank, with weighted values between 60.00% and 69.99%;
- 6 graphs of V-th rank, with weighted values between 50.00% and 59.99%.

Figure 1 shows the ideal agro-tourism model (fig. 1a) and a representative model for each rank (fig. 1b-1f).

There are 3 development models of I-st rank, Ostrov in the Danube region, Limanu on the Black Sea Coast, and Murfatlar in the central area, located along Danube - Black Sea Canal.

The three graphs are differentiated by the fact that the Ostrov (fig. 1b) graph has maximum values on axes C_1 and C_3 being dominant also on axes C_2 , C_4 and C_5 ; the Limanu graph is dominant on axes C_2 , C_4 , C_5 and C_6 , with a maximum value on C_5 ; and the graph Murfatlar

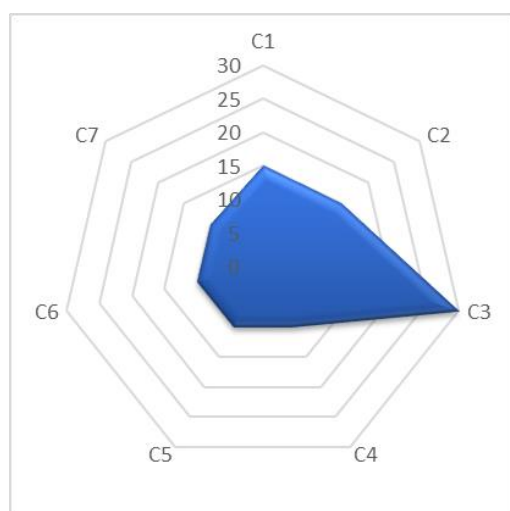
has a maximum on the C_6 axis, the C_3 , C_4 and C_5 axes also being dominant. The values corresponding to the other axes are relatively similar for the 3 ATUs, as values fall into the first category corresponding to the criterion.

The 17 development models included in II-nd rank are geographically distributed as follows: 9 in the Danube region, 5 on the Black Sea Coast, 1 in the Central part along Danube - Black Sea Canal, and 2 in other areas. In this rank category, the graphs are different, with maximum values on some axes: C_3 (Cobadin, Rasova, Aliman), C_1 (Ghindărești - fig. 1c, Lipnița, Aliman, Oltina), C_4 (Adamclisi), C_5 (Techirghiol, Costinești). For each axis, dominance is observed depending on the classification in category I for each criterion, as follows: C_1 (9 ATUs, of which 6 in the Danube region, and 3 on the Black Sea Coast), C_2 (9 ATUs), C_3 (14 ATUs), C_4 (7 ATUs), C_5 (7 ATUs), C_6 (13 ATUs), C_7 (4 ATUs). It should be noted that on the C_3 axis all 17 ATUs fall into category I with a weight between 24.00 and 30.00%.

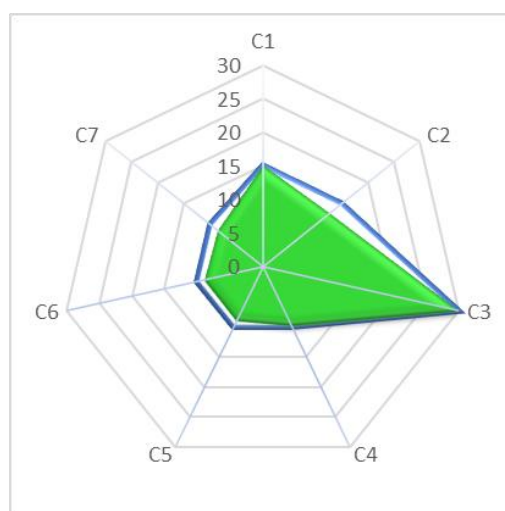
There are 8 agro-tourism development models in the III-rd rank category and geographically distributed as follows: 1 in the Danube region, 1 on the Black Sea Coast, 4 in the Central part along Danube - Black Sea Canal, and 2 in other areas. In this rank category, the graphs are differentiated according to the dominance of an axis by category of potential: C_3 (3 ATUs), C_1 (3 ATUs), C_2 (6 ATUs), C_6 (4 ATUs). There is a similarity between the graphs of the models for the first 3 ATUs in this rank category: Ovidiu, Valu lui Traian, 23 August ATU (fig. 1d).

There are 16 agro-tourism development models in the IV-th rank category and geographically distributed as follows: 1 in the Danube region, 1 on the Black Sea Coast, 4 in the Central part along Danube - Black Sea Canal (fig. 1e), and 10 in other areas. In this rank category, the graphs are different by the slight dominance of some axes according to potential (natural or cultural heritage, agricultural or infrastructure potential). Dominant axes are remarked as follows: C_1 (4 ATUs), C_2 (5 ATUs), C_3 (3 ATUs) and C_6 (3 ATUs). The rest of the axes show medium or low potential.

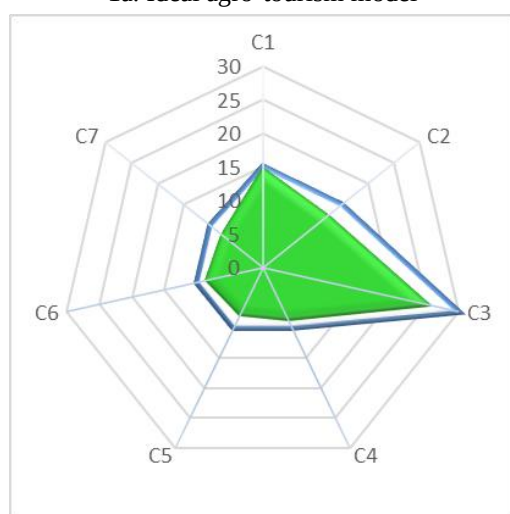
There are 6 agro-tourism development models in the V rank category and geographically distributed as follows: 1 on the coastal area, 1 in the Central part along Danube - Black Sea Canal, and 4 in the Southern region (fig. 1f). In this range, the graphs are relatively similar, with no particularly dominant axis being noted.



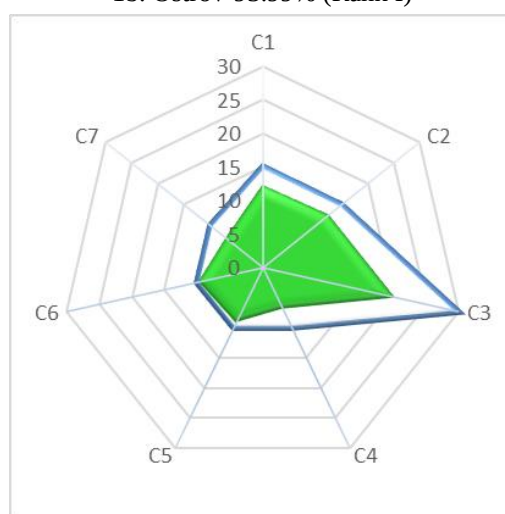
1a. Ideal agro-tourism model



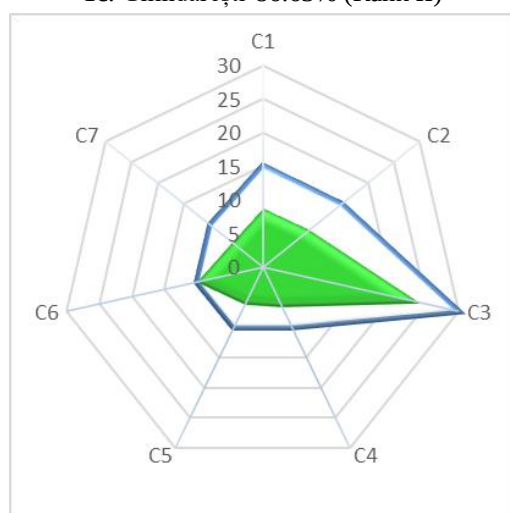
1b. Ostrov-93.99% (Rank I)



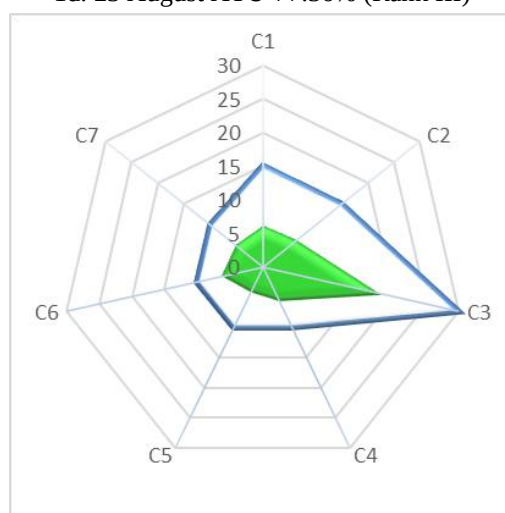
1c. Ghindărești-86.63% (Rank II)



1d. 23 August ATU-77.36% (Rank III)



1e. Saligny-69.58% (Rank IV)



1f. Cercezu-51.21% (Rank V)

Legend:

C₁
Natural
geotourist
resourcesC₂
Ethnocultural
heritageC₃
Traditional
food
productsC₄
Anthropic
sights and
locationsC₅
Technical and
material
infrastructureC₆
Communications and
transport
infrastructureC₇
Traditional
craft products

Source: own processing [20]

Fig. 1. Models of agro-tourism development from Southern Dobrogea

To the territorial distribution of the agro-tourism development took into account several criteria: the geographical position within a relief subunit, and depending on an important geographical element (the Danube, the Black Sea Coast, the Danube - Black Sea Canal), the principle of proximity between ATUs and the connection between them through access by road (national or county road).

From the data presented, figure 2 shows the territorial distribution of the value of agro-tourism development at the level of each ATUs within the Southern Dobrogea region. Thus, according to the degree of agro-tourism polyvalence, five areas can be differentiated:

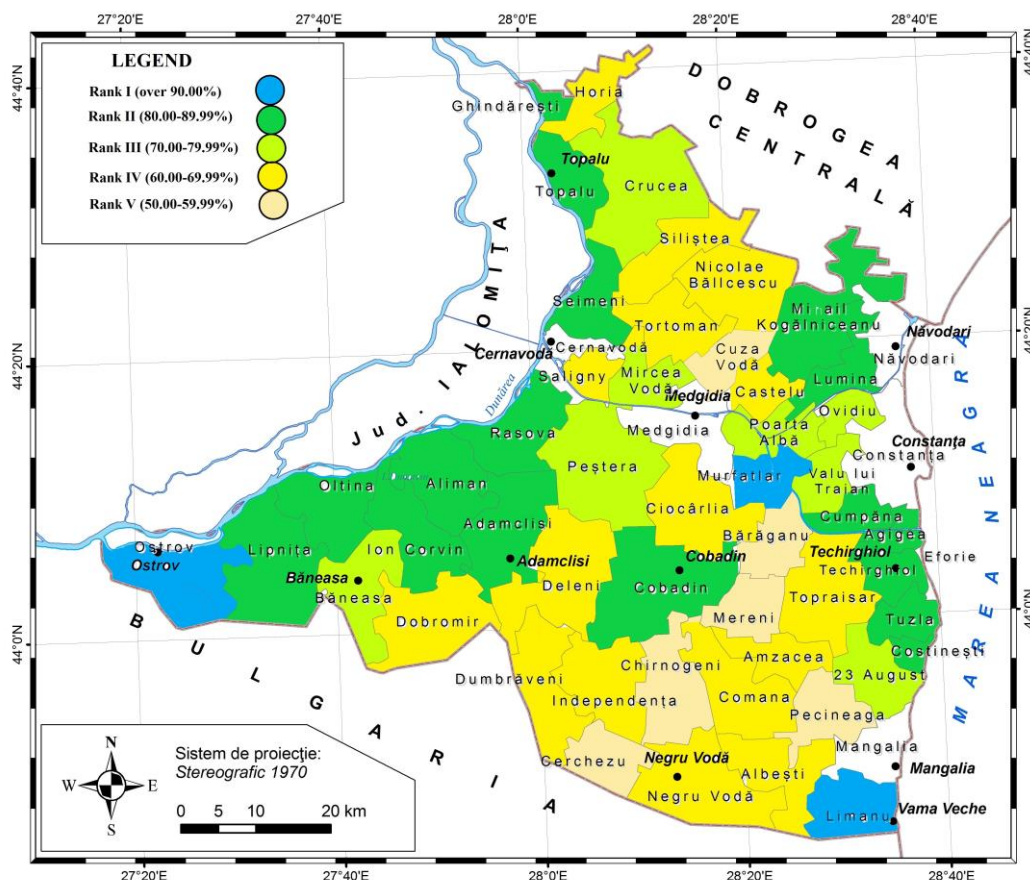
- the Danube region, with 83.23% as average value of agro-tourism potential, and 12 ATUs: 1 of the I-st rank (Ostrov - fig. 1b), 9 of the II-nd rank (Topalu, Adamclisi, Ghindărești - fig. 1c, Lipnița, Rasova, Aliman, Oltina, Ion Corvin, Seimeni), 1 of the III-rd rank (Băneasa) and 1 of the IV-th rank (Dobromir);
- the Black Sea Coast area, with 78.73% as average value of agro-tourism potential, and 9 ATUs: 1 of the I-st rank (Limanu), 5 of the II-nd

rank (Techirghiol, Agigea, Cumpăna, Tuzla, Costinești), 1 of the III-rd rank (23 August ATU - fig. 1d), 1 of the IV-th rank (Albești) and 1 of the V-th rank (Pecineaga);

- the Central part along Danube - Black Sea Canal with 72.22% as average value of agro-tourism potential, and 11 ATUs: 1 of the I-st rank (Murfatlar), 1 of the II-nd rank (Cobadin), 4 of the III-rd rank (Valu lui Traian, Poarta Albă, Peștera, Mircea Vodă), 4 of the IV-th rank (Saligny - fig. 1e, Deleni, Ciocărlia, Castelu) and 1 of the V-th rank (Cuza Vodă);

- the Northern region (Carasu Plateau) with 70.93% as average value of agro-tourism potential, and 8 ATUs: 2 of the II-nd rank (Mihail Kogălniceanu, Lumina), 2 of the III-rd rank (Ovidiu, Crucea) and 4 of the IV-th rank (Nicolae Bălcescu, Horia, Siliștea, Tortoman);

- the Southern region (Negru Vodă Plateau) with 60.35% as average value of agro-tourism potential, and 10 ATUs: 6 of the IV-th rank (Negru Vodă, Topraisar, Dumbrăveni, Amzacea, Independența, Comana) and 4 of the V-th rank (Chirnogeni, Bărgănuș, Mereni, Cerchezu - fig. 1f).



Source: own processing [20]

Fig. 2. The territorial distribution of agro-tourism potential from Southern Dobrogea

Conclusions

The criteria that formed the basis of the development of the heptavalent agro-tourism model were established after several researches, considering that 7 criteria are relevant for the optimization of the model.

In order to establish the optimal values of each criterion for the realization of an ideal model, the multicriteria analysis method was applied for each individual criterion. By the weight assigned to each criterion between 10% and 30% and by summing them up, an ideal agro-tourism development model with a value of 100 resulted.

Considering the diversity of values and the analysis of 50 models, a scale of agro-tourism polyvalence was established on 10 ranks (I-X, decreasing values) and 5 degrees of agro-tourism polyvalence (high, medium-high, medium, medium-low, low).

The graphic representation of the agro-tourism development models is of the heptagonal type. The 50 models were classified as follows: 3 of the I-st rank, 17 of the II-nd rank, 8 of the III-rd rank, 16 of the IV-th rank, 6 of the V-th rank. The analysis of the model can be the basis of a local development strategy at the level of an ATU or of a Local Action Group.

The map of the territorial distribution of the agro-tourism potential in Southern Dobrogea highlights 5 regions: the Danube area with a high agro-tourism potential, 3 areas with a medium-high agro-tourism potential (the seaside region, the Central part area along Danube - Black Sea Canal, and its Northern part), and 1 sector with low agro-tourism potential (in the Southern part of the study area).

Considering the results obtained, it is proposed that for the Danube region with high potential, a polyvalent agro-tourism route along the Danube should be promoted, and for the entire study region, the creation of an association to promote the traditional village from Southern Dobrogea.

Through the involvement of local authorities and the community, agro-tourism development will contribute to the sustainable development of rural areas.

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AN INNOVATIVE AND SUSTAINABLE SOLUTION – THE AGROVOLTAIC PANELS

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Abstract: *In context of the current evolution of sustainable technologies, agrovoltaic panels have become a central theme in energy research, proposing a beneficial synergy between agriculture and energy production, offering the potential to improve the resilience of agricultural systems and contribute to sustainable energy production. This paper examines recent advances in research on agrovoltaic panels and their use in agricultural practice. The benefits, challenges and future development directions of this innovative technology are highlighted.*

Keywords: *agrovoltaic panels, clean energy sources, sustainable agriculture.*

1. Introduction

In context of the current evolution of sustainable technologies, agrovoltaic panels have become a central theme in energy research, representing an important innovation in the field of solar energy capture. Agriculture and energy production have historically been two separate fields, but agrovoltaic panels propose a beneficial synergy between them, offering the potential to improve the resilience of agricultural systems and contribute to sustainable energy production.

Traditional agriculture faces many challenges, including climate change, soil degradation and resource limitations. At the same time, solar energy is becoming increasingly important in people's efforts to develop renewable energy sources and reduce the negative impact on the environment. Agrovoltaic panels come to solve these challenges by integrating solar panels into the agricultural landscape, turning agricultural land into dual sources of production.

The motivation behind this research is supported by the need to develop innovative solutions that simultaneously address agricultural and energy challenges. Agrovoltaic panels can not only contribute to the generation of sustainable energy but can also provide additional benefits such as protection of crops against extreme weather conditions, efficient use of water resources and improvement of soil quality.

Considering climate change, it is imperative to explore such technologies that provide multiple solutions and benefit both the environment and the agricultural sector. Agrovoltaic panel research addresses this challenge, with the potential to transform agricultural land into hybrid production hubs, contributing to food security and the transition to clean energy sources.

Investing in the research and implementation of these emerging technologies not only brings practical benefits, but also represents an essential step towards building a balanced future, where energy and agricultural needs coexist in harmony. Research in this field explores the maximum potential of technology, addressing issues such as increasing energy efficiency, adapting to different soil types, optimizing crop impact and developing deployment models in diverse geographic environments.

This research not only aims to better understand the functioning of agrovoltaic panels, but also to provide practical solutions to maximize their benefits within a holistic approach. The importance of this field is reflected in the current context of climate change, and in the need to ensure sustainable energy security and resilient agriculture in the face of future challenges.

Agrovoltaic panels represent hybrid systems that integrate photovoltaic solar panels with agricultural activities, thus offering a solution for the efficient use of land and resources. These

consist of installing solar panels on top of or near agricultural land, allowing them to simultaneously serve as sources of renewable energy and infrastructure for agriculture.

By integrating agrovoltaic panels into the agricultural landscape, land use is maximized, and dual benefits are achieved. These benefits include sustainable electricity production and shade generation, which can have a positive impact on plants and animals, as well as reducing

soil water evaporation (Fig.1). The panels can be mounted on elevated structures or on the ground, depending on the specific requirements of the project.

Therefore, agrovoltaic panels represent an innovative form of agricultural land use, helping to simultaneously solve the problems of energy production and sustainable agricultural practices.

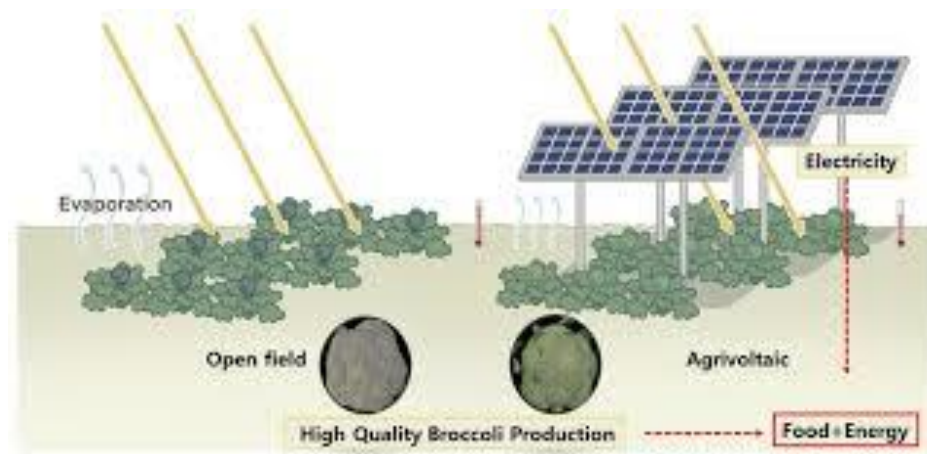


Fig. 1. The benefits of integrating agrovoltaic panels into the agricultural landscape

2. Study methods used by researchers

Researchers in the field of agrovoltaic panels have taken an exhaustive approach in evaluating the sources of captured energy and in optimizing the efficiency of solar conversion. The research methods included detailed analyzes of the photovoltaic technologies used, such as monocrystalline [1, 2], polycrystalline [3, 4] or thin film [5] cells. Evaluation of the performance of these technologies under variable lighting conditions and comparative studies of their yields were key aspects of the research. Studies have also been conducted to improve the conversion efficiency through technological innovations such as new solar cell materials [6, 7] and sun tracking technologies [8, 9].

Another essential aspect of research in the field of agrovoltaic panels has been the careful assessment of the impact on crops and the environment. These studies involved monitoring agricultural parameters such as crop yield, water consumption and soil quality in the areas surrounding the panels [9]. The researchers analyzed how the shade provided by the panels influences plant growth, as well as how the microclimate generated can have beneficial or

negative effects on the local ecosystem. These analyzes were essential to develop practical recommendations on the optimal placement and design of agrovoltaic panels.

The research also included extensive case studies to evaluate the implementation of agrovoltaic panels in various agricultural environments [10]. These studies examined the adaptability of technology to different types of soil, climate, and agricultural crops. Local agricultural practices, the specific problems encountered, and the benefits obtained by integrating solar panels were documented. The careful analysis of these case studies contributed to the development of practical guidelines and recommendations for farmers and agricultural planners in the efficient and sustainable implementation of agrovoltaic panels [12].

Through these varied research methods, the scientific community has significantly contributed to the deep understanding of agrovoltaic panels and to the optimization of their use in modern agricultural practices.

A concrete example of the application of agrovoltaic panels is their integration into an agricultural farm to provide electricity and at the same time to optimize land use (Fig.2) [13, 14].



Fig.2. *Agricultural farm with agrovoltaic panels*

Components of such a farm are (Fig. 3):

- Photovoltaic solar panels mounted on elevated structures above vegetable and fruit fields. They are oriented and angled to maximize the capture of solar energy, while also providing the necessary shade for the plants.
- Supports and supporting structures. The panels are supported by solid structures, which can be either fixed or mobile (with sun-tracking capability to maximize light exposure).
- Agricultural land. Under the panels, there are agricultural crops that benefit from the shade provided by the panels. Spacing and type of crops depend on location specifics and local conditions.
- Inverter and energy storage system. The electricity generated by the panels is directed to an inverter for conversion from direct current to alternating current. In some projects, an energy

storage system (batteries) may also be included to manage production fluctuations and to provide power during periods when the panels are not generating electricity (at night or in bad weather).

- Monitoring system. For efficient management of energy production and good system operation, a monitoring system can be implemented that collects data on panel performance.

This is a general outline and specifics may vary depending on the project and the specific goals of the farmer or developer. It is important to consider aspects such as orientation, angle of inclination, type of panels, species of plants grown and other site-specific factors to optimize the efficiency and sustainability of the project.



Fig.3. *Components of agrovoltaic farms*

Agrovoltaic panels can be integrated on top of a wide range of agricultural crops, but the selection of plants depends on several factors,

including climate, soil type and the requirements of the respective crops [15]. Here are some

examples of plants that can be grown under agrovoltaic panels:

- Vegetables with low light requirements: lettuce, spinach, rocket;
- Fruit and viticultural crops: vine, apple, pear;
- Medicinal plants: lavender, rose hips, celery;
- Aromatic plants: dill, basil, parsley;
- Cover crops: clover, lupine, peas.

These are just a few examples, and plant selection must consider local conditions and the specific objectives of the farm. It is important to assess the compatibility between plants and agrovoltaic panels so that both develop properly and provide mutual benefits. It is also recommended to consult with agricultural specialists to make informed decisions according to the specifics of each project.

The implementation of such an agrovoltaic panel farm generates a lot of benefits, primarily in terms of sustainable energy production, agrovoltaic panels generate electricity from the use of solar energy, which is abundant in some countries even throughout the year, thus reducing the farm's dependence on traditional energy sources. This contributes to the reduction of the carbon footprint of the agricultural operation and to the reduction of the impact on the environment.

Second, the agrovoltaic panels allow the efficient use of the land beneath them for growing vegetables and fruits, this dual land use approach maximizing agricultural yields and generating additional income, while the panels provide shade for the plants on hot days, contributing thus reducing thermal stress on crops. This aspect can improve the quality and yield of production.

At the same time, thanks to the shade provided by the panels, the evaporation of water from the soil can be reduced, which implies a better efficiency in the use of water resources, and another advantage would be the protection against hail and other meteorological phenomena, the panels protecting agricultural crops from damage.

This integration of agrovoltaic panels in an agricultural farm demonstrates the multiple benefits of this technology, providing a sustainable and efficient solution for energy and agricultural needs.

3. Results and conclusions of previous research

- Efficiency in electricity generation

Previous research results have highlighted significant efficiency levels in generating electricity through agrovoltaic panels. The studies evaluated parameters such as quality factor, solar conversion efficiency and annual electricity production. Agrovoltaic panels have been found to show solid performance and meet or exceed expectations in terms of electricity generation, making them an attractive option for providing renewable energy sources [16].

- Evaluation of the impact on crop yield

Research has looked closely at how agrovoltaic panels influence the yield of the crops beneath them. The findings indicate that the shade provided by the panels can be beneficial under certain conditions, such as reducing heat stress and soil water evaporation. However, the need for a proper balance between exposure to light and shade to ensure good plant growth was also emphasized. It was also found that the adaptation of plant species to the specific conditions under the panels can contribute to the optimization of agricultural production [17].

- Durability and resistance to various climatic conditions

Research has demonstrated the durability and resistance of agrovoltaic panels to varying climatic conditions. The panels were subjected to extensive tests to evaluate their behavior in the face of exposure to intense solar radiation, extreme temperatures, heavy rain and strong winds. The results indicated that the materials used in the construction of the panels have corrosion resistance and minimal degradation over time [18]. This durability was essential to ensure a stable and long-term operation of the agrovoltaic system in various climatic environments.

By synthesizing these results, previous research has helped outline the benefits and limitations of agrovoltaic panels, providing the basis for continuous improvements and guiding future projects towards efficiency and sustainability.

4. Challenges and future directions

4.1 Current Limitations of Technology

4.1.1 Energy efficiency on cloudy days

One of the main challenges is the reduced efficiency of agrovoltaic panels on cloudy days or in low light conditions. Identifying and implementing solutions to improve light capture in these conditions is an essential aspect. To improve light capture in low light conditions, there are several technological and design solutions that can be considered. Here are some of them:

- Use of advanced solar cell technologies

Adopting state-of-the-art solar cells with increased efficiency in low light conditions can maximize light capture. For example, rear-passivated back contact (PERC) solar cells have shown improved low-light performance [19, 20].

- Implementation of sun tracking systems

Sun tracking systems adjust the position of the panels during the day to track the apparent movement of the sun across the sky. This maximizes light exposure and can significantly improve panel efficiency, especially in the mornings and evenings with more diffuse light [21].

- Use of light concentration technology

Light focusing technology involves the use of optical elements to focus light onto the surfaces of solar cells. This can increase the intensity of incident light and thus the efficiency of light capture, even in low-light conditions [22, 23].

- Use of reflective or transparent materials

Integrating reflective or transparent materials into panel structures can improve light capture. Reflectors or light-transmitting materials can direct the light flux to the solar cell surfaces [24].

- Adaptation of plant species under the panels

Selection and adaptation of plant species under panels to be more resistant to partial shade can help optimize land use and maximize agricultural production [15].

- Investments in research and development
- Research and development funds can support efforts to improve existing technologies or develop entirely new technologies to better cope with low-light conditions.

In general, the approach of a combination of these solutions, adapted to the specifics of each project and to local conditions, can significantly contribute to improving light capture and

optimizing the efficiency of agrovoltaic panels in varied light conditions.

4.1.2 The effect of shade on plants

It has been observed that, in certain situations, the shade generated by the panels can negatively affect the growth of some plants. Minimizing the negative impact of the shade generated by the panels on plants represents an important challenge in the efficient implementation of agrovoltaic panels [25]. Here are some strategies that can be adopted to manage this problem:

- Selection and strategic placement of plant species

Choosing plant species that are more resistant to partial shade can reduce the negative impact on their growth. Also, strategically placing them under panels, depending on their light requirements, can help maximize agricultural yield.

- Optimizing the distance between rows of panels

Adjusting the distance between rows of panels can influence the cast shadow. Adequate spacing can minimize the impact of shade on the plants under the panels, ensuring an optimal level of light necessary for healthy crop growth.

Calculating the distance between rows of agrovoltaic panels can depend on several factors, including the technical specifications of the panels, the needs of the agricultural crops under the panels, and local environmental conditions. First, the technical specifications of the agrovoltaic panels are considered, their dimensions and height are checked, as these details will influence the required space between the rows. If plants or agricultural crops are grown under the panels, their specific requirements are considered, some crops may require more or less light and space, which will influence the distance between the rows of panels.

The orientation of the agrovoltaic panels in relation to the sun's path can also affect the space required between rows. If the panels face south, for example, they can benefit from better exposure to sunlight, and the row spacing can be adjusted accordingly. At the same time, the distance chosen between the rows must allow easy access between the panels for maintenance and agricultural operations. The impact of the distance between the rows on the energy efficiency of the panels is also considered. By calculating the efficiency of energy collection and comparing it with the advantages of

agricultural crops under the panels, an optimal distance can be arrived at.

- Use of sun tracking systems

Sun tracking systems can be configured to adjust the position of the panels to minimize the shadow cast during the day. This technology can ensure a more even distribution of light over the crops under the panels.

- Integration of crops with different light requirements

Designing and implementing mixed systems that integrate crops with different light requirements under the same panel system can optimize land use and minimize competition between plants for light.

- Adoption of advanced transparent solar cell technologies

The use of advanced technologies such as transparent solar cells can allow lighter to pass through to the crops under the panels, thereby reducing the impact of shade on plant growth.

- Computer modeling and simulation

The use of computer modeling and simulation can provide detailed insights into how the shade of the panels is projected onto the ground and guide the optimization of their placement to minimize the impact on plants.

- Education and consultancy for farmers

Providing information and training to farmers on best practices under agrovoltaic panels can help minimize negative impacts. Farmers can be guided to choose appropriate crops and implement strategies that maximize benefits.

Through the integrated approach of these strategies, it is possible to manage the impact of the shade generated by the panels on the plants and create favorable conditions for a harmonious coexistence between energy and agricultural production.

4.2 Possible future innovations and improvements

4.2.1 Development of advanced technologies for capturing light

A future direction could involve the development of innovative technologies to improve light-harvesting efficiency, such as the use of transparent solar cells or reflective materials to optimize energy collection even in low-light conditions.

Transparent solar cells represent an innovation in photovoltaic technology, allowing partial or total passage of light through the surface of solar panels. They use semi-

transparent materials that allow light to pass through while capturing solar energy. This type of solar cell can also be integrated into existing structures, such as windows or building facades, allowing the collection of solar energy without completely obstructing visibility or natural light.

Reflective materials are designed to direct and concretize sunlight to the surfaces of the solar panels, thus increasing the intensity of the light. They can be applied to the surface of the panels, or integrated into structures, to improve light capture, especially in low light conditions. Through reflection, these materials optimize their efficiency in collecting solar energy.

Reverse Face Cut (PERC) technology is an evolution in solar cell design by having an additional layer on the back of the cell. This technology allows for better light capture and improves solar conversion efficiency, being effective in low or variable lighting conditions.

Also, research into the development of new materials for solar cells can lead to improved light-harvesting efficiency. Innovative materials can have improved properties in absorbing and converting sunlight into electricity, which can increase the efficiency of solar panels in low-light conditions.

4.2.2. Advanced monitoring and control systems

Advanced monitoring and control systems are an essential component in making agrovoltaic panels more efficient, ensuring they dynamically adapt to changes in weather and light conditions to maximize energy production and minimize impact on the plants under the panels [26].

Advanced monitoring and control systems can automatically adjust panel angles or tilt direction based on weather and light conditions. These systems can optimize the panels' exposure to sunlight and maximize energy collection even in variable or low lighting conditions.

Advanced monitoring systems use weather sensors such as anemometers, temperature sensors, and humidity sensors to collect accurate data about weather conditions. Light sensors are also integrated to measure the intensity of sunlight. This data is essential to understand the environment and make real-time decisions about the positioning of the panels.

Advanced control algorithms analyze sensor data and make automated panel positioning decisions. These algorithms can also consider factors such as wind direction and speed or the likelihood of cloud cover. Automating the

process of adjusting the position of the panels eliminates the need for constant human intervention and optimizes system performance according to changing weather conditions.

Algorithms can optimize not only the positioning of light-harvesting panels, but also the overall energy consumption of the system.

They take into account energy efficiency and the condition of the batteries, if there is a storage system, to maximize the use of the energy generated. Optimizing energy consumption contributes to efficient resource management and increasing system autonomy. Algorithms can use machine learning technologies to learn and adapt decisions based on complex patterns and interdependent variables. Integrating machine learning can improve system performance over time by adapting to changes in weather and light conditions in a more sophisticated way.

In conclusion, advanced control algorithms are a crucial part of agrovoltaic panel systems, ensuring that they operate efficiently and sustainably under various environmental conditions. Their ability to analyze data, make automated decisions and continuously adapt significantly contributes to optimizing system performance and increasing energy efficiency.

4.2.3. Another improvement

The integration of IoT (Internet of Things) technology enables real-time connection and communication between different system components, including sensors, panels and control systems. It facilitates the rapid exchange of information, allowing continuous adaptation of the panels' position according to changes in weather or light conditions [27].

Predictive analysis systems can be used. Using historical data and predictive analytics algorithms, these systems can anticipate changes in weather conditions and pre-emptively adjust the position of the panels. This proactive approach helps optimize energy efficiency and production by anticipating and quickly responding to variations in light or weather conditions.

The development of intuitive and advanced user interfaces allows operators to monitor and control the system easily, providing detailed information about panel performance and environmental conditions. An efficient user interface facilitates system management and optimization, including analysis of historical data and configuration of control parameters.

These technological innovations represent future directions in the development of agrovoltaic solar panels, having the potential to significantly improve the efficiency of light capture and, implicitly, the energy performance of the systems. Integrating these technologies into future designs could bring substantial benefits in low-light conditions.

4.3 Integrating agrovoltaic panels into global agricultural policies and practices

To encourage the adoption of agrovoltaic panels globally, it is necessary to develop policies and financial support programs. These may include government subsidies, tax breaks or favorable financing mechanisms for farmers who adopt this technology.

Creating a global normative and regulatory framework to promote and regulate the implementation of agrovoltaic panels can help ensure sustainability and standardization in the use of this technology worldwide.

Integrating agrovoltaic panels into global agricultural practices also implies the need for education and consultancy for farmers. Training programs and educational resources can help to understand the benefits of the technology and to adapt it appropriately according to the specifics of each farm.

By addressing these challenges and exploring future directions, opportunities are opening up for the continued improvement of agrovoltaic panels and for strengthening their position as an essential component of sustainable and energy-efficient agricultural systems.

5. Conclusions

In conclusion, agrovoltaic panels present multiple advantages, but also challenges.

As advantages, we note the dual generation of resources, since agrovoltaic panels allow a dual use of agricultural land, generating both renewable electricity and agricultural crops, the optimization of land use, since the integration of panels in the agricultural landscape contributes to solving the problem of land occupation as well as reducing dependence on fossil resources by using renewable energy sources, which helps mitigate climate change.

As challenges, we highlight the impact on plants, as shade generated by panels and competition for light can influence plant growth, requiring management strategies.

The initial costs of implementing agrovoltaic panels can be a barrier for farmers, requiring financial solutions and government support.

The need for continuous research in the field of agrovoltaic panels is obvious, and the importance of technological and scientific advances is undeniable. Future research should focus on the development of innovative technologies, such as transparent solar cells or reflective materials, to improve the efficiency of agrovoltaic systems, to optimize the impact of panels on the environment and to develop strategies to minimize negative effects on plants.

Innovations in the field of control algorithms and monitoring systems can significantly contribute to increasing the efficiency and adaptability of agrovoltaic panels.

Future research should include detailed case studies and comparative analyzes to assess the performance of different implementations and provide practical guidance to farmers and investors.

In this dynamic field, the contribution of research projects to the sustainable development of agrovoltaic panels is essential.

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THE EFFECTS OF FETEASCĂ NEAGRĂ WINE ON THE RIPENING PROCESS OF THE CHEESE

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Abstract: The ripening process of cheeses is the primary key to obtaining quality products. In this research, we set out to obtain an assortment of cheese, the ripening process of which should be carried out in Fetească Neagră red wine. Feteasca Neagră is an old autochthonous grape variety from Romania. The obtained wine has an aroma of berries, cherries, and prunes and is slightly spiced, reminiscent of cinnamon, pepper, allspice, or vanilla. The ripening of cheeses is a complex process in which physicochemical, biochemical, and microbiological transformations take place, and by ripening the cheese in Fetească neagră red wine, we want to obtain an assortment of cheese that enjoys the color and the bouquet of aromas that the wine imparts to the cheese. To carry out this study, the fresh cheese, after salting, was placed in Fetească Neagră red wine for maturation (9 and 11 days). Also, part of the cheese was kept under normal maturation conditions. To carry out a comparative study, the three types of cheese obtained were analyzed on the 7th day of storage and the 14th day from the point of view of sensory and physicochemical qualities (chloride content, dry matter, acidity). The sensory analysis was performed by five tasters who evaluated the product's aroma, color, consistency, texture, and taste.

Keywords: cheese ripening, Fetească Neagră wine, cheese soaked in wine

1. Introduction

Feteasca Neagră is an old autochthonous grape variety from Romania. Fetească neagră has been cultivated in Romania for over 2000 years but is less known in other viticultural countries. [1] The obtained wine has an aroma of berries, cherries, and prunes and is slightly spiced, reminiscent of cinnamon, pepper, allspice, or vanilla. [2]

Fetească Neagră wine is rich in total phenolic compounds and possesses antioxidant activity thanks to the bioactive compounds it contains. The samples aged with oak staves showed a total phenolic content of 931.1 mg catechin/L at 1.5 months of maturation and 775.4 mg catechin/L at three months of maturation, and the antioxidant activity of these samples increased during the maturation period from 12.8 mM Trolox for wines aged for 1.5 months to 13.3 mM Trolox for wines aged three months. [3]

Codex Alimentarius defines cheese as a „soft, semi-hard, hard, or extra-hard product obtained by coagulating milk, skimmed milk, partly skimmed milk, cream, whey cream or buttermilk, or any combination of these materials through the action of rennet or other suitable coagulating agents, and by partially draining the whey resulting from the coagulation.” [4]

Cheese is a dairy product consumed all over the world. There are many varieties of cheese worldwide, and efforts are being made to develop new varieties of cheese to meet consumer's demands.

Quality characteristics of cheese, including physicochemical, proteolysis, and sensory properties, are affected by different parameters, i.e., raw milk composition, amount and type of the coagulant, manufacturing method, and ripening conditions. [5]

The ripening of cheeses is a complex process that occurs in environmental conditions and at a particular time in which physicochemical, biochemical, and microbiological transformations occur.

During the ripening process of the cheese, a quantity of the water and CO₂ in the cheese is vaporized from the surface of the cheese into the ambient environment, thus generating a weight loss—the cheese's pH and salt content influence cheese protein's water-binding capacity. Also, the water loss from the cheese is richly influenced by some environmental parameters such as temperature and humidity. [6]

By ripening the cheese in Fetească neagră red wine, we want an assortment that enjoys the color

and the bouquet of aromas the wine imparts to the cheese.

Cheese and wine are products consumed together for a long time. This is because wine is a situational accompaniment to food; it can match or enhance flavor and impart lubricating properties. [7]

Eating cheese associated with wine is a gastronomic recommendation appreciated by consumers, so the ideal combination between the type of cheese and the wine is studied to understand how the sensory elements in wine and cheese interact and transform each other. [8] [9]

It is known that the ripening process plays a vital role in both cheese and wine products. In this process, the gustatory and olfactory characteristics of the products are defined. Several attempts have been made over time to develop cheeses matured in wine. Currently, there are cheeses on the market that have been matured in wine.

The results of a study show that soaking the cheese in the fermented must does not influence the behavior of the proteolysis or the fermentation processes that take place during the ripening of the cheese. Instead, the aromatic fraction is strongly influenced, and the presence of alcohols and esters in the wine can give the cheese flowery, aromatic, fruity, and vinous notes. [10]

Another study shows the findings highlight the positive effects of wine marination on the physicochemical parameters of goat Coalho cheese, improving its quality and safety. Goat Coalho cheese was immersed in red wine at 6 ± 1 °C for seven days, and the cheese was

characterized during 28 days of storage (4 ± 1 °C). The marination process resulted in an intense purple color on the cheese rind, low pH, greater hardness and chewiness, and the high conservation of mineral contents, besides providing a protective layer against potential deterioration triggers, eliminating free radicals and promoting metal chelation. [11]

This research aims to identify the effects of Fetească Neagră red wine on the characteristics of semi-hard cow's cheese when the wine softens the pieces of cheese during the ripening period.

2. Material and methods

The cheese was prepared from cow's milk procured from a local producer; food rennet was used (Ideal Still SRL) 2.5g/L milk, brine (20% solution), food NaCl, and medium granulation. Fetească Neagră wine was purchased from a store and belonged to a winery in the Prahova area of Romania. It was produced in 2021.

The cheese was obtained under laboratory conditions. Fresh, whole cow's milk pasteurized at 65°C, then cooled to 37°C, seeded with rennet, and allowed to clot for 90 minutes. The curd was then placed in molds and pressed to remove the whey. The obtained cheese was salted for 18 hours in a brine solution with a concentration of 20%. A specific whipping was carried out for each sample, followed by maturation, which was carried out according to Table 1.

Table 1. Cheese sample description

No.	Sample name	Sample code	Cheese salting	Cheese drying	Dipping and ripening cheese in red wine	Ripening
1	Control sample	PMB	18 h	-	-	14 days
2	Sample no. 2	PM2	18 h	3 days	11 days	-
3	Sample no.3	PM3	18h	5 days	9 days	-

Methods of analyses

Sensory analyses

All the cheese samples were cut into 2.5x2.5x2.5 cm cubes and coded for sensory analyses. The team of tasters consisted of 7 volunteer evaluators. The following attributes were evaluated: consistency, appearance, color, intensity of odor, intensity of flavor, sweetness, saltiness, and creaminess. An intensity scale from 1 to 5 was used for each attribute. The samples were sensory evaluated on days 7 and 14 of ripening. The

obtained results were collected and represented graphically.

Physico-chemical analysis

The physical-chemical evaluation of the samples was carried out at the beginning of the ripening period, at 7 days of ripening, respectively at 14 days.

Determination of Titratable acidity

Thorner method was used to determine the titratable acidity of the cheese samples. 10 g of crushed cheese in a porcelain capsule with 5 ml

of distilled water were titrated with 0,1 n sodium hydroxide in the presence of phenolphthalein until a pink color persisted for 30 seconds [12]. The acidity is expressed in degrees Thorner and is calculated by the following formula:

$$\text{Aciditate } ^\circ\text{T} = \frac{V \cdot 10}{m} \quad (1)$$

Where:

V = volume of 0,1 n sodium hydroxide solution, used for titration, in ml;

10 = volume of sample taken in progress;

m = mass of the sample to be analyzed in g

Determination of NaCl concentration

The argentometric titration method

Principle of the method: Chlorides are extracted from the sample with hot water (70-80°C), chlorine ions are titrated with a silver nitrate solution, and potassium chromate is used as an indicator. [13]

The sodium chloride content, expressed in grams of sodium chloride (NaCl) per 100 g of product, is calculated as follows:

$$\text{NaCl} = \frac{V \cdot 100}{m \cdot V_1} [\text{g}/100 \text{ g product}] \quad (2)$$

Where:

V – volume of AgNO₃ solution, cm³

m - mass of cheese under analysis, grams

V₁ – the volume of the analyzed product, cm³

Determination of dry matter content at the thermobalance

The dry substance was determined using the A&D moisture analyzer ML-50 at 100°C. [14]

3. Results and discussion

Sensory analysis

After 7 days of maturation (figure 1), the cheeses matured in Fetească Neagră wine obtained better scores for the intensity of odor and aroma, color, creaminess, and sweetness. The control sample has a higher consistency and a slightly saltier taste.

After 14 days of ripening, the appearance and consistency of the samples were assessed as slightly lower compared to the sensory evaluation on day 7. Slight upward changes can be observed in the intensity of smell, aroma, color, and creaminess of cheeses matured in wine. The two types of wine-ripened cheeses obtained little differences in the sensory evaluation, with PM3 on day 14 having a more intense color and a better appearance than PM2.

The control sample scored lower on day 14 for consistency and odor intensity and higher scores for salty taste compared to the scores obtained by the sample on day 7.

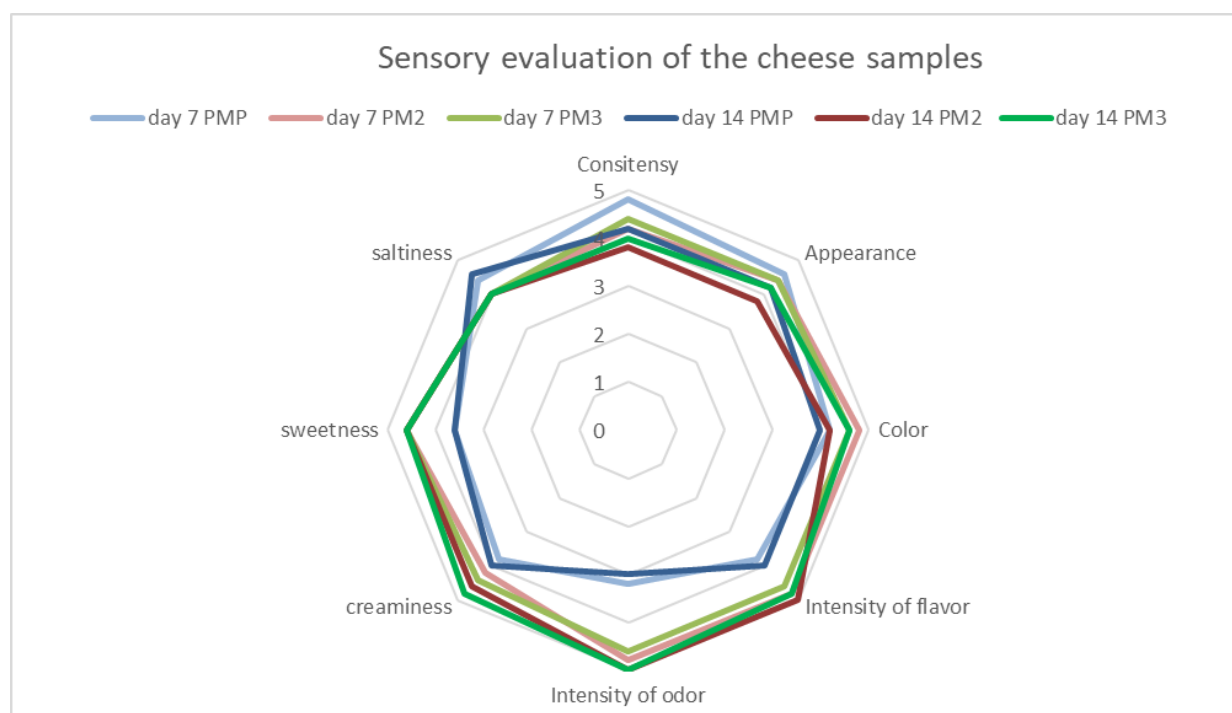


Fig. 1. Sensory evaluation of the cheese sample during the ripening process

Physico-chemical analysis

Titrateable acidity

The cheese samples' titrateable acidity ($^{\circ}\text{T}$) (figure 3) changed during the 14-day analysis period. The increase in titrateable acidity during cheese ripening. The cheese samples matured in

Fetească neagră wine obtained lower values for acidity during the analysis period, compared to the control sample, directly proportional to the immersion period in wine. This indicates that the wine intervenes in the proteolysis process of the cheese that starts from fermentation and continues during the ripening period.

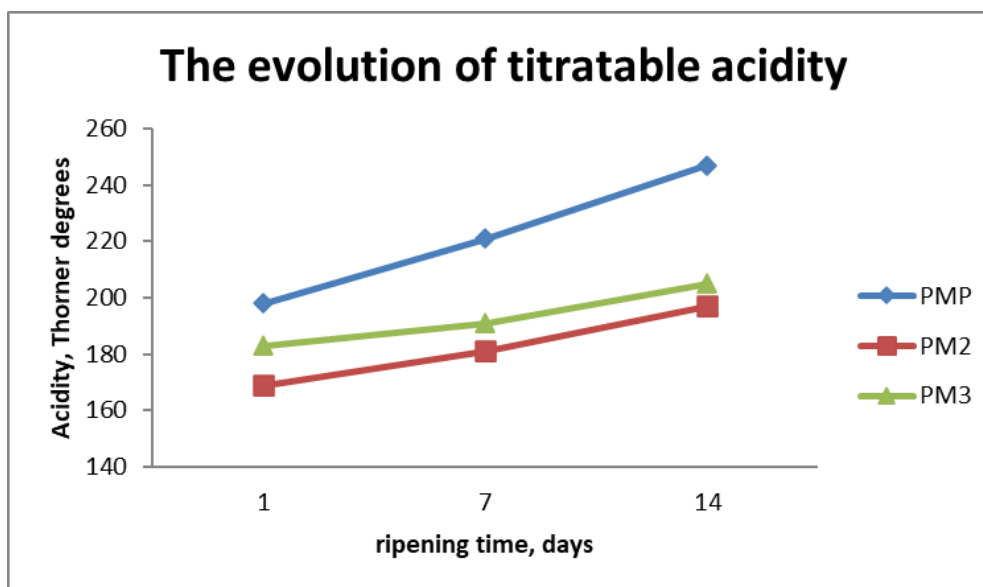


Fig. 2. The evolution of titrateable acidity

Dry matter content

As seen from graphic figure 4, the control sample's dry matter (%) increases during the ripening period. This is due to the dehydration of the cheese. The samples matured in Fetească

Neagră wine recorded decreasing moisture values during maturation. This is because the maturation occurs in a liquid environment, and the cheese absorbs a quantity of the wine. Cheese kept longer in wine has lower results for dry matter.

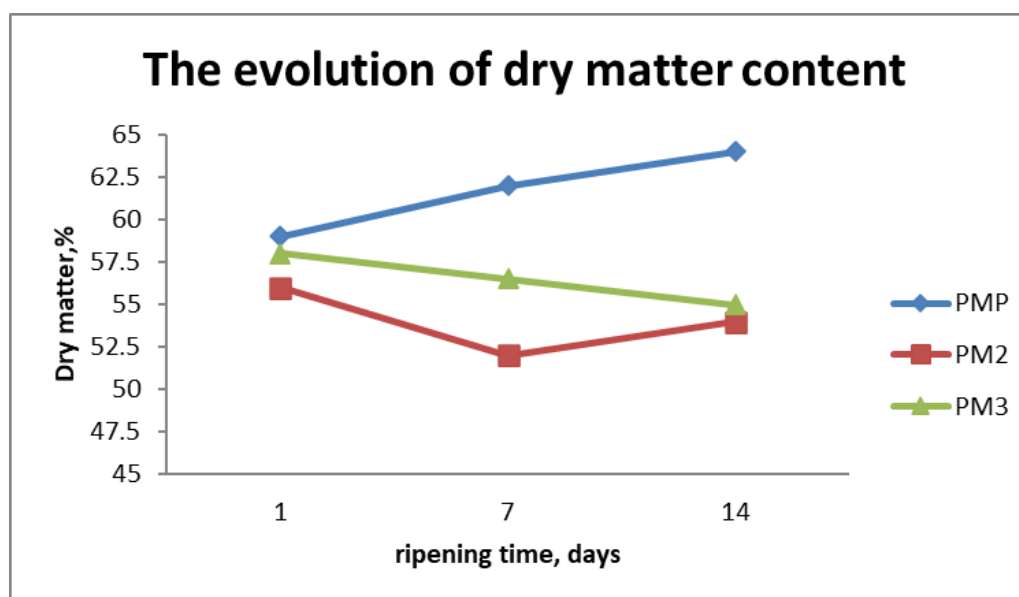


Fig. 3. The evolution of dry matter content

NaCl Content

As seen in graphic figure 5, the values obtained for the NaCl content (%) of the control sample increase during the ripening period due to the water losses in the product. Approximately

constant values were obtained for the samples matured in Fetească Neagră wine with a slight decrease, especially in the second part of the maturation process. This is due to the absorption of the wine by the cheese.

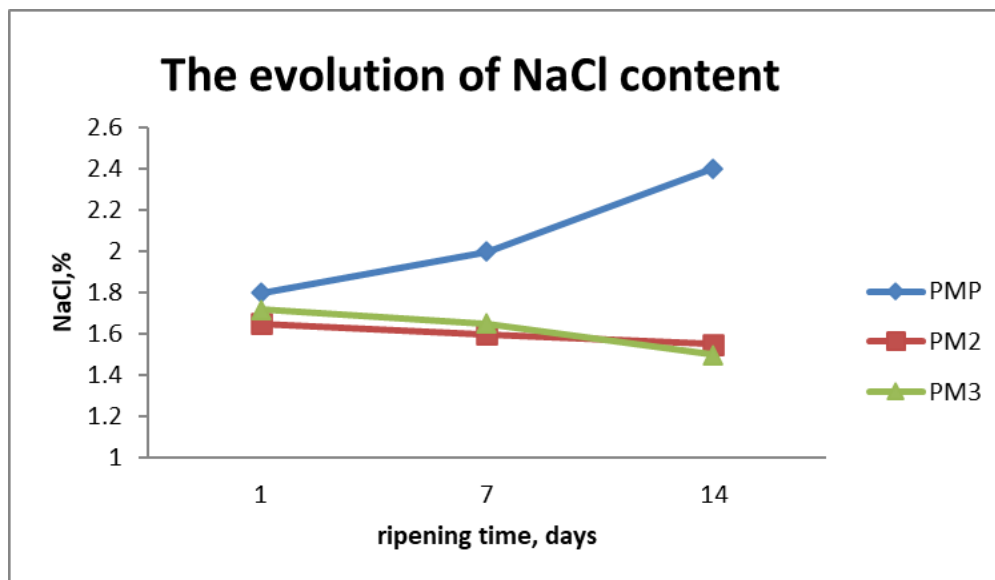


Fig. 4. The evolution of dry matter content

4. Conclusions

Fetească Neagră wine improves the sensory characteristics of the ripening cheese: creaminess, color intensity, taste, odor, and aroma.

Also, the cheese's physicochemical parameters were modified using Fetească Neagră wine during the ripening of the cheese. The titratable acidity of the cheese increases more slowly in samples that are matured in the wine compared to the control sample. The dry matter content and the NaCl content decreased during the storage period in the samples matured in wine, while they increased in the control sample.

5. Acknowledgments

We sincerely thank the Research Center in Biotechnology and Food Engineering (C.C.B.I.A.) and the Lucian Blaga University of Sibiu for their support throughout the research period. The determinations were also financially supported by the LBUS-IRG-2021-07 project.

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