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Design of an Autonomous Robotic System for Corn Field Works

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Abstract The task of vehicle-type product design has never been trivial. The paper shows the concept of a work in progress, a research work by a multidisciplinary team, ready to use the available and most modern automation equipment right where it is needed – down at the earth in this case. The project shall allow for autonomous 0-24 presence of specially designed device – a robot taking care of corn fields, eliminating weeds and performing other usually manual functions keeping the shape of the field and ground at level and in extent freed of limitations that can exist in case of a human labor. It is in the same time bringing some fresh interests to agriculture as such, and may even bring some part of people back to this business, rather than escaping to other nowadays more popular fields for some.

Keywords:
agronomy,
logistics,
robotics,
precision agriculture,
laser,
herbicides,
reduction,
drives,
automation,
computer vision,
artificial intelligence,
machine learning

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1 Introduction

There are a few drivers introducing the need for automation in agriculture, but perhaps the strongest one comes from the side of effects of using agrochemicals for long periods, often indiscriminate and abusive, and the negative effect they bring on health and sustainability of natural resources[1]. While reverting to manual weeds removal and field works sounds like a part of solution, the problem of sustaining the manpower needed to maintain such approach as well as efficiency of food production comes into focus. Therefore, the efforts of introducing automation to agriculture at all levels seems like a logical development, and this paper explains one and several of the approaches and possibilities, coming from a team of experienced automation experts.

This paper describes the work in progress therefore mainly focuses to the design phase and interesting challenges, while some details are not shown on purpose.

2 Robotics and automation approach

2.1 Industrial revolutions

Through the history the industry has had declared a few important milestones also called industrial revolutions, invoked by invention of steam machine, electrical energy application and line type production respectively. The 4-th and 5-th industrial revolutions are relatively fresh and are related to automated lines implementing robotics and advanced automation using systems like the artificial intelligence (AI) or advanced computer vision (CV). There is no doubt that all of these had a great effect to agriculture as well, where in addition, internal combustion engines shall be added to the list of important technical inventions.

[1] Ueta, J.; Pereira, N.L.; Shuhama, I.K.; Cerdeira, A.L. Biodegradação de herbicidas e biorremediação: Microrganismos degradadores do herbicida atrazine. 1 ed. Brasil: [s.n.] , 1997. 545p.

2.1.1 The automation approach

Every technical device that performs some industrial process without the need of human manipulation can be considered an automation element. The possibilities of automation grow scientifically all the time and nowadays ranges all the way usage of advanced methods like the AI and CV, and also aims for mobility, compactness and energy efficiency, even the human collaboration. Automation is also usually in relation to usage of programming, drives, actuators, and many mechanical components, therefore the field of operation is wide and often called Mechatronics.

When approaching towards the solution, there are many universal principles, which are similar in both industrial automation, and special branches like the precision agriculture field. Since laws of physics that apply are the same, it is possible to apply many parallel proven practices on both fields, as will be shown in this paper.

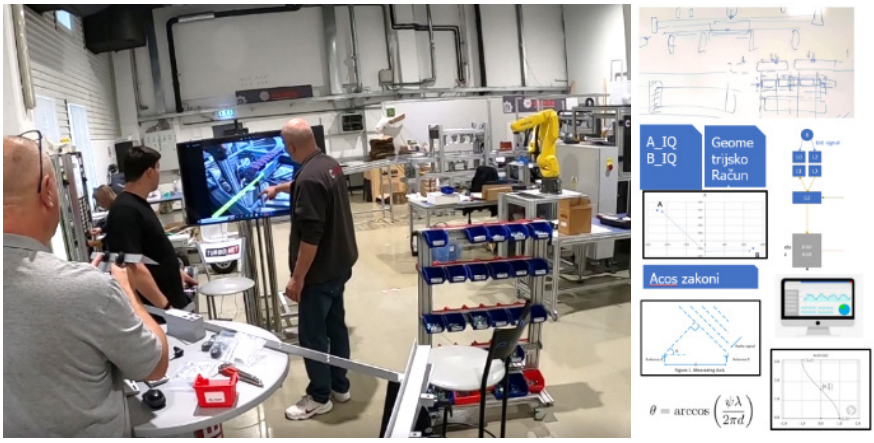

Figure 1: Ideation and multi-disciplinary design in industrial automatization
Source: Damko R&D Centre internal Archives – Photograph / Project report 2020.

In addition to visible part of an industrial automation project (like the production line, robotic arms) there is usually a complex invisible framework »backend« part containing of programs, interfaces, databases and many other elements, which can be considered as a software part of the project.

3 Design of the robot for application in agriculture

The design of every system shall start with defining the goals and afterwards researching the available technology, defining the possibilities to reach the goals under reasonable circumstances, not neglecting the economical dimension.

In the moment of this project development (2020. – 2023.) the state of technology is such that following developments are highlighted and worth of considering and therefore considered in the project:

- Computer vision application
- Artificial intelligence
- Lasers technology (positioning and weeds removal)
- GPS and other positioning systems/methods
- Advanced Battery systems
- Communication protocols (BT, LoRa etc.)

It is obvious that field works require movement through the field and therefore the robot for this application shall be a vehicle, where several traction options are available. The application of robot however must not be viewed only from the prism of currently most used technologies (e.g. wheels) as there are other options possible and some of them are shown below.

Figure 2: Some of possible traction methods applicable for Agriculture robots
Source: Websites: www.ZentaRobots.com ; www.global.agilex.ai – Commercial websites

Since one of the automation design principles is also to think of the box, the project in subject is also about to seek the selection of ideal platform for the system.

4 Project goals

The goals of the project are based on the current needs in agriculture, as well as on the technology state and possibilities, and can be roughly described as:

- Reduction of weeds presence with minimum human labor
- Reduction of agrochemical usage
- Increasing the crop output
- Design of an autonomous self-sufficient system concept

If goals are to be described in a sentence, it would be to allow for manual like operation by a robot, providing significant reduction of unwanted elements like herbicides usage and pollution in general, aiming for eco production.

The selection of crop to be planted for the project was defined early in the project, where corn has been selected.

5 Project resources

The resources needed for such an R&D project consist of human researcher's manpower, hardware, software, and specifically for agronomy – a test field with polygon – a corn field.

Figure 3: A test polygon during planting and in it's full growth phase
Source: Damko R&D Centre internal Archives – Photograph 2022.

Table 1: Project resources

Item	Resource type	App. Quantity	Duration
1	Researchers & admin	8 – 12	3 yrs
2	External cooperants	4	3 yrs
3	PC & other computers	5	3 yrs
4	Microcomputers	25	1,5 yrs
5	Other equip. and materials	50	3 yrs
6	Prototyping equipment	-	2,5 yrs
7	Test fields (with works and services)	100 Ha	2,5 yrs

Source: Damko R&D center's internal work reports / resource planning system for IRI 2 Project (estimation)

The most important resource are the qualified researches in field of automation and agronomy with competence in field of mechatronics, agronomy experts inside team or outside in form of cooperation.

6 The initial project progress

It has been realized from the start of development that many samples used to test will be required, and there is a challenge about that since crops growing depends on the time of the year. Therefore, the focus is put on the efforts to record useful footage in as early phases as possible. This has been achieved in the first year by creating an initial platform vehicle – camera carrier, which also served for initial vehicle properties and performance definitions.

Figure 4: The initial platform used for creation of initial videos and photos
Source: Damko R&D Centre internal Archives - Photograph 2020.

The initial footage has been taken on the borrowed fields already in full growth, and later on in the season the designed platform is used for driving and taking footage during the growth in the purposely prepared polygons.

Having the useful footage at the disposal, the initial computer vision analyses become possible, as well as initiating the machine learning applications. While developing the computer vision and main software parts, the possibilities opened to design the next prototype version, drives, and all the subsequent systems.

Since achieving autonomy is the important part of this project, combined with economy, every bit of design had to be considered from this side as well. Also, since there are clear timelines to be meet, there was no place for mistakes performance-vise, and therefore to select any component a lot of researching time is spent and all the critical parts were tested before becoming part of the next prototype.

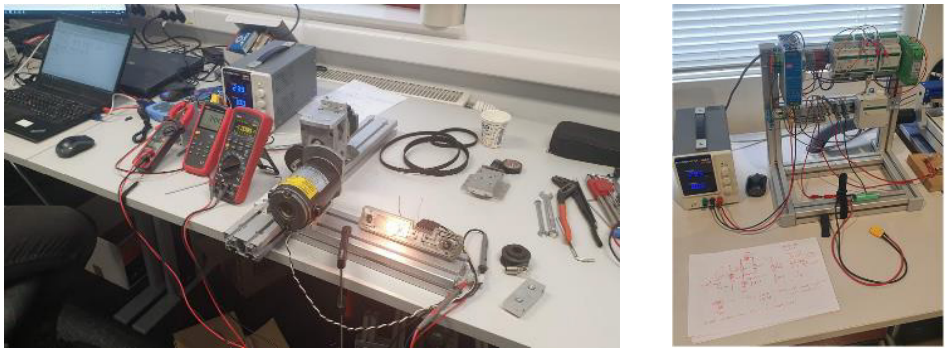

Figure 5: Test setups for testing drives (left) and batteries/battery packs (right)
Source: Damko R&D Centre internal Archives - Photograph 2021.

The intensive research, trail, selections and testing shown many interesting results, especially important since the supply chains have been broken in 2020. and many characteristics cannot be trusted, and some of them are even not defined for this kind of application. Batteries, for example often hold much smaller capacity than declared, and such details are critical for a prototype like this one to be proven.

Initial results of computer vision (and machine learning) part of the project emerged very early in the project, and also defined the type of specific equipment to be onboarded to the next prototype. And the type of components and the specification naturally changed during the project due to the new findings coming out as a result from a detailed research work.

Some of the first results emerged form computer vision / machine learning field of the project. Models created had been able to detect and recognize corn plants very soon. It however took a lot of time to develop the system that can recognize effectively using a lot of different hardware and software platforms to be optimized and fitted into autonomous robot had to be tested.

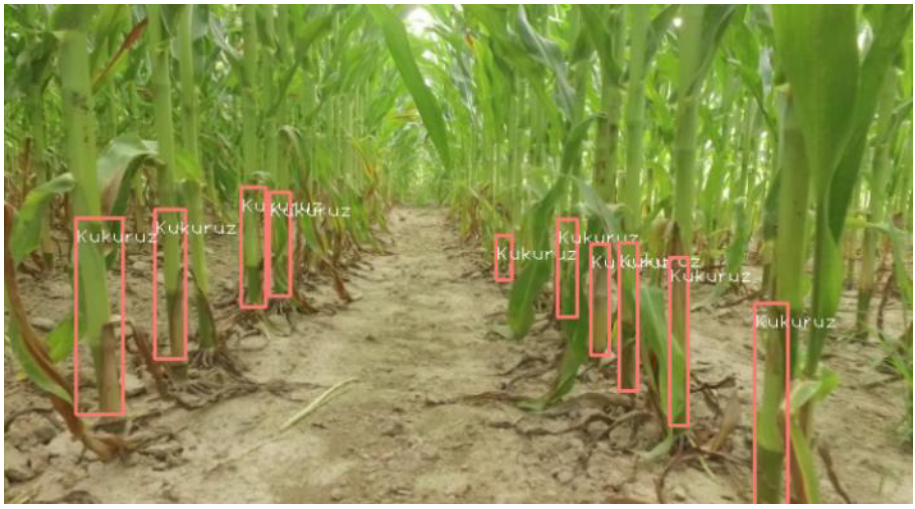

Figure 6: Visualization of the corn crops recognition on half-grown plants
Source: Damko R&D Centre internal Archives – Reports 2021.

In all the cases, the machine learning algorithms are used, creating the various models with certain number of labeled images, selected by a human, and training the respective model with certain number and type of images.

Training repetitions	Average Accuracy	%
0	0,000000	0,00%
1000	0,671013	67,10%
2000	0,721634	72,16%
3000	0,757533	75,75%
4000	0,771892	77,19%
5000	0,818656	81,87%
6000	0,827235	82,72%

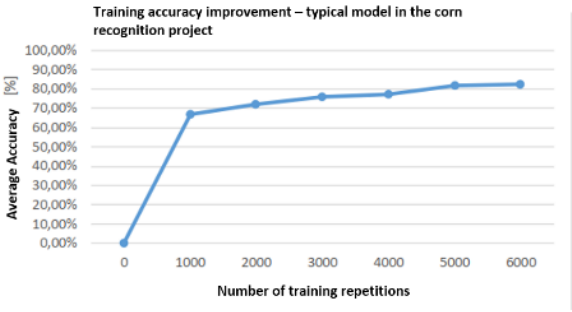

Figure 7: Average recognition accuracy vs. Number of training repetitions
Source: Damko R&D Centre internal Archives – Reports 2021.

The training efficiency depends on number, quality and timing of selected images, as well as on hardware performance. Therefore, it can typically wary from a few hours to a few weeks of training time.

In addition to machine learning type recognition, the other computer vision possibilities are observed and researched as well, like the contour's detection, colors and shapes types etc. As the goal of the project is to dissect weeds from the useful plant, all these can be useful.

Figure 8: Corn crop isolated in the picture based on computer vision methods
Source: Damko R&D Centre internal Archives – Reports 2022.

7 The second prototype design

After initial tests, the properties and selection of equipment needed to be driven on the autonomous robot became much more defined. Therefore the approx. weight to be taken to the field also became known and equaled to 75 kg together with the vehicle as the initial approximation.

The requirement to achieve the autonomy goals in the first place and the experience with the initial prototype led to the important decision that the next prototype shall not be a wheel type but a tracks type vehicle.

Figure 9: The initial assembly of track type vehicle as a second prototype platform
Source: Damko R&D Centre internal Archives – Photograph 2022.

The next steps consisted of defining the rest of equipment and fitting the complete system into the newly designed prototype, for the goal of having reliable autonomy tests to be performed. Other than autonomy, the driving characteristics and the weight handling characteristics had to be tested this way, since this type of prototype is the last step before the final testing to be performed in last phases of the project – in order to provide a practical proof of concept.

The vehicle is design as a prototype, but in the same time needed to provide for easy maintenance, and modifications and extensions to be done in the future, since at the time of vehicle design, not all the project circumstances could be known, especially the ones requiring field tests to be determined.

In addition to drive and main controls, mentioned so far, the concept needed to provide for an effective communication with the external control systems, so that tests can be done properly, so that is one other system to be fitted and antennas to be considered.

Localization at the field to be combined with autonomous driving is another field that is researched in details. Both GPS and other technologies are observed and planned to aid the main system.

Figure 10: Navigation technologies testing during the fall time and the recorded map of polygones to be used

Source: Damko R&D Centre internal Archives – Photograph / Reports of IRI 2 Project 2021.

After the definitions are determined, the second prototype has finally been assembled and put to some test drives in the last season before the final testing, assuring the quality research work during winter period. The autonomy goals are achieved, and the rough preliminary data shows that only 35% of the energy is presumed to be consumed on traction, while 25 % shall be consumed on the computing power and the rest 40% remains for the execution elements, like lasers

or other, sensing, communication and localization systems. The shares shall be finally determined at the final season tests, and the complete system adjusted accordingly.

Figure 11: The second prototype operating in the field – test drive with computer vision
Source: Damko R&D Centre internal Archives – Photograph 2022.

The prototype in this phase already consists of all the main components, and is able to drive, operate, receive and send information in basic procedures. Also, there are initial successful tests of autonomous driving done, while completion is the subject of winter research works, programming and final tests on a fresh plants to be planted. The prototype now looks as shown on the Figure 10.

8 Plant Recognition & Weed removal research results

During the development of vehicle, the focus of machine learning is also put on the plant's recognition, in order to find the other plants that are competing with the crops – the weeds. As already explained, the recognition of crops has been very successful and some results demonstrating the performance are visually shown at Figures 11 and 12.

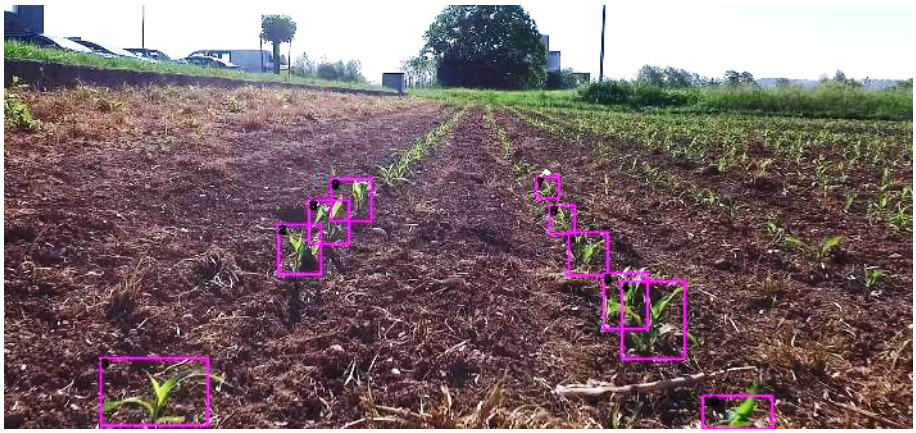

Figure 12: Plants recognition in later stages – on small emerging plants
Source: Damko R&D Centre internal Archives – Reports 2022.

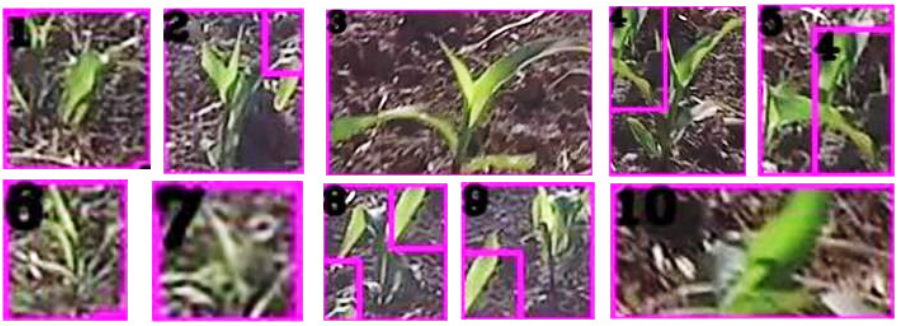

Figure 13: The details of 10 plants recognized by a computer on the image
Source: Damko R&D Centre internal Archives – Reports 2022.

The images on the Figure 13 have a noticeably low resolution, and it is interesting to observe the ability of the algorithm to correctly detect the corn plants even in such conditions (Picture shows the real resolution feed into the system and the video compression is the reality to be dealt with). It may be subjective and arguable, but it may also be challenged if human could do such a task better than a machine if presented to this sequence of images. To further demonstrate the power of algorithms, it may also be said that some middle-performing algorithms researched have so far been able to make more than 25 recognitions of 10 or more plants on the moving image (video) – each second.

For the needs of both detection and removal of weeds, both indoor setups and outdoor sites have been used for research.

Figure 14: Indoor preparation and growing of various plants for testing
Source: Damko R&D Centre internal Archives – Photographs 2022.

There are many executive elements planned to be researches, main of which are related to laser technology. Therefore, lasers have been extensively tested on various plants. Timings and plant recovery observations are some of the research focuses.

Figure 15: Exposing a plant to a laser beam – indoors
Source: Damko R&D Centre internal Archives – Photographs 2022.

There is a wide range of laser selection available today, and there are cons and pros of using a laser for this purpose. However, due to the nature and possibilities to turn on and off quickly, lasers remain the main removal method in this project where economy and compactness are important goals.

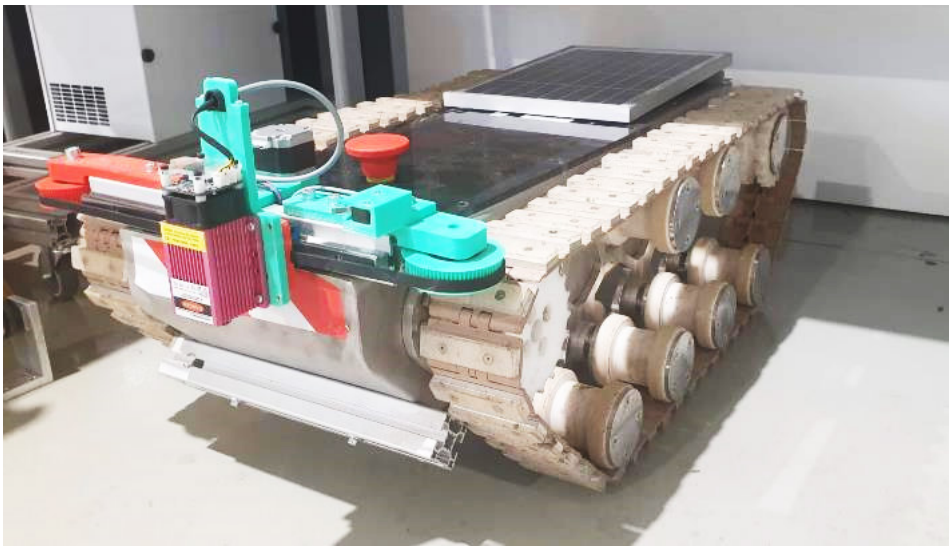

Figure 16: The laser cutter attachment mounted on the second prototype
Source: Damko R&D Centre internal Archives – Photographs 2022.

9 Conclusions

The paper shows the status of research in progress, in which results are already visible proving that possibilities exist to use the explained methods in Agronomy. Robotics in Agronomy already emerge at many fields, and this one shows its unique approach to some details. The concept is proven so far, at the possible areas as the prototype is already operating and some concepts are fully researched.

The project is scheduled to be finished by the fall of 2023, by when the rest of the tests and complete functional test are expected to be finalized.

Notes

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References

Ueta, J.; Pereira, N.L.; Shuhama, I.K.; Cerdeira, A.L. Biodegradação de herbicidas e biorremediação: Microrganismos degradadores do herbicida atrazine. 1 ed. Brasil: [s.n.] , 1997. 545p.

Majdak, T.; Petrov V.; Hrgović S. Agrotehnika proizvodnje kukuruza. Hrvatski zavod za popoprivrednu savjetodavnu službu: [s.n.] , 2016.

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A Review of Rice Straw Utilization Opportunities as Low Cost Agriculture in Egypt

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Abstract Rice production is associated with vast quantities of straw, which have historically been eliminated through the practice of burning fields in the open. However, the burning of agricultural leftovers, particularly rice straw in Egypt (about 4.4 million tons per year), results in what is called locally as Black Cloud, reverse process and utilization for rice straw a major challenge due to technical, social, institutional, and socioeconomic constraints, what was once a valuable resource is now being burned as a waste. Rice Straw could be used properly to create bioethanol, mushrooms, pulp, biofuels, paper, fertilizers, and animal feed, as well as conservation for agriculture. This article examines the composition of rice straw and husks, the procedures involved in the manufacturing of valued products, and the different applications for these materials. These include agricultural additives, energy generation, environmental adsorbents, building materials, and a variety of products.

Keywords:
agricultural waste,
rice straw,
rice husk,
sustainable environment,
silica and cellulose

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1 Introduction

Rice is a main grain for the majority of the world's population, particularly in Africa but its annual production generates enormous volumes of straw (estimated as ~8 $\times 10^{11}$ kg) and husks (~1.5 $\times 10^{11}$ kg) [1]. Rice straw is presently used for practical reasons, such as the manufacturing of biofuels, paper, fertilizers, and animal feed. Rice is the primary cereal crop for more than fifty percent of the world's population. Rice production is recognized as a significant source of greenhouse gas emissions, particularly methane, due to rice management practices and the burning of rice straw after harvest. After harvest, the majority of rice straw is either burned in situ, integrated into the soil, or used as mulch for the next crop. Straw incorporated into the soil degrades slowly and may harbor rice illnesses, but burning is becoming socially unacceptable due to considerable atmospheric pollution[2], which includes greenhouse gas emissions and smoke. As noted, all of the components from the rice production cycle can be utilized despite efforts to discover economically and socially acceptable uses for agricultural waste[3]. Broken rice and rice bran are fully utilized by the food industry and are therefore not considered in this review[4]. However, it is worth noting that rice bran has potential applications as a functional food due to its ability to inhibit Salmonella colonization of the gastrointestinal tract[5], in addition to being a source of oil with a variety of reported beneficial health properties and a high smoke point. Many studies showed the possibility of using rice straw for the production of fuel and other products. Due to the fact that rice husks are created off-site during grain processing, a greater proportion of them are utilized, despite the fact that they were historically regarded as waste and frequently thrown or burned[6]. However, rice husk is readily available and inexpensive; therefore, it has long been used as a source of energy for minor applications. In recent years, a variety of rice husk derived goods, such as polymeric composite resins and polymeric lumber as a substitute for natural wood, have been created by blending ground rice husks with polymer resins, energy-generating pellets can be created too. This study presents the status of the rice straw burning practice in Egypt and examines current

[1] Arai, H., Hosen, Y., Pham Hong, V. N., Thi, N. T., Huu, C. N., & Inubushi, K. (2015).
[2] Liu, C., Lu, M., Cui, J., Li, B., & Fang, C. (2014).
[3] Ray, D. K., Ramankutty, N., Mueller, N. D., West, P. C., & Foley, J. A. (2012).
[4] Conrad, R. (2007). Microbial Ecology of Methanogens and Methanotrophs.
[5] Jiang, Y., Qian, H., Huang, S., Zhang, X., Wang, L., Zhang, L., Shen, M., Xiao, X., Chen, F., Zhang, H., Lu, C., Li, C., Zhang, J., Deng, A., Jan van Groenigen, K., & Zhang, W. (2019).
[6] Li, Z., Unzué-Belmonte, D., Cornelis, J. T., Linden, C. vander, Struyf, E., Ronsse, F., & Delvaux, B. (2019).

procedures for utilizing rice production's waste straw and husks to expand its full usage[7].

The rice straw recycling system was able to change the negative perception towards agricultural waste, after the crucial challenge of burning rice straw and its emissions from fires beside the black smoke caused an environmental imbalance that threatened the lives of all living creatures for many years. burning it, as well as its contribution to creating job opportunities for many laborers that can generate income for them that improves their standard of living through the process of collecting, pressing and selling straw, as the optimal use of agricultural residues helped fill the shortage of organic fertilizers, achieve clean agriculture and protect the environment from Pollution and providing job opportunities in rural areas[8], thus improving the economic and environmental situation in the Egyptian countryside.

In order to make full use of rice straw, it is now recycled in designated sites using shredding and baling machines, to make pellets used to obtain industrial organic fertilizer, and to produce biogas to obtain organic fertilizer and energy, and to use it as an unconventional feed for livestock by adding urea and ammonia injections, and germinating barley seeds on Rice straw and its use as green and dry fodder for livestock, production of mushrooms as human food, and in poultry farms as a bedding for the farm floor with a mixture of sawdust, pressed and sold to paper mills and brick factories, and used in the manufacture of concentrated feed for animals, the manufacture of building bricks, furniture and housing construction[9].

2 Scalable Solutions for Sustainable Rice Straw Management

Rice straw and rice husk fiber are underutilized agricultural leftovers that have the potential to be used in polymer composites that would conserve wood and petroleum. R12 Traditionally, much of the produced rice straw has been burned in the field, as a quick and easy method of disposal. However, this results in the generation of atmospheric pollution from smoke and greenhouse gases; the latter are affected by moisture which enhances emission of CO2, CH4 and other organic carbons, whilst inhibiting N2O emission[10]. In addition to rice straw as shown in

[7] Abdelaal, H. S. A., & Thilmany, D. (2019).
[8] Abdelaal, H. S. A., & Thilmany, D. (2019).
[9] Singh, G., Gupta, M. K., Chaurasiya, S., Sharma, V. S., & Pimenov, D. Y. (2021).
[10] Arai, H., Hosen, Y., Pham Hong, V. N., Thi, N. T., Huu, C. N., & Inubushi, K. (2015).

Figure 1, various other substrates can be digested to produce biogas, including food waste, animals waste, poultry manure, and cow manure, among others. The expense of installing biogas systems is a barrier to the widespread adoption of biogas technology.

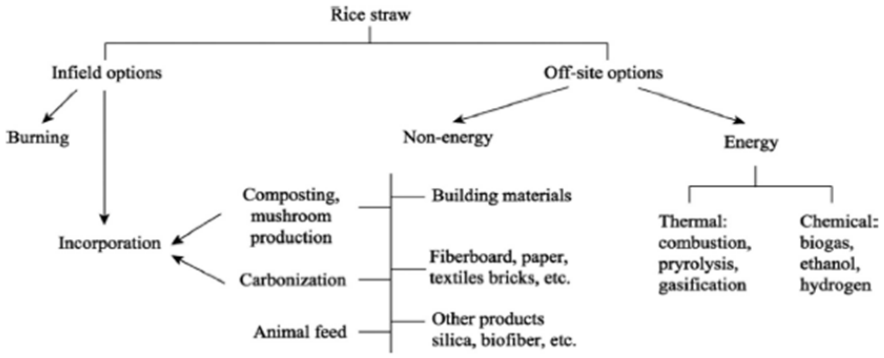


Figure 1: Summary of main options for use of rice straw.
Source: (Goodman, 2020) [11]

2.1 Incorporation

Incorporating rice straw into the soil is a typical method of management, but sufficient time must be allowed for its breakdown to maintain effectiveness and production efficiency[12]. In addition, after soil inclusion, straw management considerations must be considered for greenhouse gas emission (GHGE)[13]. Rice straw has a slower decomposition rate; hence, some farmers avoid incorporating it into the soil, particularly in intensive cropping systems. Rice straw composting is done by adding animal manure and enzymes to rice straw and mixing by a turner and ensilage, in order to homogenize the mixture. The biophysical processes of decaying matter can drastically improve thru mechanized composting. In turn, the compost can serve as fertilizer for growing vegetables and other crops, or can be used directly as soil conditioner. As soil conditioner, it improves the nutrient and organic matter content of the soil. R13 Straw integration is a typical approach for

[11] Goodman, B. A. (2020).
[12] Gummert, M., Nguyen, ·, Hung, V., Chivenge, P., & Douthwaite, B. (2020).
[13] Sander, B. O., Samson, M., & Buresh, R. J. (2014).

boosting soil fertility[14], however its influence on increasing methane emission is a cause for worry[15].

Rice straw could be pyrolysis under control to make biochar. Combining biochar soil aids in carbon sequestration, reduces GHG emissions, and promotes sustainable soil management. Biochars generated from rice straw as well as husks can be used to enhance soil characteristics. Significant increases in rice seedlings substance were noted after biochar amendment, In soils with low silica content, use of xerogel silica produced from micronized rice husk ash has been reported to boost rice crop yields[16]. However, soil type has a substantial impact on the value of biochar as a soil amendment for enhancing soil properties.

2.2 Energy Production

Rice is a main food for the majority of the world, its production is extensive. Nonetheless, it also produces vast quantities of non-food biomass, primarily in the form of straw and husks. Although they have been underutilized and most rice straw is being burned, these cellulosic materials have the potential for significant use. These include agricultural additives, energy generation, environmental adsorbents, building materials, and a variety of specialized products. This article investigates employing rice straw and husks to produce clean energy, the procedures involved in the manufacturing of valued products

Although pyrolysis and gasification can be used to make bio-diesel, rice husk pellets are also a viable alternative to diesel oil and coal for small-scale electricity generating[17]. The large generation of ash including silica and alkali might damage combustion equipment and cause agglomeration. However, there are potentially beneficial applications for the ash[18]. have presented a reactor that uses rice husk mixed with sawdust or charcoal to produce high-quality fuel. Rice husk briquettes made using starch or gum arabic as binders offer superior combustion qualities to firewood[19]. Carbonization of rice husk yields char with a somewhat high heating

[14] Liu, C. , Lu, M. , Cui, J. , Li, B. , Fang, C.M. , (2014).
[15] Conrad, R. (2007).
[16] Rambo, M. K. D., Cardoso, A. L., Bevilaqua, D. B., Rizzetti, T. M., Ramos, L. A., Korndörfer, G. H., & Martins, A. F. (2011).
[17] Quispe, I. , Navia, R. , Kahhat, R. , (2017).
[18] Wu, H.C. , Ku, Y. , Tsai, H.H. , Kuo, Y.L. , Tseng, Y.H. , 2015.
[19] Yahaya, D.B. , Ibrahim, T.G. , 2012.

value, with the addition of starch as a binder and ferrous sulphate or sodium hypophosphite to improve ignitability.

As with other organic wastes, rice straw can be utilized for energy production, including the production of ethanol, biogas, and bio-oil, as well as direct burning. Although ethanol is the most often utilized biofuel for transportation, manufacturing of ethanol from lignocellulose sources is still in its infancy[20]. Rice husk briquettes or pellets can be used as a substitute for fossil fuel in the gasification process to convert rice husk synthesis gas in a reactor with controlled air; this gas can be used as fuel or in a power generating system to generate electricity. In the past decade, rice straw has attracted the utmost interest of scientists as a potential source of energy in the form of bio oil. Several organizations have successfully recovered oil from straw using thermo-chemical techniques, and pyrolysis is one of these promising methods. Rice straw was pyrolyzed on a fluidized bed equipped with a mechanism for char separation. The optimal temperature for bio-oil extraction The oil was rich in oxygenated hydrocarbons[21]. Rice Utilization Biomass is a unique resource for the sustainable manufacture of bio-derived chemicals and fuels to replace products obtained from fossil fuels. Although lignin is a significant component of lignocellulose materials, its complex cross-linking polymeric network renders it intractable to present chemical methods, and alternative catalysts are being developed for its deploy medication[22].

2.3 Rice straw silage for livestock feed

Utilization of Rice Straw as a low cost natural food of rice straw for animal feed, There growing demand for animal source foods which consider a major concern for Egyptian population therefore rice straw affordable source of food for livestock feed. Rice straw includes 65.5% holo-cellulose (34.2% cellulose and 27.9% hemi-celluloses) and 10.2% lignin. Thus it was suitable for feeding ruminants. Previous research by Tengerdy and Szakacs[23] revealed that, because ligno-cellulosic crop residues include substantial amounts of cellulose, hemi-celluloses, and lignin, they may be suitable substrates for the manufacture of single cell protein for use in animal feeds. However, the biggest issue with dry rice straw is its low protein level of

[20] Balat, M., (2011).
[21] Biswas B, Pandey N, Bisht Y, Singh R, Kumar J, Bhaskar T (2017).
[22] Pineda, A. , Lee, A. , (2016).
[23] Tengerdy, R.P. and Szakacs, G. (2003).

approximately 2%. According to El-Haggar et al.,[24] the chemical treatment approach using urea or ammonia is more practical than the mechanical treatment method. Adding 3 percent ammonia (or urea) to the entire mass of garbage produced the best results. Rice straw is the most plentiful form of feed for ruminants in Vietnam, particularly during the dry season[25]. Ammonization techniques employing urea or anhydrous ammonia to increase a crop's nutritional content are well-established and utilized in a number of Asian nations. When urea is used in the wet ensiling technique, the suggested amount is 4 kg of urea per 100 kg of air-dried straw little more than half of this amount remains in the straw when it is fed to the animal.

2.4 Exploitation of paddy straw for the fabrication of pulp and paper

The Food and Agriculture Organization of the United Nations (FAO) reported in 2018 that the worldwide forest area decreased by 3.2 million hectares (0.1% per year) between 2010 and 2015. Global urbanization and rising demand for wood and wood products are the primary causes. As a result of the high cost and limited supply of wood, many developing nations have begun to rely on non-wood based pulps (bamboo, corn straw, bagasse, flax, jute, sisal, etc.) for paper manufacture. Particularly in India and China, 70% of the pulp industry's raw materials come from non-wood plants, including wheat straw, cereal straw, and bagasse[26]. There are numerous advantages to utilizing non-wood resources in the pulp and paper business. The use of non-wood pulps will reduce deforestation. Use of agricultural leftovers in the paper sector will reduce wood and cellulose fiber imports in wood-shortage nations. Customer satisfaction will grow as a result of their desire for paper made from recycled or non-wood fibers. Agricultural leftovers are simpler to pulp than wood pulps[27]. In 2013, the global demand for paper was 402 million tons per year[28]; by 2021, the demand reaches 521 million tons per year. Increasing demand for paper does not indicate an increase in the literacy rate, but paper is in great demand for wrapping and packaging of goods and commercial products. Despite the various advantages of exploiting rice straw in the paper industry, it is not regarded a profitable biomass due to its high silica concentration (10 to 17 percent).

[24] El-Haggar, S. M.; Mounir, G. and Gennaro, L. (2004).
[25] El-Dewany,G,Awad,F,. (2018).
[26] Liu et al., 2018; Singh et al. (2019).
[27] Rodriguez et al. (2008).
[28] Kulkarni, A. (2013).

2.5 Mushroom Production

The rice straw mushroom species is often utilized because it grows quickly and has a 14-day growth period. The species develops in tropical climates at temperatures between 30 and 35 degrees Celsius during the mycelia development stage and between 28 and 30 degrees Celsius during the fruiting body production stage which fit in Egyptian climate especially in summer. Rice straw spawn, labor, and water are the key inputs for mushroom cultivation. Typically the mushroom harvest begins in the third week following inoculation and concludes one week afterwards[29]. In Vietnam's Mekong River Delta, outdoor mushroom farming is widespread crop. The minimal cost of investment is a benefit of this firm that generates income. It yields 0.8 kg of mushrooms every 10 kg of dried straw, resulting in a net profit of USD 50–100 per tons of straw. Due to increased investment requirements and the need for stringent control over growing conditions, indoor cultivation is a less prevalent technique. On the other hand, the yield per 10 kg of dry straw is around 2 kg higher for mushroom cultivation indoor.

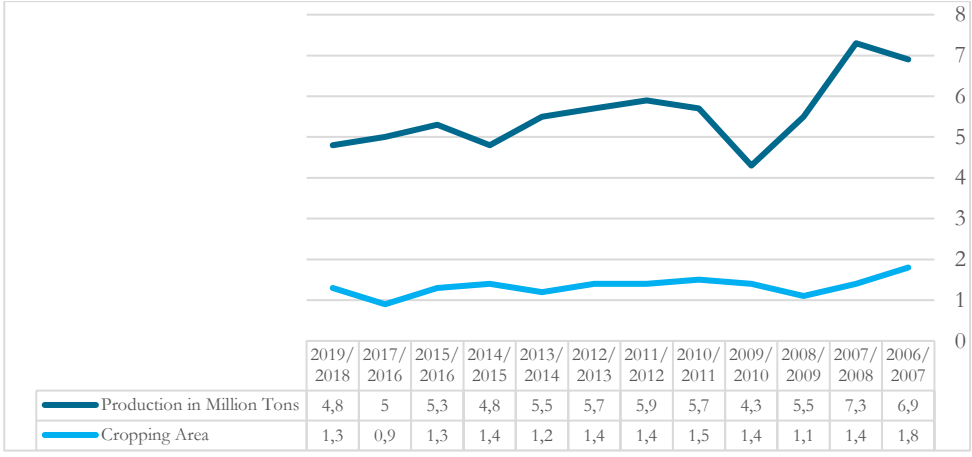
3 Africa Context

In notwithstanding the of Asia's dominance in rice production and consumption, the importance of rice in other regions of the world is not diminished. It is the primary food crop in the majority of African nations. Population growth over the past two decades has increased the demand for the crop that is currently the second most important source of energy in Africa. In fact, the current rate of rice consumption in Africa exceeds its rate of production, which is balanced with the help of effortless and sustainable imports from Asia. Egypt, Madagascar, and Nigeria are the leading rice producers in Africa, followed by Mali, Tanzania, Sierra Leone, and Senegal. It is primarily grown in countries along the western and eastern coasts of Africa and has become a crop of paramount political significance. The 2007–2008 rice crisis in Africa is a classic example of the extent of public unrest caused by its shortage or price fluctuations, illustrating its significance[30].

[29] Singh, G., Gupta, M. K., Chaurasiya, S., Sharma, V. S., & Pimenov, D. Y. (2021)
[30] Abdelaal, H. S. A., & Thilmany, D. (2019).

3.1 Local Context

The total cultivated area reached 1.3 million acres of rice. Figure 1 show the rice production and total rice cropping area in Egypt from 2006 to 2019.Study show that Dakahlia Governorate is the largest governorate of rice cultivation, where the rice area reached 369 thousand acres, 29.3%, and rice production reached 1.1 million tons, or 30.3%, followed by the Eastern Province, with an area of 278 thousand acres, at a rate of 22, 1%, and the amount of production amounted to 868 thousand tons, at a rate of 23.0%.Kafr El-Sheikh Governorate, with an area of 266 thousand acres, representing 21.2%, and the amount of production amounting to 742 thousand tons, or 19.7%. Then, Al-Bahira governorate has an area of 192 thousand acres, at a rate of 15.3%, with a production amount of 511 thousand tons, at a rate of 13.5%. Al-Gharbia comes with an area of 100 thousand acres, 7.9%, a production amount of 342 thousand tons, at 9.1%, and finally Damietta, 53 thousand acres, 4.2%, with a production amount of 167,000 tons, at a rate of 4.4%.



	2019/2018	2017/2016	2015/2016	2014/2015	2013/2014	2012/2013	2011/2012	2010/2011	2009/2010	2008/2009	2007/2008	2006/2007
Production in Million Tons	4,8	5	5,3	4,8	5,5	5,7	5,9	5,7	4,3	5,5	7,3	6,9
Cropping Area	1,3	0,9	1,3	1,4	1,2	1,4	1,4	1,5	1,4	1,1	1,4	1,8

Figure 1: Rice annual Production Amount and Cropping Area
Source: Egyptian Statistical Authority[31]

[31] https://www.capmas.gov.eg/

Table 1: Average productivity of rice in major Egyptian Cities 2019

Item	Average quantity (Ton / Acre)		Rice straw (Tons)	Barley rice (Tons)	Cultivated area with rice
Governorates	Rice straw	Barley Rice			Acre
Damietta	1.65	3.18	86590	167064	52613
Dakahlia	1.89	3.1	697970	1143287	368756
Sharkia	1.59	3.13	441430	867976	277658
Kafr Al sheikh	1.56	2.79	413492	741713	265903
Gharbia	1.64	3.43	163107	341931	99588
Behera	1.39	2.66	267127	510665	192147
Total	**1.65**	**3.0**	**2069716**	**3772636**	**1256665**

Source: Egyptian Statistical Authority[32]

2.1 million tons of rice straw produced in 2019, with a productivity of 1.65 tons of straw/Acre, was planted with rice. 43.9 thousand tons of straw were burned out of the total amount of straw produced, cultivated area with rice and Average quantity rice straw per ton as shown in Table 2 .

3.2 Egyptian Disposition Practices

Disposition style rice straw is crucial topic attract attention from Egyptian Government Table 2 shows the main practices by Egyptian Farmers The percentage of farmers who used straw as animal feed reached 65.9% of the total number of farmers and given what the state has done in the form of the Ministry of Environment to spread awareness among farmers the importance of making use of rice straw by using it in many fields to obtain a reasonable return.

Table2: Distribution disposal methods of rice straw in major Egyptian Cities 2019

Item	Disposition style rice straw				
Governorates	Burning oven	Burning	Converted to animal feed	Selling	Buried in the land
Damietta	0	0	3075	3123	0
Dakahlia	969	9509	104422	12809	0
Sharkia	3853	483	33451	29703	370
Kafr Al sheikh	1486	122	28709	39883	1410
Gharbia	812	2772	8094	37844	0
Behera	208	0	7583	24145	0
Total	**7327**	**12886**	**185333**	**147507**	**1780**

Source: Egyptian Statistical Authority[33]

[32] https://www.capmas.gov.eg/
[33] https://www.capmas.gov.eg/

The percentage of farmers who sold straw reached 23.4%. As for burning straw, it was followed by two types of farmers, one of whom burns it in the home oven and reached 5.1%. as for the other one, he started and started burning straw on the ground, and their rate was (0.5%), which is negligible, because the farmers were aware of the possibility of selling and benefiting from it. The percentage of Gharbia Governorate farmers who burned was 54.9%, while the farmers of Kafr El- Sheikh Governorate accounted for 30.5% of the total farmers who did by burning. It became clear that 12.5% of the farmers had disposed of straw by placing it under a mattress under livestock. As for the method of disposing of straw by (burying the land), it reached 0.2% of the total, because the farmers who bury straw on the ground are the area. Rice planted with a small rice planting area.

3.3 Government Initiatives

Government of Egypt is pursuing a strategy plan aiming to achieve a contribution of renewable energies by 20% of the total electricity generation by the year 2030, and to diversify its energy source through the development of new and renewable energy resources. Egypt has a good potential for biomass resources but very limited work has been done to quantify this potential for power generation. The main sources of biomass waste in Egypt are agricultural waste (crop residues), followed by municipal solid waste, animal waste, and sewage waste.

4 Conclusion and future research

Improving the value chain of rice straw byproducts and implementing sustainable straw business practices are the key to persuading farmers not to engage in open-field burning and avoiding the resulting negative environmental and health impacts. Rice straw incorporation into the soil is an option; however, it must be carefully required to ensure timely degradation and minimize GHGE emissions. The stash of rice straw with balers plays a crucial role in its sustainable utilization. In the remaining chapters of the book, alternative straw management options such as straw-based mushroom and feed production, mechanized composting to produce organic fertilizer, etc. are debated. This study focuses on the scalable options that will increase the economic value of Egyptian rice production. Information that has been reviewed and updated, as well as scientific evidence regarding the sustainable operations of rice straw, will be useful for future improvements and relevant

regulations. How rice straw can be used to produce biofuel and high-end materials such as bioplastics, bio fibers, and silica could be the subject of another publication.

It is crucial to consider whether burning straw should keep going or whether it should be converted into a variety of valuable products. In addition to providing sustainable solutions for managing large quantities of straw, the technologies discussed above have the potential to improve the socio – economic status of farmers. The most important requirement is the full participation of the federal and state governments in the development of schematics detailing how cleaner technologies can be implemented at the root level for the proper management of biomass. Despite the progress of using rice straw Study show there still gap of local practices and lack of awareness of agriculture's uses potentials to fully exploitation of rice straw and husks.

References

Abdelaal, H. S. A., & Thilmany, D. (2019). Grains production prospects and long run food security in Egypt. *Sustainability*, *11*(16). https://doi.org/10.3390/su11164457

Abdelhady, S., Borello, D., Shaban, A., & Rispoli, F. (2014). Viability study of biomass power plant fired with rice straw in Egypt. *Energy Procedia*, *61(2014)*, 211–215. https://doi.org/10.1016/j.egypro.2014.11.1072

Arai, H., Hosen, Y., Pham Hong, V. N., Thi, N. T., Huu, C. N., & Inubushi, K. (2015). Greenhouse gas emissions from rice straw burning and straw-mushroom cultivation in a triple rice cropping system in the Mekong Delta. *Soil Science and Plant Nutrition*, *61*(4), 719–735. https://doi.org/10.1080/00380768.2015.1041862

Bassyouni, M., & Waheed Ul Hasan, S. (2015). The use of rice straw and husk fibers as reinforcements in composites. In *Biofiber Reinforcements in Composite Materials*. 385–422. Elsevier Inc. https://doi.org/10.1533/9781782421276.4.385

Biswas B, Pandey N, Bisht Y, Singh R, Kumar J, Bhaskar T. (2017) Pyrolysis of agricultural biomass residues: comparative study of corn cob, wheat straw, rice straw, and rice husk. Bioresour Technol 237:57–63

Balat, M. , (2011). Production of bioethanol from lignocellulosic materials via the biochemical pathway: a review. Energy Convers. Manag. 52, 858–875 .

Bhattacharyya, P., Bisen, J., Bhaduri, D., Priyadarsini, S., Munda, S., Chakraborti, M., Adak, T., Panneerselvam, P., Mukherjee, A. K., Swain, S. L., Dash, P. K., Padhy, S. R., Nayak, A. K., Pathak, H., Arora, S., & Nimbrayan, P. (2021). Turn the wheel from waste to wealth: Economic and environmental gain of sustainable rice straw management practices over field burning in reference to India. *Science of the Total Environment*, 775(2021), 145896. https://doi.org/10.1016/j.scitotenv.2021.

Conrad, R. (2007). Microbial Ecology of Methanogens and Methanotrophs. In *Advances in Agronomy*. 96, 1–63. https://doi.org/10.1016/S0065-2113(07).

El Dewany, C., Awad, F., & Zaghloul, A. M. (2018). Utilization of Rice Straw as a Low-Cost Natural By-Product in Agriculture. Int. J. of Environmental Pollution & Environmental Modelling, 11(16), 4457.

Elbasiouny, H., & Elbehiry, F. (2020). Rice Production in Egypt: The Challenges of Climate Change and Water Deficiency. In *Springer Water*. 96, 295–319. Springer Nature. https://doi.org/10.1007/978-3-030-41629-4_14

Ghorbani, M., Asadi, H., & Abrishamkesh, S. (2019). Effects of rice husk biochar on selected soil properties and nitrate leaching in loamy sand and clay soil. *International Soil and Water Conservation Research*, 7(3), 258–265. https://doi.org/10.1016/j.iswcr.2019.05.005

Goodman, B. A. (2020). Utilization of waste straw and husks from rice production: A review. In *Journal of Bioresources and Bioproducts*. 5(3), 143–162. KeAi Communications Co. https://doi.org/10.1016/j.jobab.2020.07.001

Gummert, M., Nguyen, ·, Hung, V., Chivenge, P., & Douthwaite, B. (2020). *Sustainable Rice Straw Management*. Springer.

Jeffery, S., Verheijen, F.G., van der Velde, M., Bastos, A.C., (2011). A quantitative review of the effects of biochar application to soils on crop productivity using meta-analysis. Agric. Ecosystem. Environ. 144 (1), 175–187.

Jiang, Y., Qian, H., Huang, S., Zhang, X., Wang, L., Zhang, L., Shen, M., Xiao, X., Chen, F., Zhang, H., Lu, C., Li, C., Zhang, J., Deng, A., Jan van Groenigen, K., & Zhang, W. (2019). Acclimation of methane emissions from rice paddy fields to straw addition. *Science Advances*, *5*(1), 1–9. http://advances.sciencemag.org/

Jiang, T. Y., Jiang, J., Xu, R. K., & Li, Z. (2012). Adsorption of Pb (II) on variable charge soils amended with rice-straw derived biochar. *Chemosphere*, 89(3), 249–256. https://doi.org/10.1016/j.chemosphere.

Li, H., Liu, Y., Chen, Y., Wang, S., Wang, M., Xie, T., & Wang, G. (2016). Biochar amendment immobilizes lead in rice paddy soils and reduces its phytoavailability. *Scientific Reports*, 6(1). https://doi.org/10.1038/srep31616

Li, Z., Unzué-Belmonte, D., Cornelis, J. T., Linden, C. vander, Struyf, E., Ronsse, F., & Delvaux, B. (2019). Effects of phytolithic rice-straw biochar, soil buffering capacity and pH on silicon bioavailability. *Plant and Soil*, 438(2019), 187–203. https://doi.org/10.1007/s11104-019-04013-0

Liu, C., Lu, M., Cui, J., Li, B., & Fang, C. (2014). Effects of straw carbon input on carbon dynamics in agricultural soils: A meta-analysis. *Global Change Biology*, 20(5), 1366–1381. https://doi.org/10.1111/gcb.12517

Maiti, S. , Dey, S. , Purakayastha, S. , Ghosh, B. , (2006). Physical and thermochemical characterization of rice husk char as a potential biomass energy source. Bioresour. Technol. 97, 2065–2070.

Manya, J.J., (2012). Pyrolysis for biochar purposes: A review to establish current knowledge gapsand research needs. Environ. Sci. Technol. 46, 7939−7954.

Pineda, A. , Lee, A. , (2016). Heterogeneously catalyzed lignin depoly merization. Appl. Petrochem. Res. 6, 243–256 .

Quispe, I. , Navia, R. , Kahhat, R. , (2017). Energy potential from rice husk through direct combustion and fast pyrolysis: a review. Waste Manag. 59, 200–210.

Rambo, M. K. D., Cardoso, A. L., Bevilaqua, D. B., Rizzetti, T. M., Ramos, L. A., Korndörfer, G. H., & Martins, A. F. (2011). Silica from rice Husk Ash as an additive for rice plant. *Journal of Agronomy*, 10(3), 99–104. https://doi.org/10.3923/JA.2011.99.104

Ray, D. K., Ramankutty, N., Mueller, N. D., West, P. C., & Foley, J. A. (2012). Recent patterns of crop yield growth and stagnation. *Nature Communications*, 3(1). https://doi.org/10.1038/ncomms2296

Sander, B. O., Samson, M., & Buresh, R. J. (2014). Methane and nitrous oxide emissions from flooded rice fields as affected by water and straw management between rice crops. *Geoderma*, 235–236(2014), 355–362. https://doi.org/10.1016/j.geoderma.2014.07.020

Singh, G., Gupta, M. K., Chaurasiya, S., Sharma, V. S., & Pimenov, D. Y. (2021). Rice straw burning: a review on its global prevalence and the sustainable alternatives for its effective mitigation. In *Environmental Science and Pollution Research*, 28(25), 32125–32155. Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s11356-021-14163-3

Sui, F., Wang, J., Zuo, J., Joseph, S., Munroe, P., Drosos, M., Li, L., & Pan, G. (2020). Effect of amendment of biochar supplemented with Si on Cd mobility and rice uptake over three rice growing seasons in an acidic Cd-tainted paddy from central South China. *Science of the Total Environment*, 709, 136101. https://doi.org/10.1016/j.scitotenv.2019.136101

Wu, H.C. , Ku, Y. , Tsai, H.H. , Kuo, Y.L. , Tseng, Y.H. , 2015. Rice husk as solid fuel for chemical looping combustion in an annular dual-tube moving bed reactor. Chem. Eng. J. 280, 82–89.

Xiang, L., et al., (2020). Effects of rice straw biochar on sorption and desorption of di-n-butyl phthalate in different soil particle-size fractions. Sci. Total. Environ. doi.org/10.1016/j.scitotenv.2019.134878.

Yahaya, D.B. , Ibrahim, T.G. , (2012). Development of rice husk briquettes for use as fuel. Res. J. Eng. Appl. Sci. 1, 130–133.

Impact of Digital Technology and Smart Systems on Mobility and Agriculture in Serbia

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Abstract As mobile device location data becomes more available, new analyzes reveal significant changes in the way you navigate when an unplanned event occurs. With different control policies from local and state governments, the outbreak of Covid-19 has dramatically changed travel behaviour. In particular, the necessity of fundamental changes in certain sectors was noted, some of which are mobility and agriculture. Not only the pandemic, but also urbanization, climate changes, ecology and especially the ongoing War in Europe, marked these two categories as very important and connected, crucial for future survival in unpredictable new circumstances. Examples of agriculture in the Netherlands and Serbia were analyzed, as a possibility for the application and implementation of new solutions. The concept of precision agriculture, connecting new technologies and a traditional branch of the economy such as agriculture, enables functioning even in extreme conditions, such as limited movement during the pandemic and locking.

Keywords: mobility, precision agriculture, technology, smart systems, Serbia

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1 Introduction

For most of the 20th century, it was believed that increased traffic safety was achieved by separating vehicles from other road users. In order to apply the principle of common space, streets must be specially planned and equipped for slower traffic. In the new circumstances, it is necessary to predict movement and logistics for specific conditions, such as the pandemic. This requires the application of various project solutions, before various researches had carried out. The negative impacts of today's traffic, is a growing initiative for change in terms of improvement. There is a global need for implementation new ideas and systems that would change the negative impact of traffic in the future (Cvitković *et al.* 2021). Smart technologies and systems have proven as the most adequate and universal solution for all conditions.

During the first wave of the pandemic, mobility decreased sharply across Europe. The effect was stronger in countries with stricter lockdown policies, while countries with politically oriented or partial lockdowns also significantly reduced mobility. Until now the Covid-19 pandemic had an unprecedented impact on traffic in general, but also on the sector as a whole, the consequences of which are felt in the reduced number of passengers, and therefore also in the financial consequences. As mobile device location data become more available, new analyzes reveal significant changes in the way you navigate when an unplanned event occurs.

With different control policies of local and national authorities, the outbreak of Covid-19 has dramatically changed the movement behavior in the affected cities. Many countries have closed their borders and imposed curfews in a sharp reduction in transport demand both regionally and continentally. Different countries have dealt with these challenging circumstances in different ways – and, in some cases, directives differ from city to city. Cities in developing countries and emerging economies face greater challenges than ever before. At the beginning of the Corona virus (Covid-19) pandemic, Google and Apple started collecting detailed statistics about people's movements using location data from mobile devices. The paper analyzed the data obtained for different areas of movement such as shops, recreation areas, parks, public transport, etc.

Also, as these digital data were very important in the coordination of the crisis, so also a very important sector such as agriculture had to be adapted to the new circumstances. In conditions of lack of food due to global challenges such as the pandemic, energy crisis, wars, digitalization of agriculture and the use of smart technologies and solutions, they are inevitable. The example of agriculture of Netherlands, as one of the leaders in this field, turns out to be useful for a country like Serbia, which has a huge natural potential.

2 Using Digital Technologies in Order to Obtain Mobility Data During the Pandemic

The Coronavirus pandemic has a significant impact on countries around the world and many countries have imposed restrictions on transportation. Different countries have dealt with these challenging circumstances in different ways, in some cases, directives differ from city to city. How effective these guidelines have been in reducing people's movement can be seen from the data Google presents in its Covid-19 mobility reports. Using anonymized data provided by apps like Google Maps, the company created a regularly updated dataset that shows how people's movements have changed during the pandemic (Badr *et al.* 2020).

This mobility data can provide useful insights to local governments and health authorities, and colud be used as a basis for new public policies by showing the change in the extent of mobility of people in their communities.

We can learn about this from the data that Google presents in the report on community mobility. The United Nations and other organizations source and categorize data into the following categories: social distancing, movement restrictions, public health measures, social and economic measures, and blockades (Lapatinas 2020).

Table 1: Policy measures considered in the analysis

Category	Measure	Description
Social distancing	Limit public gatherings	Cancelation of public events. Limit to the number of people that can meet in public and private spaces.
	Public services closure	Public services and facilities are closing access to the public. In some countries, services are available online.
	Changes in prison policies	Change in policies around prisons to mitigate the spread of the disease. This may include early release but also suspension of day-release programs, suspension of visits etc.
	Schools closure	Authorities have closed schools.
Lockdown	Partial lockdown	Partial lockdown includes: 1. The population cannot leave their houses apart for specific reasons that they have to communicate to the authorities. 2. All stores that are not related to alimentation or pharmacies are not open.
	Full lockdown	Full lockdown includes: 1. The population cannot leave their houses apart for specific reasons that they have to communicate to the authorities. 2. All non-essential services closed and production stops.
	Lockdown of refugee camps	Limitations to the population living in camps and/or camp like conditions.

Source: (Cvitković *et al.* 2021).

Google has published reports on community mobility that show trends in movement by region, in different categories of places. For each category in the region, the reports show changes in two different ways. Compares the mobility for the report date with the base day. Calculated for the report date and displayed as a positive or negative percentage. The reports show trends over time by geography, in various place categories such as retail and recreation, grocery and pharmacy, parks, transit stations, workplaces and residential.

Table 2: Description of mobility reports categories

Category	Description	Data Source
Retail and recreation	Restaurants, cafes, shopping centres, theme parks, museums, libraries, and movie theatres.	Google
Grocery and pharmacy	Grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies.	Google
Parks	National parks, public beaches, marinas, dog parks, plazas, and public gardens.	Google
Transit stations	Public transport hubs such as subway, bus, and train stations.	Google
Workplace	Places of work.	Google
Residential	Places of residence.	Google

Source: (Cvitković *et al.* 2021).

Using anonymous data provided by apps like Google Maps, the company has created a regularly updated dataset that shows how people's movements have changed during the pandemic. This data set measures the number of visitors to specific categories of sites on a daily basis and compares this change to the initial day before the outbreak.

2.1 The impact of the Covid-19 pandemic on changing mobility

People increase their activity at home and reduce their mobility at workplaces in the first months. The results confirm the assumption and show that, in the early phase of the pandemic, workers in the subsectors reduce their activities at workplaces and increase their activities at home when the number of new daily cases increases. This suggests that people tend to increase their activities at home and decrease their activities at the workplace. Until the pandemic, home jobs were generally considered a non-standard, flexible work arrangement, where the workplace was the employer's place. Of course, during the pandemic, employees worked from home out of necessity rather than choice, and the formalized flexible working regime fell somewhat. Many employers are also considering long-term downsizing of office space and moving to hybrid working, allowing employees to split their time between working from home and working in the office.

The analysis suggests that the blockade has the strongest causal influence on increasing presence at home and decreasing visits to workplaces, public transport hubs, groceries, pharmacies, open public spaces. The impact of closing public services and closing schools is significant, but on a smaller scale. The results show that the most effective COVID-19 policies to reduce mobility are closure of public services and facilities, partial closure and full closure.

3 The necessity of change as a consequence and introduction of smart systems

A clearly visible side effect of the Covid-19 pandemic is a reduced need for daily mobility. This can mainly be attributed to the expansion of telecommuting, the movement restrictions that have been imposed in countries and the decreasing sense of safety in public transport. Long-term changes to telecommuting or virtual mobility might be result in time changes, including less frequent travel. Improving

cycling and walking accessibility could improve traffic safety, health and the environment. During the pandemic, many cities began to expand existing cycling and pedestrian infrastructure, first as temporary solutions, to gradually, wherever possible, make them permanent. Continuing the trend, many regulators will focus on environmental issues when adopting mobility guidelines. Urban mobility and, in particular, its management are undergoing a period of profound change to enable sustainable mobility in small and large cities. After the COVID-19 pandemic, we appreciated living with better air quality and less noise. Movement restrictions have shown us the extent to which streets and public spaces in our neighborhood are essential to community cohesion. By suddenly entering the »new normal« we learned the hard way that behavioral change at the community and individual level can happen at a much faster pace than we thought. According to Kotler and Bloom (1984) intangibility was defined as everything that cannot be seen, tasted, heard or smelled (Vujić, et al., 2020), so sometimes we don't see all the hidden changes. The environment is exposed to the negative impact of business activities, which is reflected in extensive exploitation of natural resources and pollution of nature.
Based on this research, it was determined that drastic changes in mobility during the pandemic affect various spheres of life and economy, including agriculture. The concept of smart agriculture is already being applied in Serbia, but after the pandemic and changes in mobility, the need for the concept was seen as inevitable.

3.1 Smart traffic

Smart traffic and smart mobility are two intertwined concepts, and they are unthinkable without each other, because mobility is a service, and the biggest service and need today is traffic. By applying smart technologies and smart solutions, traffic is regulated, which affects the reduction of costs and the increased satisfaction of passengers, pedestrians, or drivers. All IoT solutions are based on the application of smart and environmentally sound cars, and their connection to traffic infrastructure and infrastructure facilities such as gas stations, parking lots. Apart from communication, more modern solutions of IoT technology lead us to communication between vehicles, with each other (Inić 1997).

One of the services and smart solutions of modern technologies is the monitoring of traffic at a given moment (in real time), and these are vehicle navigation systems, as well as systems for locating cars, enabling the provision of information on the distance from other traffic participants, information on the current state of the car, as well as the condition of the roads and potential accidents on the roads.

Smart traffic consists of:

- Smart vehicles;
- Smart infrastructure (Stojkov & Resanović 2016).

3.2 Smart agriculture

In London, the sewage network had done only after the cholera pandemic in 1850, perhaps now is the time to adopt the best technology and infrastructure for smart cities and villages. The digital revolution is underway and agriculture has not been bypassed. On the contrary, new technologies have also found application in agriculture. Integrations between agriculture and new technologies, mainly from the IT industry and others, are called by one name – smart agriculture (Faculty of Agriculture 2022).

Earth observation by remote sensing (EO) is the interpretation and understanding of measurements made by airborne or satellite instruments of EMR that is reflected or emitted by objects on the Earth's surface, ocean or ice surface, or in the atmosphere, together with establishing the relationship between these measurements and the nature and distribution of the phenomenon on surface of the Earth or in the atmosphere (Mather 1999). In this way, we can use the recordings for various purposes of the functioning of villages and cities, as shown in the previous example of tracking via google mobility during the pandemic.

Today, around 70% of the world's population lives in cities, and that percentage will probably increase more and more, so it is necessary to use all agricultural potentials to ensure enough land, food, meat, fruit and vegetables, etc. (Figure 1). For this reason, we should invest in agriculture, help the rural population, and protect water and the environment, in order to ensure the healthiest and highest quality products. In Serbia, modern agricultural production that also takes care of environmental

protection has become the present. ICT provide precise mechanization and an Internet network in which machines, objects, people and animals are networked, as well as data analysis collected by drones and robots. The biggest problem for farmers in Serbia is how to bridge the gap between traditional farmers and scientists, how to use all the technical devices and technological possibilities of today? The Government of the Republic of Serbia and the Ministry of Agriculture often organize various forums, seminars, conferences in order to attract young people not to leave the village but to advance in agricultural activities. The future of agrarians is family farms equipped in a technical and technological sense, and united in cooperatives (Kostić 2005).

Availability of land resources per inhabitant in the time domain, Bruinsma, J. 2009.

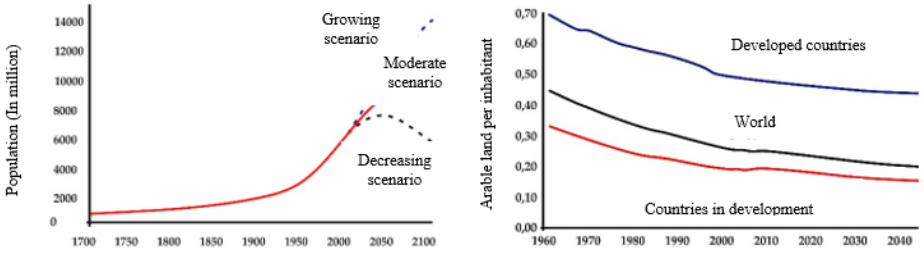

Figure 1: Human population growth with forecast of further trend, Ganivet E. 2019.
Source: (Kostić, 2021)

4 Serbia's potential for smart agriculture

Rural areas are riched by ecosystems and biodiversity, natural rarities, various activities, cultural and historical heritage (Borović et al., 2022). Serbia is a country with a diverse geographical structure: varied relief, pleasant climate, wealth of natural resources, fertile plains in the north, hilly and mountainous area south of the Sava and Danube, the Pester plateau. All these factors tell us that Serbia is a country with great agricultural potential. The types of land in Serbia are numerous, with huge areas that are not fully utilized, or uncultivable. More than a million hectares of Vojvodina are chernozem, while in the southern regions there is a lot of uncultivable land that can be used for organic agriculture, because organic fruits, medicinal herbs, and vines thrive even on poor quality land. Serbia also had potential for traditional agriculture, but the performance can be many times better and greater when agriculture is also

modernized and digitized, so that in the future it can be one of the leading countries in Europe in the agricultural and food industry (Ristić, Barbarić, 2019).

The process of modernization of agriculture is represented, in the north smart farming, and in the south smart animal husbandry and smart farms. The state must build the entire chain, from the first step and tilling the land, to the processing and production of finished products. One link in the chain has stopped, Serbia exports wheat, corn and other basic products of agricultural production, but imports finished agricultural products. This is a characteristic of poorer countries, they are rich in natural resources, but the processing industry has »failed«.

4.1 Necessity in using smart systems and mobility in agriculture in Serbia

4.1.1 A positive example of the Netherlands

The best example for farmers should be the Netherlands and it's agriculture. Compared to that relatively small country, Serbia has 3 times more arable land and 76% more available fresh water. However, on our fertile land, the income is 3t of grain from one hectare, and farmers from the Netherlands, as much as 8.5t from one hectare. In addition, they have developed the entire chain of the food industry, from seeds, through processing to the finished product, so the Netherlands is the second country in the world in terms of food exports, right after the USA. The government of the Netherlands invests a huge amount of money in projects it calls »sustainable, smart and circular agriculture« In the absence of fertile land, the Government of Netherlands is dried a part of the sea, cultivated that land and made it fertile (Kostić, 2005).

Farmers use sensors, drones, and farmers use drones and robots, and in all sectors, from cultivation to processing and packaging of finished products, they use automated processes. Because of these smart and sustainable solutions, the Netherlands is a leader in efficient and sustainable agriculture in the world, even though it has limited natural resources (Figure 3). With the introduction of IoT technology, smart and innovative solutions, modern sensors are available for farmers to use. This system helps us get real-time data and make the right decisions. With the help of sensors and IoT technology, farmers monitor the water level in the reservoirs, thus increasing the efficiency of water supply, i.e. irrigation. Using sensors

and smart technology, farmers monitor the growth of seeds, that is, they measure the consumption of resources and the time it takes for the seed to grow into a plant ready for processing or picking. By applying modern techniques, the yields are many times higher, less labor is required, a great saving of time, and almost no losses from drought or floods, because systems against droughts, i.e. protection against floods and natural disasters, were created (Polovina, Kostovski, Popadić, Milijašević, 2019).

5 Precision agriculture

There is no clear difference in the interpretation of the concept, as synonyms such as site-specific farming; smart farming and digital farming appear. On the official website of the University of Lleida, researchers from the AgroTIC department gave 27 different interpretations of the term precision agriculture (Lleida University, 2018). It is not clear what is meant by the term precision agriculture technology (Kostić, 2021). Precision agriculture is anything that makes the farming process precise (accurate and controlled) when it comes to raising livestock and crops and growing crops. One of the most famous and important applications of IoT in agriculture is precision agriculture (another name is satellite agriculture). The goal of precision agriculture is to analyze the data obtained by sensors, and react based on them, i.e. make intelligent and faster decisions, as well as monitoring the operation of machines and quality analysis of samples. This makes farming precise and controlled. The concept of precision agriculture enables many times higher yields, using fewer resources, on a smaller area. The advantages of modern technology are that things can be managed remotely; farmers or farmers do not have to be physically present. In this way, greater efficiency and precision are achieved, while reducing costs, money and time (Kostić, 2014).

Smart technologies and sensors provide information about weather conditions, pests, soil quality. Modern agriculture takes place with the help of artificial intelligence, smart IoT sensors and robotics, and the aim is to show how technology can make agriculture and industry more efficient and productive.

5.1 Agricultural drones

An agricultural drone is an unmanned aerial vehicle that has multiple purposes and functions:

- Yield optimization;
- Irrigation efficiency;
- Pest and disease control;
- Cattle control.

With the combination of IoT technology and drones, great progress can be made in the agricultural sector. Using drones, precise 3D maps can be placed when planting seeds and crops. Such drones recognize parts of the land that are dry or require fertilizer.

The advantages of using drones: until now, there was no machine that performed functions like drones. Tractors with tanks were used for guidance, mostly human resources for monitoring.

- Speed. Spraying soil is 50 times faster with a drone than the traditional way.
- Savings. During spraying or irrigation, 90% of water and about 40% of pesticides are saved.
- It also saves crops, because the drone flies above the crops, it does not trample the crops like a tractor.
- Security. The drone does pollination, no one has contact with chemicals-pesticides and
- herbicides (Kostić, 2014).

5.2 A smart farm

The Internet of Things (IoT) in animal husbandry also has a large application; it is used to monitor the movement and health of animals. Also, smart technology allows insight into the complete supply chain of hay, water and nutritional supplements, from the entry of feed into the warehouse until the moment the cows eat the feed. IoT devices are placed in the collar and monitor the movement of the animal, as well

as its advertising, the animal's activity is also measured. The animal's collar contains sensors that measure temperature, pressure, physical activity, heart rate, need for food or water (Zoranović, Bajkin, Vujić, 2009).
Based on that data, classifications are made among them, they are sorted by categories, and their medical condition is monitored. With the help of IoT technologies, a sick animal is identified, separated from the herd and treated. The goals of smart farms are: increasing milk and the quality of milk products, reducing the volume of labor, identifying livestock diseases, providing healthy food and correct water.

Modernization of farms has started in Serbia, we have several examples on the Pešter Plateau, where family farms have technically and technologically improved their stables and farms, we have a case of milking cows using robots. The Milka robot, which is the only one in Serbia, milks 6 cows at the same time, squeezes the milk and directly delivers the milk in a tanker ready for sale. After milking the cows, the robot goes around the stalls where the cows are housed and distributes food to them, based on their needs (Kostić, 2014).

6 Disadvantages of the implementation of smart agriculture in serbia

A rural area could be defined as „an environment with a small population concentration, whose main occupation is agriculture, characterized by a special way of life, work, customs and village identity. According to the traditional approach, rural areas in Serbia include 70% of the total territory with 43% of the total population, and according to the OECD definition, rural areas include 85% of the territory and 55.5% of the population with an average population of 63 inhabitants per km^2“ (Cvijanović, et al., 2009). Agriculture in the Republic of Serbia, in addition to the great age of farm owners, is also affected by the fact of a very low level of education, where generally only 6% have higher education, and even 49% without any formal education.

A prerequisite for transitioning to modern technology is understanding the effects of application, which requires basic knowledge of natural and technical sciences. All of the above is largely absent and it is realistic to expect that, if there is no insistence

on the education of farmers, it is questionable how quickly the agricultural practices of Serbia will adapt to current trends.

7 Conclusion

The rapid advancement of technology in the field of agricultural production is significant, because the need for food is increasing day by day. Due to this rapid progress of technology and technique, in the future, a staff will be needed who will know how to manage and maintain the technique and technology of agriculture (Faculty of Agriculture, 2022). Among the priorities, it is necessary to include a new methodology of development, based on local subjects while using the advantages offered by the given region. Novaology improves and ennobles the environment, promotes development and gives new chances for young people who are leaving. Considering that there is little research that deals with this relatively new topic for the needs of regional development, a number of new researches should be conducted and a special dimension should be given to the development of specific regions.

As in other sectors, agricultural producers inevitably turn to technological achievements in order to produce more profitably. Due to the high investment prices of smart agriculture and the problems that Serbia has in the purchase prices of products and the departure of young people from the countryside, there are still no significant investments in the development of new systems. There is a global tendency to apply the most modern technology, ICT systems, then the systematization of agronomy knowledge, but the fact is ignored that farmers are a population of people who, by tradition, in all countries of the world have the lowest level of education (Kostić, 2021).

The necessity of multidisciplinarity is recognized, which is lacking in scientific circles as a result of individualism and specialization in only one field. Also, the spread of the COVID-19 virus pandemic changed perceptions and movements and highlighted the previous thesis of abandoning individualism. Social distancing and lockdowns have affected mobility globally. The necessity of using digital tools, artificial intelligence (Sridhar, et al., 2022), in general precise, smart agriculture as a platform to overcome the crisis of modern challenges, from pandemics, wars to climate change and lack of food on the planet, has been established.

References

Badr, H. S., Du, H., Marshall, M., Dong, E., Squire, M. M., & Gardner, L. M. (2020). Association between mobility patterns and COVID-19 transmission in the USA: a mathematical modelling study. *The Lancet Infectious Diseases*, *20*(11), pp. 1247-1254.

Bruinsma, J. (2009). The resource outlook to 2050: by how much do land, water and crop yields need to increase by 2050?. In *How to feed the World in 2050. Proceedings of a technical meeting of experts, Rome, Italy, 24-26 June 2009* (pp. 1-33). Food and Agriculture Organization of the United Nations (FAO).

Cvijanović, D., Katić, B., & Kljajić, N. (2009). Rural development in Serbia – regional dissimilarities and problems. *The economic and social conditions of the develepoment of the Polish food economy following Poland's accession to the European Union-Multi-Annual Programme* 2005, 128, 107-120.

Cvijanović, D., Sekulić, D. & Pavlović, D. (2018) Are green hotels suitable for the development of entrepreneurship in tourism?, *Ekonomika preduzeća*, 66(7-8), pp. 424-432. doi:10.5937/EKOPRE1808424C .

Cvitković, I., Stojanović, K., & Lukačić, K. (2021). »The effect on Mobility trend during the pandemic«, 8th International Conference "Towards a Humane City"- New Mobility Challenges, Faculty of Technical Sciences, Novi Sad.

Cvitković, I., Vilke, S., Krpan, L., & Brlek, P. (2022). Removing regulatory features of traffic control in school zones. *Transportation research procedia*, *60*, pp. 228-234.

Ganivet, E. (2020). Growth in human population and consumption both need to be addressed to reach an ecologically sustainable future. *Environment, Development and Sustainability*, *22*(6), pp. 4979-4998.

Inić, M. (1997): *Bezbednost drumskog saobraćaja*. Novi Sad: FTN.

Kostić, M. (2015): *Razvoj mernog sistema za poziciono merenje mehaničkog otpora zemljišta*. Novi Sad: Poljoprivredni fakultet.

Kostić, M. (2021): *Precizna poljoprivreda*. Novi Sad: Poljoprivredni fakultet.

Kotler, P., & Bloom, P. (1984). Marketing professional services. Englewood Cliffs:

Lapatinas, A. (2020). *The effect of COVID-19 confinement policies on community mobility trends in the EU* (p. 5). Luxembourg: Publications Office of the European Union.

Lleida University. 2018. Principal precision agriculture definitions retrieved from the scientific literature and from the web. http://www.grap.udl.cat/en/presentation/pa_definitions.html

Mather, P. (1999). *Computer Processing of Remotely-Sensed Images*. Nottingham: University of Nottingham.

Poljoprivredni fakultet. (2022). *INBIN: Šta je to pametna poljoprivreda?* [WWW] <URL: https://poljoprivrednifakultet.rs/inbin-sta-je-to-pametna-poljoprivreda/ [Accessed 17 September 2022.]

Polovina, Đ. , Kostovski, A. , Popadić, I. , Milijašević, I. (2019). *Koncept industrije 4.0 u oblasti poljoprivrede – Poljoprivreda 4.0*. Novi Sad: Poljoprivredni fakultet.

Prentice Hall.

Ristić, L., Barbarić, Ž. (2019): *Pametna sela – budućnost održivog ruralnog razvoja*. Kragujevac: Ekonomski fakultet.

Sridhar, A., Balakrishnan, A., Jacob, M. M., Sillanpää, M., and Dayanandan, N. (2022). Global impact of COVID-19 on agriculture: role of sustainable agriculture and digital farming. *Environmental Science and Pollution Research*, pp. 1-17.

Stojkov, B., Resanović, M. (2016). *Pametan grad u Srbiji – mogućnost sistematske implementacije*. Beograd: Akademija inženjerskih nauka Srbije.

Vujić, M., Sekulić, D. & Cvijanović, D. (2020) The importance of intangible elements in the assessment of service quality in hotels in Kolubara District, *Menadžment u hotelijerstvu i turizmu*, 8(2), pp. 43-52. doi:10.5937/menhottur2002043V.

Zoranović, M., Bajkin, A, Vujić, Ž. (2009): *Konvencionalni i razvojni tretmani otpadne vode u stočarstvu*. Novi Sad: Poljoprivredni fakultet.

AGRICULTURE 4.0 APPLICATIONS IN SUPPLY CHAIN MANAGEMENT FOR FOOD SAFETY– A STRUCTURED LITERATURE REVIEW

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Abstract The purpose of this paper is to is to examine how Industry 4.0 applications can be used in agricultural context in order to create more efficient food safety operations in supply chain management, leading towards the Agriculture 4.0 era. The Industry 4.0 trend is transforming the production capabilities of all industries as companies try to keep pace with the era of globalization and aiming to obtain a competitive advantage on the market as they benefit from technological advancements and this also applies to the agricultural sector. As the world's population is increasing, the importance of the food safety is more important than ever. As a result technological development is a necessity especially in light of the length and complexity of the global supply chains. This paper provides a structured literature review of related papers, examining the various applications and opportunities created by the Industry 4.0 in the agricultural sector, and aims to show how the use of technology in agricultural supply chains has evolved.

Keywords: industry 4.0, agriculture 4.0, supply chain management, food safety, digitalization

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1 Introduction

The fourth industrial revolution which is also called Industry 4.0 and its technological advancements impacted many areas of our life during the last decade. The fourth industrial revolution became a very important topic in many domains such as production, design, sales, inventory, scheduling, quality, engineering, customer service, and many more.

There are several approaches to precisely define its concept. According to Hoffmann and Rütsch (2017) we can talk about industry 4.0 when devices and services are connected to a network and not only people but also machines communicate with each other. The driving force behind this phenomenon is the spread of the Internet and, as a result, the emergence of various cyber-physical systems (CPS), the main task of which is to satisfy the agile and dynamic requirements of production, as well as to improve the efficiency and effectiveness of the entire industry. Industry 4.0 encompasses a range of technologies and related paradigms, including for example radio frequency identification (RFID), enterprise resource planning (ERP), the Internet of Things (IoT), cloud-based manufacturing, and social product development.

According to the literature that the main pillars of Industry 4.0 are digitization, data and continuous connectivity. Regarding the extent of the fourth industrial revolution, different formulations can be read, but overall, companies must face changes that cover the entire company value chain, and even challenges that grow beyond the borders of the company, that cover the supply chain or even the entire supply network, in order to maintain their competitiveness. It requires companies and their employees to introduce state-of-the-art technological systems and procedures, learn new competencies, be open to the new and unknown, and even develop changing business models. Industry 4.0 is therefore a phenomenon that, through a set of technological tools and activities, by exploiting the opportunities provided by digitalization, raises the transparency of processes to a high level and integrates the company's value chain and the supply network, raising customer value creation to a new level.

The purpose of this paper is to is to examine how Industry 4.0 applications can be used in agricultural context in order to create more efficient food safety operations in supply chain management, leading towards the Agriculture 4.0 era.

The Industry 4.0 trend is transforming the production capabilities of all industries, including agriculture. The cornerstone of this transformation is connectivity, and IoT is a key technology that is increasingly part of the agricultural equipment.

As the world's population is increasing, the importance of the food safety is more important than ever. As a result technological development is a necessity especially in light of the length and complexity of the global supply chains.

This paper provides a structured literature review of related papers, examining the various applications and opportunities created by the Industry 4.0 in the agricultural sector, and aims to show how the use of technology in agricultural supply chains has evolved.

2 Industry 4.0 and Agriculture 4.0

Industry 4.0 refers to technological evolution by using automation, intelligent systems and digitalized production (Muhuri, Shukla, & Abraham, 2019). One of the critical challenges which organizations have faced is the ability to respond to demand speedily in light of the increasing volatility. Recently, the competition between companies has increased significantly and rapidly. Because of the clear similarity between products in terms of quality and price in addition to the short life cycle of the product, the companies have become required to focus on managing supply chains and speeding up their operations because of competitive pressures (Christopher, 2016).

The aim of Industry 4.0 is to raise efficiency and productivity to a higher level, as well as to achieve extensive automation of processes. The research of Roblek et al (2016) and Posada et al. (2015) clearly names the five drivers of the revolution: digitization, optimization and production customization; automation and adaptation; human-machine interaction (HMI); value-added services and businesses, as well as automatic data exchange and communication. These functions are not only closely related to Internet technologies and advanced algorithms, but also indicate

that Industry 4.0 is an industrial process of value addition and knowledge management.

According to Zezulka et al. (2016), the whole phenomenon is driven by digitization and the Internet. Its goal is to combine the value-creating activities of a company and the partners working together in the value-creating chain into a large digital system with the help of the Internet and modern tools.

According to Nagy (2019) the concept of Industry 4.0 is a phenomenon that, based on technological tools, through a set of activities, by exploiting the opportunities provided by digitalization, raises the transparency of processes to a high level, integrates the company's value chain and the supply network, raising customer value creation to a new level by making customized and smart products available. According to Nagy (2019), Industry 4.0 includes the need for change organizational changes as well, but still does not discuss the rethinking of the company-wide strategic goals or the business process. Prause and Günter (2019) writings already clearly mention that the constantly changing industry necessitates a change in management thinking, according to which, during Industry 4.0, the line between the independent operations of individual sectors becomes gray, and this makes it increasingly necessary for business transformation of models and structures, this is digital transformation itself.

The emergence of Industry 4.0 provides a number of opportunities for organizations across the world in the current rapidly changing environment as Industry 4.0 can be used to engender a transformation from machine dominant manufacturing to digital manufacturing by bridging the physical industrial assets and digital technologies in cyber-physical systems. One of the main objectives is essentially to enable autonomous decision-making processes, monitor assets and processes in real-time, and enable equally real-time connected value creation networks through early involvement of stakeholders, and vertical and horizontal integration (Wamba & Queiroz, 2022).

Today's digital supply chain networks employ a wide range of technologies to create efficient, transparent, adaptive, and resilient systems at various stages of supply chain development, such as new product development, manufacturing, procurement, planning, logistics, and marketing (Ghadgeet al., 2020).

Enterprises have realized the significance of technological advancements and regard technology as a powerful strategic tool for ensuring long-term performance (Chavarría-Barrientos et al., 2017). Companies must be prepared to adopt required technological innovations and understand their capabilities and potential benefits in business processes in order to successfully implement the Industry 4.0 perspective (Moktadir et al., 2018).

Agriculture 4.0, also known as the fourth agricultural revolution, differs from precision farming in that it applies technology to all aspects of farming processes, from the crop yield through harvesting, to logistics and transportation. Agriculture 4.0 is basically the digitization of the classic agricultural farm operations. (Maffezzoli et al., 2022)

Agriculture 4.0 offers a strong opportunity to stimulate economic growth and increase the incomes of companies working in the agricultural sector by increasing the efficiency of agricultural production. Because of these aspects Agriculture 4.0 also plays a decisive role in terms of sustainability, as it enables agricultural practices to adapt to climate change, reduce greenhouse gas emissions and use inputs such as water and fertilizers more efficiently. The agriculture of the future will use sophisticated technologies such as robots, temperature and moisture sensors, aerial photography and GPS technology. These advanced tools, along with precision farming and robotic systems, enable farms to be more profitable, efficient, safer and more environmentally friendly. (Weltzien, 2016)

Agriculture 4.0 encompasses the development of precision farming and refers to all activities carried out in agriculture based on accurate and precise analysis of data and information collected and transmitted using advanced tools and technology. It refers to the tools and strategies that enable the synergistic use of a range of digital 4.0 technologies, enabling the automatic collection, integration and analysis of data from the field, sensors or other technologies. (Beluhova-Uzunova et al., 2022)

Agriculture 4.0 refers to the use of the Internet of Things (IoT), Big Data, Artificial Intelligence and robotics to extend, accelerate and increase the efficiency of activities affecting the entire production chain. The purpose of these technologies is to provide the most comprehensive and accurate support to farmers in the decision-making processes related to their activities, as well as in maintaining contact with

other actors in the supply chain. The ultimate goal is to increase the economic, environmental and social sustainability and profitability of agricultural processes. (Aricioğlu, Yılmaz, 2020)

According to Silveira et al. (2021) the adoption of 4.0 solutions in agriculture means voiding unnecessary wastage by accurately calculating the crop's water requirement or detecting the appearance of certain plant diseases or pests in advance, having more control over costs and you can plan every stage of cultivation, sowing and harvesting with high precision, saving time and money, and improving supply chain traceability, resulting in a short supply chain that can sustainably produce high-quality food with a low margin of error.

Effective data management is also a crucial part of Agriculture 4.0 applications according to Oleiro Araújo et al. (2021), stating that the most innovative technologies have to be applied in order to be able to manage the large amount of data and information coming from the fields, and also to have the ability to interpret this information in a useful way.

According to Maffezzoli et al. (2022) there are several main technologies that can be effective in the increased digitalization and connectivity of agricultural processes. Drones for example can be used as small unmanned aircrafts to monitor crops in real time and transmit images and useful information. They are mainly used for land mapping, but the most advanced versions use infrared sensors and imaging systems to detect problems that cannot be seen otherwise. Besides that environmental sensors can record weather data and information about soil moisture requirements.

The Internet of Things (IoT) allows many devices (drones, sensors or satellites) to connect and communicate with each other to exchange useful data to monitor crop development conditions. As more and more information will be generated by the connected technologies, Big Data applications can also useful to assist in making more efficient decisions during the production process. However, these datasets can be very different since they will usually originate from different sources. Because of that during the processing of the information applying Artificial Intelligence can also be beneficial as it has the ability to process and interpret large amounts of data is the main input for machine learning. (Silveira et al., 2021)

Nevertheless the approach and the applied set of tools the management of data and information is very important to exploit the economic value of this information

3 Food safety in supply chain management

Agriculture is the main source of raw materials for the food industry and since the importance of the food safety becomes a crucial challenge nowadays, the continuous development and digitalization of the agricultural supply chain becomes a focal point (Yadav, et al., 2022).

There are three main obstacles that have led to a decline in agricultural development in general around the world, namely the lack of water, and the shrinking of arable land, for many reasons, including desertification, high salinity and urban sprawl. And migration from the countryside towards the city, and thus a shortage of labor. These factors can be overcome by employing modern technology, which will greatly reduce the land area. It reduces the amount of water used and allows it to be recycled. Of course, robots will reduce the need for labor. Adopting modern technology primarily requires creating the appropriate environment for its use, and this will only happen with the support of governments and with huge investments (Mendes, 2022).

(Yadav, et al., 2022) in their paper described the industry 4.0 technologies as an added value features to the agricultural supply chain, which also helps in a better decision making process. The concept of smart agriculture has emerged, which allows for the fulfilment of agricultural activities with greater accuracy and efficiency, in line with the increasing demand for food products in the world. In smart farm applications, electronic sensors distributed in the field monitor different conditions. In some cases, the tools send data to a cloud server on the farm (network servers are widely used for computing and data processing). These numbers are automatically analyzed and instructions are sent to the farm's automatic irrigation system, which in some cases may add the correct dose of fertilizer as needed before dispersing the right amount of water; through the drip tape. This technology increases efficiency, periodically distributes the right amount of water, can prevent wastage and reduce the volume of fertilizer water. Farmers can access this data via a tablet or smartphone; Which gives them real-time information that would have required the slow and extensive manual soil testing process in the past (Javaid et al., 2022; Abbasi et al., 2022).

In case of The Internet of Things, the digital transformation is revolutionizing the agricultural sector. IoT technologies enable the linking of structured and unstructured data to provide insights into food production. In data-driven agriculture, farmers can make better decisions by analyzing interconnected data on climate, grain types, soil quality, disease probability, historical data, market trends and prices (Abbasi et al., 2022).

Another application is the use of drones in the agricultural sector using technology by planning sowing seeds through accurate 3D mapping of primary soil analyses, and data collection to manage irrigation and nitrogen levels. It also helps detect dry parts that need irrigation and sprays crops five times faster than conventional machines. In addition to tracking changes in plants and indicators of their health, and alerting farmers to the presence of any diseases (Maffezzoli et al., 2022).

Also one of the most important and useful tools in the agriculture sector is the blockchain technology, which secures digital transactions and keeps records. blockchain technology can reduce inefficiency and fraud, enhance food security, and pay farmers on time. Improving the ability to trace products within the supply chain will make it easier for regulators to trace contaminated food, determine the range of affected products during contamination cases, as well as reduce waste by identifying bottlenecks in the supply chain that lead to food spoilage. The transparency that blockchain provides can reduce food fraud. As consumer demand for organic and free from genetically modified products' foods has increased, the number of cases of fraud in antibiotics and antibiotics has increased, so has food ratings. The smallest of transactions in farms, warehouses or factories can be efficiently monitored and their details communicated along the supply chain when paired with IoT technology such as sensors and RFID labels. The benefits of this openness extend to all honest parties in the market. Blockchain technology can prevent price gouging, delay payments, eliminate middlemen and lower transaction costs, leading to fair pricing and helping small farmers get a greater share of the value of their crops (Yadav, et al., 2022).

Artificial intelligence and smart small robots, which can distinguish between weeds and agricultural crops, have been employed to improve resources, preserve the environment and human health, and produce healthy and high-quality agricultural crops. This can be done by performing a mechanical eradication of it, or dealing

with it with electricity or laser beams, or using precise spraying of chemical pesticides on weeds only, without agricultural crops. That is, a very large reduction in the chemicals that farmers spray in the entire field, by twenty times, which means less negative environmental impact and a significant reduction in the annual expenditure of farmers on herbicides. One of the tasks of robots in agriculture is also to help farmers choose and pack their crops, as 30 human workers can be replaced by one robot, and here the problem of labor shortage can be solved. (Krstić et al., 2022) & (Javaid et al., 2022).

Modern transportation helps in making the products in the markets available from the farm at the right time. Technologies in the field of transportation help farmers easily transport fertilizers or other agricultural products to their farms, and also speeds up the process of providing agricultural products from farms to markets where consumers get them daily (Krstić et al., 2022).

In terms of cooling in logistics applications, the farmer buys modern refrigeration to ensure that tomatoes and other perishable crops are delivered and kept fresh while they are transported to the market. Coolers are installed in food transport trucks, which keeps perishable crops like tomatoes fresh on delivery (Chandran et al., 2022).

In terms of modern greenhouses, it has become high-tech, using LED lights and automated control systems to adapt the agricultural environment. An important contribution to technological development, indoor vertical farming is the practice of cultivating products stacked one on top of the other in a closed environment. This type of growth is often associated with urban and urban agriculture due to its ability to thrive in a limited space, and is unique in that the plants do not require soil, mostly aquatic plants, where the roots of plants are regularly sprayed with water and nutrients. Humans cannot create this type of farm without relying heavily on technology in terms of observing plants, determining the amount of light, moisture, and other conditions that are difficult for humans to accurately determine (Kobayashi et al., 2022).

4 Conclusion

There is consensus in the literature on the great effects and benefits of the application of industry 4.0 technologies in the agricultural sector, in addition to some challenges such as the cost of employing these technologies and the need to train the farmers to accept and use the equipment in an appropriate manner.

However, there is still a lot of reluctance towards a new way of understanding agriculture and the new technologies associated with it. Nonetheless, there is no doubt that Agriculture 4.0 has many advantages.

First, it can provide economic advantages, through greater control over the agricultural processes leading to better optimization of resources, thus resulting in less waste in terms of materials. Second, the environmental benefits are another great addition as technological advancements in agriculture can result in more sustainable processes and operations while reducing the environmental impact of the entire food chain. Third, constant and precise monitoring of each stage of the production chain translates into a higher quality end product, which is undoubtedly beneficial for food safety and human health conditions. Last, these new applications can be also beneficial for the workers as they can improve the working conditions and decrease the burdens of everyday processes.

References

Abbasi, Rabiya & Martinez, Pablo & Ahmad, Dr Rafiq. (2022). The digitization of agricultural industry – a systematic literature review on agriculture 4.0. Smart Agricultural Technology. 2. 100042. 10.1016/j.atech.2022.100042.

Aricioğlu, M., Yılmaz Gezgin, A. (2020). 4.0 For Agriculture. European Journal of Business and Management Research. 5. 1-8. 10.24018/ejbmr.2020.5.3.364.

Beluhova-Uzunova, R., Dunchev, D. (2022). AGRICULTURE 4.0 -CONCEPTS, TECHNOLOGIES AND PROSPECTS.

Chandran, Ratanashangkari & Hasanuzzaman, Md & Arıcı, Müslüm & Kumar, Laveet. (2022). Energy, economic and environmental impact analysis of phase change materials for cold chain transportation in Malaysia. Journal of Energy Storage. 55. 105481. 10.1016/j.est.2022.105481.

Chavarría Barrientos, Dante & Batres, Rafael & Wright, Paul & Molina, Arturo. (2017). A methodology to create a sensing, smart and sustainable manufacturing enterprise. International Journal of Production Research. 1-20. 10.1080/00207543.2017.1386333.

Christopher, M. (2016). Logistics & supply chain management. Pearson Uk.

Fosso Wamba, Samuel & Queiroz, Maciel. (2020). Industry 4.0 and the supply chain digitalisation: a blockchain diffusion perspective. Production Planning & Control. 33. 1-18. 10.1080/09537287.2020.1810756.

Ghadge, Dr Abhijeet & Er, Merve & Moradlou, Hamid & Goswami, Mohit. (2020). The impact of Industry 4.0 implementation on supply chains. Journal of Manufacturing Technology Management. ahead-of-print. 10.1108/JMTM-10-2019-0368.

Hofmann, E. – Rüsch, M. (2017): Industry 4.0 and the current status as well as future prospects on logistics. Computers in Industry, 89, p. 23-34.

Javaid, Mohd & Haleem, Abid & Singh, Ravi & Suman, Rajiv. (2022). Enhancing smart farming through the applications of Agriculture 4.0 technologies. International Journal of Intelligent Networks. 3. 10.1016/j.ijin.2022.09.004.

Jéssica Alves Justo Mendes, Nubia Gabriela Pereira Carvalho, Murilo Neves Mourarias, Catarina Barbosa Careta, Vânia Gomes Zuin, Mateus Cecílio Gerolamo, (2022). Dimensions of digital transformation in the context of modern agriculture, Sustainable Production and Consumption, Volume 34, Pages 613-637, https://doi.org/10.1016/j.spc.2022.09.027.

Kobayashi, Y., Kotilainen, T., Carmona-García, G., Leip, A., & Tuomisto, H. L. (2022). Vertical farming: A trade-off between land area need for crops and for renewable energy production. *Journal of Cleaner Production*.

Krstić, Mladen & Agnusdei, Giulio & Miglietta, Pier Paolo & Tadić, Snežana. (2022). Logistics 4.0 toward circular economy in the agri-food sector. Sustainable Futures. 4. 100097. 10.1016/j.sftr.2022.100097.

Maffezzoli, F., Ardolino, M., Bacchetti, A., Perona, M., Renga, F. (2022). Agriculture 4.0: A systematic literature review on the paradigm, technologies and benefits. Futures. 142. 102998. 10.1016/j.futures.2022.102998.

Moktadir, Md & Ali, Syed Mithun & Kusi-Sarpong, Simonov & Shaikh, Md. (2018). Assessing challenges for implementing Industry 4.0: Implications for process safety and environmental protection. Process Safety and Environmental Protection. 117. 10.1016/j.psep.2018.04.020.

Muhuri, Pranab & Shukla, Amit & Abraham, Ajith. (2019). Industry 4.0: A bibliometric analysis and detailed overview. Engineering Applications of Artificial Intelligence. 78. 218-235. 10.1016/j.engappai.2018.11.007.

Nagy, J. (2019). Az ipar 4.0 fogalma és kritikus kérdései – vállalati interjúk alapján. Vezetéstudomány – Budapest Management Review. 50. 10.14267/VEZTUD.2019.01.02.

Oleiro Araújo, S., Peres, R., Barata, J., Lidon, F., Ramalho, J. (2021). Characterising the Agriculture 4.0 Landscape – Emerging Trends, Challenges and Opportunities. Agronomy. 11. 10.3390/agronomy11040667.

Posada, Jorge, Carlos Toro, Iñigo Barandiaran, David Oyarzun, Didier Stricker, Raffaele de Amicis, Eduardo B. Pinto, Peter Eisert, Jürgen Döllner, and Ivan Vallarino. (2015). Visual Computing as a Key Enabling Technology for Industrie 4.0 and Industrial Internet. *IEEE Computer Graphics and Applications* 35: 26–40

Prause, M.& Günther, C. (2019). Technology diffusion of Industry 4.0: An agent-based approach. International Journal of Computational Economics and Econometrics. 9. 29. 10.1504/IJCEE.2019.097793.

Research.

Roblek, Vasja, Maja Meško, and Alojz Krapež. 2016. A Complex View of Industry 4.0. SAGE Open 6.

Silveira, F., Lermen, F., Amaral, F. (2021). An overview of agriculture 4.0 development: Systematic review of descriptions, technologies, barriers, advantages, and disadvantages. Computers and Electronics in Agriculture. 189. 106405. 10.1016/j.compag.2021.106405.

Weltzien, C. (2016). Digital agriculture – or why agriculture 4.0 still offers only modest returns. Agricultural engineering. 71. 66-68. 10.15150/lt.2015.3123.

Yadav, Vinay & Singh, A. R. & Raut, Rakesh & Mangla, Sachin & Luthra, Sunil & Kumar, Anil. (2022). Exploring the application of Industry 4.0 technologies in the agricultural food supply chain: A systematic literature review. Computers & Industrial Engineering. 169. 10.1016/j.cie.2022.108304.

Zezulka, F. & Marcon, Petr & Veselý, Ivo & Sajdl, Ondrej. (2016). Industry 4.0 – An Introduction in the phenomenon. IFAC-PapersOnLine. 49. 8-12. 10.1016/j.ifacol.2016.12.002.

SELECTING THE LOGISTICS SERVICE PROVIDERS: TOWARDS A MATHEMATICAL MODELING APPROACH

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Abstract With the increased competitiveness of the global market, the use of logistics services in Morocco has become an urgent necessity in order to optimize costs and the quality of services. As a result, an adoption of the logistics outsourcing strategy is in high demand. To succeed in this strategy, we propose guidelines for the support of Decision Makers (DM). One of the fundamental pillars of this strategy is based on the choice of an efficient Logistics Service Provider. The main challenge is to always seek the effectiveness and sustainability of the relationship at the level of a network, often very complex of potential partners. To this end, an eminent need to model this relationship between the actors of this network is required. The study conducted consists of modeling the problem of the choice of the provider as well as the assignment of the service to be outsourced to the appropriate LSP as part of the success of the logistics outsourcing strategy of a DM. The linear model developed takes into account qualitative and quantitative criteria to be complementary to our previous work. These criteria are expressed in the constrained part of the model.

Keywords:
logistics service, logistics services providers, decision making, modeling

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1 Introduction

The emergence of business networks from the 90s concretizes the strategic alliances that companies must forge in order to solidarize and share financial risks as well as to find the industrial and technological complementarities necessary for their development. However, with the volatility of markets and the evolving requirements of competitiveness, several companies have found themselves forced to take into account the logistics dimension as a competitive weapon, allowing them to optimize costs and improve the quality of their services [1].

As a result, and for reasons of rationalization and optimization, DMs tend to gradually outsource their logistics activities to qualified service providers [2] and [3], so optimization has been at the center of any decision-making problem.

Currently, the major problem of supply chain management is to want to control all the activities involved in the creation of a finished product [4]. Hence the need to use a wide range of Logistics Service Providers (LSPs).

As a result, ordering companies are in contact with a large number of LSPs, among which they must choose the most suitable for their requests. The sustainability and efficiency of this relationship positively influences supply chain management by making it easier to maintain a competitive advantage [5] and [6].

Given that the analytical capacity of a human being is limited to consider simultaneously the possible compensation and substitution effects related to thousands of interdependent choices [7], as well as the lack of certain methods such as MCDMs in terms of expression of needs in the form of constraints , especially since these methods are based on human judgment which often has an instinctive non-objective character. Asa result, we have opted for mathematical modeling that will allow us to overcome this deficiency.

Our modeling approach is part of the application of Operational Research Methods for the improvement and support of decision support processes. Our situation is a matter of mathematical modelling, making it possible to formally evaluate different alternatives and anticipate their impacts [8].

2 Literature Review

2.1 Modelling

The literature aimed at studying the logistics outsourcing of Moroccan companies as well as the management of relations between actors in a supply chain contributing to the success of this strategy is almost absent [9]. Indeed, the resulting supply chains involve a large and growing number of logistics players, subsequently requiring robust methods for the selection of the latter. Their roles are therefore becoming increasingly important [10]. The model developed will be supported by Ods in order to opt for this strategy without hesitation regarding fears about the choice of LSPs.

However, the literature review shows the need for an integral system of measurement indicators to assess the performance of actors that derive from the supply chain as a whole [12].

Indeed, mathematical programming models are the most used for modeling in logistics network planning as well as for the evaluation of 3PL providers [12].

An optimization model for the selection of LSPs in the field of transport has been developed by [15], for the case of »Reynolds Metal Company«, opting for the method (Mixed Integer Programming) for the selection and deployment of carriers.

In the same vein, a mathematical programming model for the selection of a 3PL type LSP for storage outsourcing was established by [13]. However [14] have opted for a multi-objective programming model for the problem of choosing LSPs involving a set of often contradictory multi-objective criteria.

Other researchers have developed approaches to solve the problem of selecting providers for the transport service. It is a multi-objective mathematical programming model, acting on the minimization of the total cost [15].

In addition, [16] addressed the problem of selecting carrier-type LSPs with the reliability of the transportation network in order to find the best choice using (Optimal Carrier Selection problem based on Network Reliability).

For the outsourcing of part of the production and to model the fixed and variable costs related to purchase and production, [17] used binary functions.

In addition, a mathematical model of optimization with several suppliers over several planning periods was developed by [18], using mathematical programming and Total Cost of Ownership (TCO) for the supplier choice problem. [19] has developed a multi-objective model of supplier selection.

[20] proved the value of using several claimants through mathematical modelling.

2.2 Mathematical optimization methods

Many academic works focus on the problem of choosing the best provider by opting for mathematical models which are in turn numerous depending on the problem posed, the type of data concerned and the structure studied [21].

In addition, at the level of modelling, operations research is one of the popular analytical methods within the scientific community [22], based on optimization theories, game theory, statistics and algorithmics.

These methods are often formalized in the form of one or more objective functions in order to minimize it or maximize a set of constraints. The models developed are linear, or non-linear with the presence of integer, real, mixed or binary variables, ... [23].

Among the resolution techniques of this type of modeling are linear programming [30], mixed integer programming [24], and multi-objective mathematical programming [18] and [25].

3 Elaborate model

3.1 Context of study

Although the choice of LSPs can be made according to several criteria, focusing only on an evaluation that takes into account only quantitative criteria devalues the importance of qualitative criteria. The latter provide a long-term benefit [26].

Our problem, therefore, is to model the choice of LSPs based on two types of data that are qualitative illustrated by traceability, technological level, level of services offered, range of transport and type of LSP and others that are quantitative illustrated by the fixed cost of choice of LSP and the cost associated with the service offered.

The approach can be summarized in figue 1.

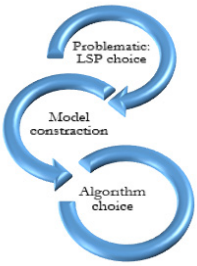

Figure 1: The approach of context study.
Source: own.

3.2 Scenario adopted

At the level of the problem of choosing the LSP, we assume that we have i logistics service providers to choose from among them to provide S services.

The scenario adopted is to consider a predetermined number of services, each LSP providing a single service, as well as a service cannot be supported by only one LSP.

However, the cost of outsourcing is subdivided into 4 categories: a cost associated with the choice of LSP, a cost associated with the performance of service S by provider i, a cost of risk associated with the choice of PLS i and a cost of risk associated with the wrong choice of PLS i for service S.

Overall, we are thus on the side of DM which seeks to minimize the total cost resulting from the choice of better LSP as well as the assignment of service to be outsourced to the right LSP, while seeking in the meantime to maximize criteria.

Our contribution concerns the application of mathematical modelling to combine between qualitative and quantitative variables to fill the gap due to the use of one type of variable without taking into account other types. So our study consists not only in the evaluation of the costs of service encompassing the cost of carrying out the service and the cost generated by the risk that may take place, but we will also take into account, the qualitative aspect associated with the few criteria considered interesting according to previous studies carried out [27], for the choice of LSP. This aspect will be illustrated as a constraint in the developed model.

3.3 Mathematical formulation

We will present the elaborated model as well as the details concerning it, as well as the appropriate method of resolution is explained.

3.3.1 Data

I: the number of the panel of LSPs
S: the number of services to be outsourced
J: Criterion index
Cv_{is}= Cost of outsourcing the service s by the PLS i
Ct_s= Cost of carrying out an internal service
Cf_i : fixed cost of choosing a LSP i
Q_3: Third quartile of the distribution of LSP scores
W_j : weighting of criterion j
S_{ij} = the score (score) of for criterion j PSL_i
Cr_{is}= the risk-related cost of a service provided by a PLS i
Cr_i= the cost related to the risk of poor choice of a PLS i
ξ : a margin of tolerance
p_i : multiplying the score by weighting criterion j for all services$S_{ij}W_j$

3.3.2 Decision Variables

$\boldsymbol{Y_{is}}$= 1 if the LSP i supported service s.
$\boldsymbol{Y_{is}}$= 0 Otherwise.

$\boldsymbol{X_i}$= 1 if the LSP (i) is retained
$\boldsymbol{X_i}$= 0 otherwise

3.3.3 The objective function

The objective considered is to minimize the costs related to the choice of suitable LSP as well as the assignment of service (s) to the right LSP then the cost of risk assessment incurred whether it is the risk related to the wrong choice of PLS as a whole or the non-compatibility of the assignment made between the service and the chosen LSP.

At the level of the model cited, the optimized criterion in principle and which is illustrated in the objective function is the cost, but in addition we have explained qualitative criteria that we will point out later in the constraint part.
The objective function is written as follows:

Minimize Z= $+\sum_i \sum_s (\boldsymbol{Cv_{is}} + \boldsymbol{Cr_{is}}) * \boldsymbol{Y_{is}} \sum_i (\boldsymbol{Cf_i} + \boldsymbol{Cr_i}) * \boldsymbol{X_i}$

3.3.4 Constraints

$\sum_i X_i$ =S (3.1)
Y_{is} <= s S , i I (3.2)$X_i \forall \in \forall \in$
$\sum_s Y_{is}$<= i I (3.3)$X_i \forall \in$
$\sum_i Y_{is}$= 1 s S (3.4)$\forall \in$
$Cf_i * X_i + Cv_{is} * Y_{is}$<= s+*(s S , i I (3.5) $C_t \xi C_t s)$ $\forall \in \forall \in$
$Q_3 \leq \sum_j (S_{ij} * W_j) * X_i \forall$ i I (3.6) $\in$
$X_i \in \{0,1\}$, i I (3.7)$\forall \in$
$Y_{is} \in \{0,1\}$, i I, s S (3.8)$\forall \in \forall \in$

The objective function minimizes the total cost associated with choosing the best LSP and assigns it to the most suitable service, this cost includes two terms, the first is associated with the choice of LSP and the performance of a service(s) and the second is associated with the cost of the risk that may occur due to a bad choice of LSP or the cost related to the non-homogeneity of PLS for such a service. The constraint (3.1) ensures that there will be (S) LSP chosen that will correspond exactly to the number of services to be outsourced. Constraint (3.2) ensures that a service

cannot be outsourced unless a LSP is retained. The constraint (3.3) dictates that a LSP cannot support at most one service (0 or 1). Constraint (3.4) ensures that a service must be supported by a single LSP. For the constraint (3.5) admits that outsourcing can only take place if the cost of outsourcing is less or just exceeding with a small tolerance the cost of internalization of such service. The constraint (3.6) achieves a limitation of the LSP that will be the subject of the study by taking just the third quartile in our case and it depends on the size of the sample used, in the case of large sample size, we can go up to the second quartile. This quartile will be compared with the product of the LSP score calculated by combining the 5 criteria already previously reported which are (traceability, technology, type of PL, range of service and transport modalities), and the weighting of each criterion according to the opinion of the Ods. The two constraints (3.7) and (3.8) relate to the binary nature of the decision variables associated with the selected LSP and the assignment of each service to the correct LSP.

This model is a linear program with binary variables.

4 Conclusion

In this article, we have focused on the problem of deciding on the choice of the best LSP as well as the allocation of services to be outsourced. We have taken a view based on LSP modeling and services in the supply chain. Thus, we studied the design models of the latter in a supply chain in order to be able to establish a mathematical modeling of the decision problem based on the cost criterion as well as other qualitative criteria that we explained in the model.

Elsewhere, the costs relating to each situation of outsourcing each service to a given LSP by making a comparison with the cost of developing the same service internally.

The purpose of this mathematical modeling is to allow the company to choose, for part of its activities between the option of doing it internally or do-it-yourself by choosing the LSP that will be solicited between a candidate panel. We thus place ourselves on the side of the DM company which seeks to minimize the total cost relative to the two options, as well as maximize the quality criteria existing in the LSP and minimization of the risk that can be generated due to the choice of either bad service to outsource or the wrong choice of LSP for this mission. The

constraints are related to the cost of carrying out services internally, also to the respect of a certain threshold of some qualitative criteria such as traceability, the technology used ..., other constraints imposed to avoid the monopoly of a single LSP for the outsourcing of all services ...

So, we tested the scenario we chose according to the accessibility to the data tested with CPLEX. The model developed has certain limitations. Apart from the difficulties of resolution in some cases where the data are important, the model developed has certain limitations, in the event that some information is not available or rather is not accessible given its confidentiality for some LSP. In addition, the information concerning the sharing of service between several LSPs in the multi-sourcing strategy pushed us to limit ourselves to a very specific scenario.

This is why it would be interesting, in perspective, to develop another scenario by taking the case of service sharing between several LSP and the fact that a LSP can provide more than a service or the taking into account of the cost associated with the different types of risks, are all possible study situations.

References

[1] - McGinnis, M.A., Kohn, J.W. (2002), Logistics strategy-revisited. Journal of Business Logistics 23 (2), 1–17

[2] Lieb, R., Butner, K., (2007.a.). "The North American Third Party Logistics Industry in 2006: the Provider CEO Perspective." Transportation Journal, 46(3), 40- 52.

[3] Lieb, R., Butner, K., (2007.b.). "The year 2006 Survey: CEO Perspectives on the Current Status and Future Prospects of the European Third Party Logistics Industry." Supply Chain Forum : An International Journal, 8(1).

[4] NAJI Marouane and MOUNIR Younes, « De la mesure de performance des chaines logistiques – Revue de littérature et taxonomie », Revue Internationale des Sciences de Gestion, vol 4, N° 2, pp1187 :1214.

[5] Horvath. L, (2001), "Collaboration: the key to value creation in supply chain management", Supply Chain Management: An International Journal, Vol.6 n°: 5, pp.205-207.

[6] Philipp, B. (2007), Supply chains durables : changement de paradigme, modèle ou mode ?, in Paché G., Spalanzani A. (Eds), La gestion des chaînes logistiques multi-acteurs: perspectives stratégiques, Presses Universitaires de Grenoble, Grenoble, pp. 85-100.

[7] MARC-ANDRÉ CARLE, « LA MÉTAHEURISTIQUE CAT POUR LE DESIGN DE RÉSEAUX LOGISTIQUES DÉ TERMINISTES ET STOCHASTIQUES »,Thèse,la Faculté des études supérieures et postdoctorales de l'Université Laval, QUÉBEC 2012

[8] Roy, B. (1996). Multicriteria methodology for decision aiding. In Nonconvex optimization and its applications. Dordrecht: Kluwer Academic Publishers.

[9] Lhoussine ABOUDRAR, Jamal el Baz and Hassan Batrich, « Impact de l'externalisation du transport/logistique sur le triptyque coût-qualite-delai: cas des entreprises marocaines»,

Dossiers de Recherches en Economie et Gestion : Numéro spécial : Décembre 2014, pp464-484.

[10] Paché, G. 2009. « Quels impacts de la crise sur la logistique ?» Revue Française de Gestion 35 : 51–57. doi:10.3166/rfg.193.51-57.

[11] Akgün, M., & Gürünlü, M. (2010). Cash to Cash Cycle as an Integral Performance Metric in Supply Chain Management: A Theoretical Review. IUP Journal of Supply Chain Management, 7(1/2), 7-20.

[12] Ko, H.J., Ko, C.S. and Kim, T., 2006, "A hybrid optimization/simulation approach for a distribution network design of 3PLs", Computers & Industrial Engineering, 50, 4, 440-449.

[13] Chen, F.Y., Hum, S.H. and Sun, J., 2001, "Analysis of third-party warehousing contracts with commitments",European Journal of Operational Research, 131, 3, 603-610.

[14] Kumar, M., Vrat, P. and Shankar, R., 2006, "A multi-objective 3PL allocation problem for fish distribution",International Journal of Physical Distribution & Logistics Management, 36, 9, 702-715

[15] Liao and Rittscher, (2007),"Integration of supplier selection, procurement lot sizing and carrier selection under dynamic demand conditions". International Journal of Production Economics 107,p.502-51

[16] Lin, Y.K. and Yeh, C.T.,(2010),"A Decision Method for Disruption Management Problems in Intermodal Freight Transport ". International Journal of Production Economics, vol.128,p.510-51

[17] Ahmadi, R.H. and C.S. Tang, 1994. Production allocation whith dual provising, European Journal Of Operational Research, 75, p. 186-199.

[18] Degraeve, Z. and F. Roodhooft, 1999. Improving the efficiency of purchasing process using total cost of ownership information : the case of heating electrodes at at cockerill Sambre S.A, European Journal of Operational Research, 112, p. 42-53, 1999

[19] Weber et Current,1993] Weber C.A, Current J.R. A Multiobjective Approach to Vendor Selection. European Journal of Operational Research 68, pp 173-184, 1993

[20] Anupindi, R., & R. Akella (1993). Diversification under supply uncertainty. Management Science, 39 (8), 944-963.

[21] M.E.BOUNIF , Optimisation à base de simulation pour le développement des systèmes décisionnels, Doctorat, Msila, 2015

[22] Parunak et al., 1999] Parunak, H.V.D, Savit, R., Riolo, R.L, Steven, J.C, 1999. DASCh: Dynamic analysis of supply chains. Center of Electronic Commerce Final Report.

[23] Abdelkader Hammami, « Modélisation technico-économique d'une chaîne logistique dans une entreprise réseau », thèse de doctorat à L'Ecole Nationale Supérieure des Mines de Saint-Etienne (Université Jean Monnet, Saint-Etienne, France), 3Mars 2013

[24] [Pan, 89] A.C. Pan, "Allocation of order quantity among suppliers", Journal of Purchasing and Materials Management, pp 36-39, (1989).

[25] [Buffa et Jackson, 83] F.P. Buffa et W. M. Jackson, "A goal programming model for purchasing planning", Journal of Purchasing and Materials Management, pp 27-34, (1993)

[26] MacCormack et al., 94] A. D MacCormack, L.J. Newman III et D.B Rosenfield, "The new dynamics of global manufacturing site location", Sloan management review , pp 69-80, Summer (1994).

[27] Azzouz khaoula, Arif jabir et Benboubker Mohamed Badr, « Exploratory Study of the Role of Logistics Service Providers in Terms of Traceability in the Process of Outsourcing of Logistics' Activities: Case of Moroccan LSP », International Journal of Engineering Research in Africa, Vol 54, 187-208.

Free IT Applications and Platforms for the Improvement of Agriculture

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Abstract A large number of applications and IT solutions have appeared on the market to easily and quickly monitor, record and control processes that are very dynamic, especially when we are talking about livestock production. Each of these solutions has its advantages and disadvantages. During work, we tested the potential of using Google applications.

Keywords: informatics, IT systems, IT solutions, livestock production, monitoring, real-time monitoring

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1 Introduction

The twenty-first century is rightly said to be the century of information and informatics. Organizations that quickly and easily adapt to incredibly fast changes in all fields of work in terms of the inclusion of IT systems, will manage to survive the latest industrial revolution. In these developments, agriculture is not only not neglected, but perhaps the most intense changes are expected in it in the next period, because humanity is not only more and more numerous, but we also have to take into account the quality of produced food and the pollution of the environment as a result of production. food.

Modern agriculture requires intensive work, constant control and monitoring in all segments of work, and above all in control points. Without intensive control of the production process, we cannot count on sustainable agriculture, not only conventional, but to a greater extent organic agricultural production, which we are increasingly turning to in work, production and food processing.

The question of all questions at a time of numerous procedures, exceptional intensity of production and food traffic, how to reconcile needs and real possibilities.

The use of various IT solutions proved to be not only good, but absolutely necessary here. The next question that arises is which and what kind. In accordance with the new situation, a large number of applications and IT solutions have appeared on the market to easily and quickly monitor, record and control processes that are very dynamic, especially when we talk about livestock production. Each of these solutions has its advantages and disadvantages, and due to the fact that these are commercial IT solutions, we will not mention them individually due to positive and negative aspects. We will present the advantages and disadvantages.

Advantages of commercial applications:

- they are usually made to order by complying with the required tasks by the lieutenant
- they are transparent
- -have a sufficient number of options and sufficient memory capacity
- Disadvantages of commercial applications:

- -require not so small material expenses
- if they are made to order, they require great knowledge of the customer, what and how it should contain and how to solve certain problems
- -require knowledge of the subject from the IT specialist
- if they are templated, there is a high probability that some of the essential segments do not meet the needs
- -if the platforms are concerned, additional money needs to be invested in order to properly and sufficiently protect the data.

For these reasons, the question arose whether there are opportunities to use some applications that are free to download in production. It turns out that many applications that can be downloaded for free from the Internet are very problematic because they have numerous technical flaws, are not compatible with the valid registry, or the data is stored on servers of dubious security status, and as such, our data can be exposed publicly, which can threaten our business.

The third possibility that we have seen (and which we have successfully tried) is the use of publicly available platforms by uploading our documents to those platforms.

Example of good practice

In order to test our idea experimentally, we decided to do it on the farm of the Agricultural School with the home of the student "Sonja Marinković" from Požarevac. From the official website of the Ministry of Agriculture, Forestry and Water Management, we downloaded a number of documents for keeping records in agriculture (field book – figure1), and in cooperation with the selection service with which we have a contract, we downloaded a group of documents for keeping records in animal husbandry. This part related to animal husbandry was a much bigger challenge because it involves a large number of bound documents (cows' register card, milk card, health card of cows and heifers, insemination card of cows and heifers, register card of sows, registration card of sows and gilts, dusting card, record of used food). This documentation is characteristic because the documents are official and keeping such records in this form greatly facilitates communication with official institutions.

How was the experiment conducted? We transferred all the documentation we received from the competent institutions into an electronic record (figure3). After that, we created a special google account to which we assigned access parameters only to colleagues who need to enter data. We placed the previously mentioned documents on the Google Drive of the created account. Immediately after the intervention or measurement, i.e. some of the actions in agriculture, the colleague who did the intervention with the animal, i.e. who did the control measurement or the agricultural operation, writes the data in the table that is on Google Drive (figure2). At the same moment, such data is available for review by all colleagues (superiors and subordinates) who have access to the account.

22.01.2022.	krava 2606	crna holstajn	indigestijq	Vlada
23.01.2022.	junica 7046	holštajn	teljenje	Vlada,Žikica
28.01.2022.	krava	8575	teljenje	Vlada,Žikica
28.01.2022	krava	8575	slabije jede	Vlada, Žikica
28.01.2022.	tele	sitnije od 8575	slabije sisa,temp.normalna	Vlada,Žikica
09.02.2022.	krava	8575	ušivanje vagine	Ivan,Vlada,II/2
12.02.2022.	krave	2606,9656,4414	diarea-dat carbobizmut	Vlada
13.02.2022.	krmača	9084	prašenje-oxytocin	Vlada
15.02.2022	**krava**	8575	uživanje vagine	Žikica,Vlada
19.02.2022.	prasići	13 komada	prevencija anemije	Vlada
23.02.2022.	nazimad	7 komada	prevencija ascaridose	Vlada,II/2
24.02.2022.	4 krave,5 svinja		ultrazvuk	Žikica,Vlada
25.02.2022.	jagnje		vulnera-ušivanje	Boba,III/2,Vlada
26.02.2022.	2 jagnjeta		shotapen,promselen	Vlada,II/2
26.02.2022.	krava	v.o. 1425		Vlada,Žikica
10.03.2022.	ovca		shotapen,dexa	Vlada IV/2
12.03.2022.	telad	8661,8662,8663	diarea,enrocin,hemoglobin s	Vlada,Žikica
22.03.2022.	krmača		prašenje,oxytocin	Vlada
28.03.2022.	17 prasadi		prevencija anemije	Vlada,Vesna,IV/
28.03.2022.	krmača		prašenje,oxytocin, shotapen	Vlada
29.03.2022.	krmača		retencija, ,shotapen, oxytocin	
29.03.2022.	2 nazimice		pg600	
	krava	8575	repozicija i uživanje vagine	Vlada,Žikica,IV/
23. 03.2022.	junica	4414	v.o.	Vlada, Žikica
01.04.2022.	12 praseta		prevencija anemije	Vlada,III/2
01.04.2022.	12 praseta		avitaminoza,promselen,B complex	Vlada, III/2
01.04.2022.	krmača	4785	prašenje,oxytocin,shotapen	Vlada
03.04.2022.	2 praseta		shotapen,dexa	
03.04.2022.	junica	4413	v.o.	Vlada,Žikica
08.04.2022.	12 praseta		avitaminoza AD3E,B kompleks	Vlada,Ii/2
08.04.2022.	16 praseta		prevencija anemije	Vlada,II/2
22.04.2022.	krave	9656,6553	lečenje sterilitet,deferelin	Vlada,Ivan,II/2
28.04.2022.	krava	9656	diarea,enrocin 10%,velecarbo pulvis	

Figure 2:
Source: own.

In this way, each of the colleagues has insight in real time into the changes that are happening in the economy, and it is easier to plan the next steps, but the realization of previously agreed actions. However, immediately after starting to use this approach in our work, we noticed a big problem – access to data by a large number of people potentially leads to accidental or intentional errors in entries, i.e. it is very easy to change the data in the tables, and it is easy to change previously entered data. In this way, a very important item, which is data security, has become very debatable and problematic.

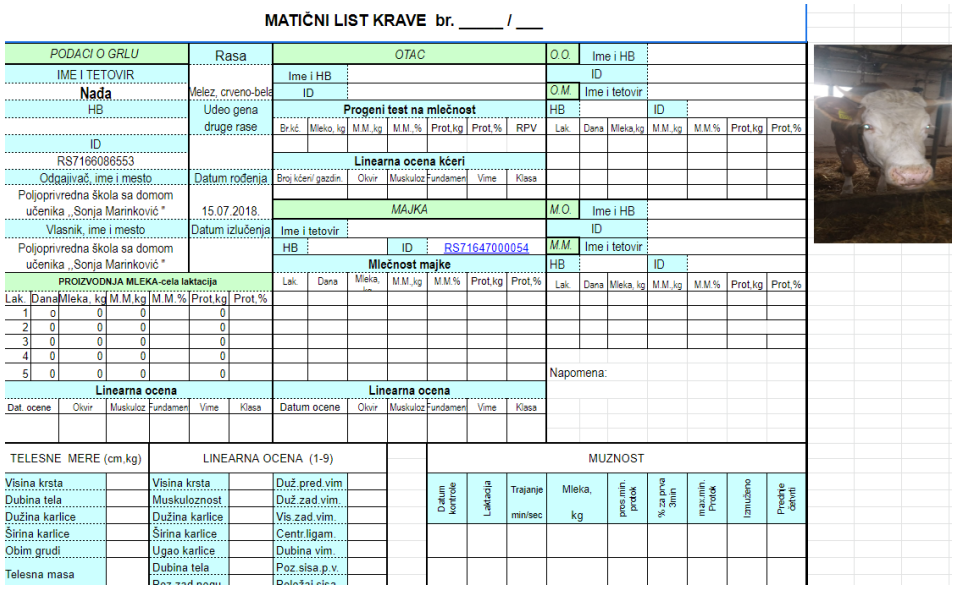

Figure 3:
Source: own.

This problem was solved in such a way that the data was entered in real time, but several memory records were made during the day in order to permanently save the data through recorded tables. With such an approach, we solved the problem of losing tables, but we created another problem related to the appearance of a large number of saved tables. However, when we made a cross-section of costs and obtained quality, we accepted that such solutions are still applied.

Advantages of this approach:

- it's completely free
- mobile phones and computers are used without high technical requirements
- they can be used by people without special training
- easy data entry
- easy access to data
- the data is entered into the electronic form of the official documents of the selection service
- Disadvantages of this approach:
- easy data loss
- tables are difficult to view for quick input, it is necessary to know the table formation well
- active internet is required for entering and searching data
- regular memorization of data is necessary
- good management of stored data is necessary.

References

https://www.og.stocarstvo.edu.rs/formulari
https://www.psss.rs/publikacije/knjiga.polja.pdf

Proceedings in

SLOVENE LANGUAGE

KONCEPT ZA VZPOSTAVITEV SAMO-ORGANIZACIJSKEGA IN SO-NARAVNEGA PODJETNIŠTVA NA PODEŽELJU V DOBI DIGITALIZACIJE

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Sinopsis V prispevku predstavljamo zasnovo koncepta, ki bo mlade pritegnil k izobraževanju na način, da bosta njihov razvoj in delo sonaravna, ne glede na program izobraževanja. Z več podpore, sodelovanja, mreženja in kolektivne pripadnosti lahko ustvarjamo zdravo in ustvarjalno okolje za podjetništvo prihodnosti. S kvalitativnimi metodami smo raziskovali in postavili koncept: »Od njive do mize in do akademije«. Naredili smo preplet principov, vrednot socialnega fenomena »Autopoiesis« in sistema »Zaupanja vreden« z namenom postavitve dinamičnega sistema, ki nadgradi postavljene evropske smernice »Od vil do vilic«. Mi dodajamo živost ustvarjalnih autopoietic ljudi, ki čutijo, razmišljajo, usmerjajo in delujejo s svojo notranjo radostjo, ki izžareva zunanjo ekologijo vse od vrtca do akademije in prenos v podjetniški svet. S tovrstnimi pristopi kažemo pot, kako soustvariti samo-organizacijsko podjetništvo, ki bo znalo najti harmonijo med naravo in sodobno tehnologijo. So-naravni podjetnik odgovorno vpeljuje človeku prijazne tehnologije, ki so mu v pomoč za kakovostno življenje. S konceptom pridobijo vsi, ki vlagajo znanje, tehnologijo in energijo: lokalno okolje, kmetije, start-upi, podjetniki, zadruge, konzorciji in različne institucije. Koncept se iz podeželskega prostora, kjer se vpeljuje digitalizacija, usmerja v pametna mesta. Rezultate pričakujemo v tradiciji mladih s prenašanjem znanja in izkušenj iz roda v rod, kar se sklene kot življenjski krog.

Ključne besede:
samo-organizacija, avtopoieza, zaupanja vreden, so-naravno podjetništvo, digitalizacija

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The Concept for Establishing Self-organizational and Co-natural Entrepreneurship in Rural Areas in the Age of Digitization

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Abstract In this paper, we present the concept that will attract young people to education in such a way that their development and work will be natural of an education program. With more support and cooperation, we can create a healthy environment for an entrepreneurship of the future. Using qualitative methods, we researched and established the concept: "From the field to a table and to an academy". We made the interweaving of the principles of the social phenomenon "Autopoiesis" and the "Trustworthy" system with the aim of setting up a dynamic system that builds on the established European guidelines "From forks to forks". We add liveliness to the creative autopoietic people who can radiates the ecology all the way from kindergarten to the academy. With such approaches, we show the way to co-create self-organizing entrepreneurship. A sustainable entrepreneur responsibly introduces human-friendly technologies that help a man lead a quality life. The concept benefits everyone who invests knowledge and energy: local environments, entrepreneurs, business and institutions. The concept is moving from rural areas, where digitization is being introduced, to smart cities. We expect results in the tradition of young people by passing on knowledge from generation to generation, which concludes as a circle of life.

Keywords:
self-organization, autopoiesis, trustworthy, natural entrepreneurship, digitization

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1 Uvod

V slovenskem prostoru opažamo, da postajajo mladi čedalje bolj individualisti, hiperaktivni, tekmovalni, introvertirani in usmerjeni v informacijsko komunikacijsko tehnologijo, robotizacijo in digitalizacijo, kar se odraža v odnosih v organizaciji in v vseh nivojih družbe, predvsem pa v okolju, ki vse bolj izgublja prvinskost, simbiozo in zgled kulturne krajine. Naša predpostavka je analiza Filozofske fakultete v Ljubljani, kjer izpostavljajo zaskrbljujoče rezultate raziskave med mladimi v Sloveniji, v tri ključne faktorje (Naterer in Lavrič, 2020): individualizem, prekarnost in stres. Mladi rastejo v družbi, kjer ni dovolj časa, da se jih posluša in zato mnogokrat rešljivi problemi postanejo nerešljivi. To vrzel vidimo tako v celotnem izobraževalnem procesu, kot tudi na področju podjetništva in v organizacijah. Poleg tega so mladi veliko časa vpeti v virtualna socialna omrežja, namesto da bi bolj osebno komunicirali, se gibali na svežem zraku in v simbiozi delovali v različnih timih.

Kakovost življenja mladih je na precej nizkem nivoju, če sledimo formuli, koliko časa naj človek namenja za delo v zaprtem prostoru in koliko za so-bivanje in gibanje zunaj, v naravi. Vse bolj je vprašljiva tudi kakovost prehranjevanja mladih, saj se zaradi načina življenja poslužujejo nezdrave in nekakovostne prehrane. Na tem področju smo preko SWOT analize evidentirali veliko slabosti in ovir, zato predstavlja izziv prihodnosti vzpostavitev pristnega stika z mladimi in kako ustvarjati aktivnosti v dobrobit vseh. To pomeni delovanje v dobro ljudi, živali in vseh ostalih naravnih ekosistemov ter tudi umetnih sistemov. Ugotavljamo, da smo s 4.0 in 5.0 industrijsko družbo ustvarili mnogo umetnih sistemov na vseh nivojih družbe, premalo pa je multidisciplinarnih in so-ustvarjalnih timov, ki bi delovali tako široko, kot je danes kompleksno postavljena naša družba.

Naš razvojno raziskovalni, znanstveni in nenazadnje aplikativni koncept nakazuje možnosti, da raziščemo te vrzeli posamično in naredimo koncept vseživljenjskega izobraževanja, ki bo opolnomočil mlade ter jih vzgajal v sonaravne podjetnike. V okviru koncepta predpostavljamo, da je lahko njiva kot simbol življenja in simbioze v naravi ali kot zelena učilnica in tudi laboratorij za izobraževanje na vseh stopnjah, vse do akademskega nivoja. Mlade želimo naučiti, da njiva ne predstavlja zgolj prostora za pridelavo pridelkov, ampak tudi dodano vrednost za različne strokovnjake, tehnologe informacijske tehnologije, učitelje, zdravnike, farmacevte,

organizatorje, ekonomiste, pravnike in druge, ter da je potrebno vsa znanja simbiotsko integrirati v so-naravnih poklicih prihodnosti, kjer moramo delovati sodelovalno, povezovalno, ciljno usmerjeno, trajnostno in družbeno odgovorno. V Sloveniji je posodabljanje digitalnih tehnologij in tehnik nenehno v teku, bistveno manj pa posodabljanje poslovnih modelov, zaradi česar večina slovenskega kmetijstva temelji le na samooskrbnosti z minimalnim presežkom produktov, namenjenih v lokalno okolje. Kmetijstvo v veliki meri pomeni podedovano sekundarno dejavnost, ki dopolnjuje prihodke iz naslova drugih delovnih razmerij v kmečkih gospodinjstvih.

Temu primeren je tudi odnos do vloge kmetijstva, saj je v tem pogledu dejavnost, kateri se lahko ljudje v primeru potrebe po izobraževanju najhitreje odpovejo. To pa se dodatno povezuje s trendom praznjenja podeželja oziroma odhajanja mladih družin in delovno aktivnega prebivalstva v mesta, od koder se vračajo pretežno šele v času upada delovne aktivnosti. Ker je prihodnost že tu in se te problematike močno zavedamo, želimo odgovorno prispevati h kakovosti življenja, varne in zdrave hrane ter k mreženju socialnega kapitala, saj bo slovensko kmetijstvo tudi v prihodnje raznoliko in bo poleg hrane zagotavljalo tudi mnoge druge javne dobrine. Ocenjujemo, da je z načinom simbioze možna tudi prekvalifikacija ljudi, ki imajo že svoje poklice, nimajo pa delovnih mest in bi želeli delovati v so-naravnem podjetništvu. Še posebej je tematika privlačna in daje zadnje možnosti tistim mladim, ki imajo doma kmetije, da te ne propadejo, ker mladi ne vidijo ekonomskega smisla za življenje in delo na kmetijah, pač pa kmetije opuščajo in se raje odločajo za druge dejavnosti, usmerjene v digitalizacijo, robotizacijo, umetno inteligenco in bolj virtualen svet, namesto da področja povezovalno nadgradijo v sonaravne poklice ozaveščenega sveta. Prav mladi, ki izhajajo iz kmetij, predstavljajo osrednje mesto v razvoju slovenskega kmetijstva.

2 Izhodišča in definicije

2.1 Kaj je 'Autopoiesis'?

'Autopoiesis' v grščini pomeni dobesedno samo-produkcija ali samo-kreacija. Lahko rečemo, da gre za naravni fenomen samo-produkcije, samo-delovanja ali samo-organizacije, ki ga najdemo v vseh bioloških sistemih, torej tudi znotraj človeka. O njem sta prva začela govoriti čilenska biologa Maturana in Varela (1980) na začetku

sedemdesetih let minulega stoletja, ko sta odkrila, da v celici poteka samo-obnavljajoče kemijsko ravnovesje. V sebi ima vgrajene naravne principe, ki ga vzdržujejo in samo-regulirajo. Imenovati nekaj za avtopoietsko je enako, kot reči »to je živo bitje«. Ta pojem se je nato prenesel tudi na označevanje domnevne samo-organizacije kompleksnih poslovnih, ekoloških, družbenih in drugih sistemov.

Bistvena lastnost človeka kot živega sistema je, da je sposoben samo-adaptacije, ker vedno znova proizvaja sebi lastne snovi za samo-revitalizacijo. Ta princip deluje pri našem celotnem razvoju in nas vodi k samo-uresničevanju kot najvišji stopnji našega razvoja, kajti dinamika avtopoieze je živa dinamika in v neprestanem gibanju po povratnih zankah. Človek po tej teoriji razvija samega sebe, saj se zaradi avtopoieze vse živo razvija in spreminja samo od sebe. Ljudje sami smo pravzaprav živ dejavnik tega, kar se dogaja, in to v dveh vlogah: kot opazovalci in kot akterji. V osnovi nam je narava podarila vse principe, da lahko zavestno delujemo in ustvarjamo živi svet. Kako? S svojim opazovanjem lahko nenehno opazujemo dogajanje v okolici in če se nas to dogajanje dotakne oziroma smo pozvani v določeno aktivnost, lahko zavestno, spoštljivo in organizirano razmišljamo, usmerjamo, delujemo in udejanjamo (Balažic Peček, 2018).

Avtopoietski procesi so osnovni za delovanje človeka in tudi človeške organizacije, družbe in nenazadnje civilizacije, kajti gre za krožni življenjski princip oziroma (so)evolucijo življenjskega kroga, ki se uresničuje v samo-organizaciji. Vendar pa so znanstveniki, ki ta pojav podrobneje raziskujejo, odkrili, da te žive procese avtopoieze zavirajo najrazličnejše ukalupljenosti. Že Maturana in Varela (1998) sta zaznala, da živimo v svetu ustaljenih kulturnih tradicij in omejitev, ki nas usmerjajo v to, kaj in kako vidimo, občutimo, ravnamo in prikrivamo, kar omejuje naš naravni proces ustvarjanja, zato ne moremo govoriti o napredku družbe, če ljudem niso dopuščene njihove naravne dejavnosti.

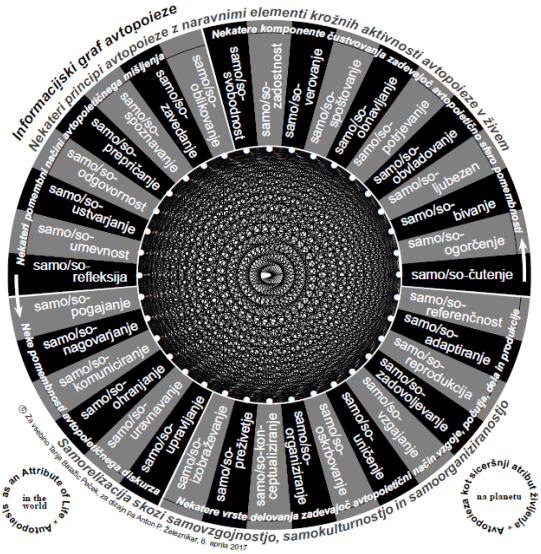
Evidentno je, da je sodobni način življenja sistem, v katerega smo vpeti kot živa bitja z naravno živostjo in ustvarjalnostjo. V raziskovanjih in razmišljanjih od avtopoieze do robotov, Balažic Peček (2019) izpostavi, da čeprav mislimo, da je v nas živost, je v resnici velikokrat odsotna. Delujemo kot stroji, bolj ali manj nezavedno, zgolj po navadah in prepričanjih, ki smo jih ponotranjili v zgodnjem otroštvu in mladosti. Življenje je bolj ali manj nezavedno in predstavlja mehanično ponavljanje naučenih vzorcev vedenja. Oddaljili smo se od narave, sebe, dela in našega zdravja, ob tem pa

izgubljamo naravno ravnovesje in se odtujujemo od svoje lastne vrojene živosti ter drug od drugega.

2.2 Uporaba socialnega fenomena »Autopoiesis«

Predstavljena tematika je nadaljevanje raziskovanja avtopoieze v človeku, organizaciji in širšem družbenem okolju, kjer smo s kvalitativnimi metodami ugotovili, da je pri krovni primerjavi sodobne in 4.0 organizacije pomembna razlika v vrednosti gradnikov čustvovanja in razmišljanja. Na procesnem nivoju pa je poglobljena kvalitativna analiza pokazala, da v 4.0 organizaciji ni več zaznati procesov sočutja, svobode, samo-referenčnosti ter sožitja in sobivanja z naravo. Ti dejavniki kažejo na upadanje človekove ustvarjalnosti že po zelo kratkem času od uveljavitve industrije 4.0. Po drugi strani pa zmanjšanje pestrosti procesov lahko povzroča korenite spremembe, ki se odražajo v neharmoniziranem človeku, organizaciji, okolju in posledično družbi (Balažic Peček, 2018).

Rezultate smo podali v »Informacijskem grafu avtopoieze – IGO« (Slika 1), ki lahko služijo za odpornost, kakovost življenja in soustvarjanje so-naravnega podjetnika.

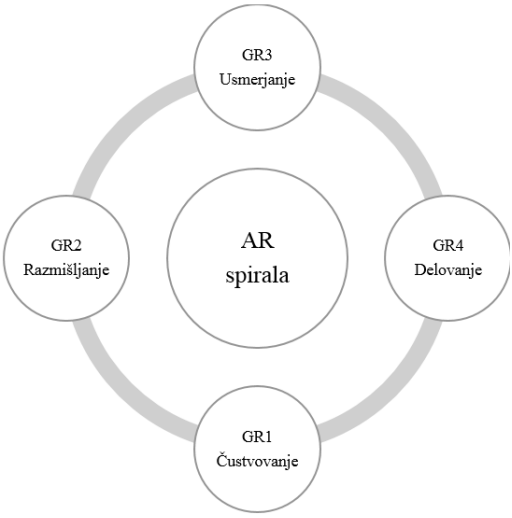


Slika 1: Samo-organizacijski model – Informacijski graf avtopoieze
Vir: Balažic Peček, 2018

Izhajamo iz avtopoietskega kroga (Slika 1), ki predstavlja socialni fenomen za udejanjanje krožnega so-naravnega gospodarjenja, kot temelja za ustvarjalnost in zdravje podjetnika s poudarkom na treh nivojih:

- Avtopoietski krog – kot samo/so-upravljanje v neprestani samo/so-komunikaciji.
- Kakovost življenja – polnost aktivnega so-naravnega življenja.
- Etika in ekologija – moralni, so-naravni notranji in zunanji odnosi v enovitem sistemu.

Ustvarjalni življenjski krog kot koncept gradnikov avtopoieze zajema čustvovanje, razmišljanje, usmerjanje in delovanje, kar je ključno za kakovost življenja, varno in zdravo hrano ter krepitev gospodarskih aktivnosti na podeželju (Slika 2).



Slika 2: Koncept gradnikov avtopoieze kot življenjski krog
Vir: Balažic Peček, 2018

2.3 Uporaba sistema »Zaupanja vreden«

Prav tako izhajamo iz usmeritev načrtovanega modela Gospodarskega grozda za podeželje na temelju poslovne filozofije »Zaupanja vreden« (Hrovat, 2016), s katerim želimo ob sodelovanju Konzorcija biotehniških šol Slovenije na zavodu Grm Novo mesto – centru biotehnike in turizma ter Visoki šoli za upravljanje podeželja Grm

Novo mesto oblikovati inkubacijski sistem za učenje in usposabljanje za zaposlovanje na področjih za hrano, okolje in podeželje. S pomočjo inkubator zadruge želimo učiti in usposabljati za vrednote povezovanja po načelih zadružništva na področjih ekološkega kmetijstva, gozdarstva, predelave, živilstva, gostinstva, turizma, razvoja podeželja in potrošniškega zadružništva s čim bolj neposrednim trženjem med pridelovalcem oziroma predelovalcem in potrošnikom. Cilj je ozavestiti in usposobiti tako pridelovalca, proizvajalca kot potrošnika in jih povezati med seboj (da se poznata, vidita iz oči v oči) s čim krajšo tržno potjo in čim manjšimi stroški, ob čim boljši kakovosti in nizkim ogljičnim odtisom oziroma brez ogljičnega odtisa. To je priložnost za nastanek novih delovnih mest, ugoden dostop do kakovostnih, zdravih pridelkov in izdelkov organiziranemu in osveščenemu potrošniku, kjer se bodo gojile vrednote, kot so (Hrovat, 2016): (1) poštenje, (2) spoštovanje sočloveka (ne glede na njegovo starost, sposobnosti in druge različnosti), (3) poslušati in razumeti potrebe sočloveka, sodelavca, stranke, učenca, (4) spoštovanje narave, kmetijske zemlje in hrane, (5) spoštovanje dela – vsako delo opravljeno s srcem, tako umsko kot fizično, je spoštovanja vredno, (6) poznavanje in spoštovanje slovenske kulture in tradicije in njeno vzpodbujanje ter odprtost za nove spremembe, (7) spodbujanje ustvarjalnosti in ideje posameznikov, (8) znanje in učenje, (9) pozitivno razmišljanje – upanje in potrpljenje, (10) pozdravljanje ter hvala, prosim, oprosti. Ker so mnogi končni proizvodi namenjeni tudi turistom, želimo pri tem izpostaviti usmeritve Strategije slovenskega turizma 2022–2028, katere vizija je »Zelena butičnost. Manjši odtis. Večja vrednost za vse.«.

»Zaupanja vreden« sistem temelji na kakovosti, predvsem pa tudi na korektni sledljivosti in odnosih pravične verige (WFTO – World Fair Trade Organization) od pridelovalcev oziroma predelovalcev do potrošnikov. Etični kodeks pričakuje od svojih članov, da spoštujejo vrednote, kjer ustvarjajo s svojim znanjem, delom in srcem zaupanja vreden odnos. Pri svojih odločitvah se zato vedno odločajo za dobro. Tako je potrebno graditi odnose, kjer človek ostane človek in ne samo robot za ustvarjanje profita. Potrebno je, da etični kodeks utrjuje zavest o pomenu osnovnih človekovih vrednot in da člane varuje pred neutemeljeno kritiko, kadar so ravnali v skladu z duhom etičnega kodeksa. Namen verige je torej oblikovati med posameznimi členi – pridelovalci, predelovalci, prodajalci ter potrošniki, med učitelji ter učenci in med sodelavci zaupanja vreden odnos.

2.4 Pomen socialnega kapitala

V prispevku »Socialni kapital – za SRS« avtorji ugotavljajo, da je socialni kapital relativno nov pojem, ki je povezan s človeškim kapitalom, označuje pa vključenost posameznika ali kolektivnih akterjev v družbene vezi in omrežja. Določeni cilji in projekti zahtevajo sodelovanje in podporo okolja in če je posameznik ali skupina sposobna pridobiti si sodelovanje in podporo, govorimo o visoki stopnji socialnega kapitala. Tako kot v človeški, moramo vlagati tudi v socialni kapital in oba sta – tako kot »pravi«, ekonomski kapital v družbi cenjena – saj je mogoče z njima priti do denarja in moči. Socialni kapital zlasti omogoča dostop do informacij, ki so včasih ključnega pomena za dosego ciljev. Menijo, da sta zaupanje in kooperativnost kot sestavini socialnega kapitala temelj za vzpostavljanje prožnih organizacijskih oblik koordinacije (projektna organizacija) in intermediarnih struktur. Pri tem gre tako za njegov vpliv na dinamiko ekonomske rasti, kot tudi za vpliv na bolj kompleksno pojmovano razvojno učinkovitost v primerjalni perspektivi (Adam, Rončevič in Tomšič, 2022).

Colarič – Jakše (2017) v svojem delu »Sodelovalno mreženje in izraba inovacijskega potenciala v turističnem prostoru« izpostavlja dejstva Putnama (Putnam, 1993, 1995) o pomenu zaupanja v procesu ustvarjanja socialnega kapitala, ki je v razumevanju vpetosti kapitala v širši kontekst, kjer delujejo predvsem norme vzajemnosti in omrežja civilne vključenosti. S pomočjo vzajemnosti posamezniki verjamejo, da se lahko njihovo pozitivno vedenje obrestuje. Skozi omrežja civilne vključenosti posamezniki namreč ustvarjajo zaupanje do drugih ljudi. Prav tako izpostavlja raziskave: Granowetter, (1973), Putnam, (1993), Uslaner, (2000) in Best in Krueger (2006), ki ugotavljajo, da so socialne vezi na individualni in na skupinski ravni osrednje bistvo socialnega kapitala (prav tam). Colarič – Jakše (2017) meni, da socialni kapital ustvarja zaupanje, stabilno družbeno in poslovno okolje ter spodbuja socialne akterje, da tvegajo in izrabljajo svoj inovacijski potencial. Znanje posameznika je namreč mogoče izrabiti samo takrat, ko ga omrežimo, ga delimo z drugimi socialnimi akterji in ga usmerjamo s socialnimi odnosi, kot so spoštovanje (npr. spoštovanje drug do drugega, spoštovanje drugih kultur), odprtost (npr. vzdržanost do sodb in predsodkov), radovednost (npr. obravnavanje razlik kot priložnosti za življenje) in odkrivanje (npr. strpnost do dvoumnosti).

3 Predstavitev izhodišč koncepta in metodologija

3.1 Metodologija raziskovanja

Koncept »Od njive do mize in do akademije« je odgovor za samo-organizacijsko, so-naravno družbeno odgovorno podjetništvo, ki ga je moč vzpostaviti v okviru nastajajoče AS Akademije in uveljavljene Visoke šole za upravljanje podeželja Grm Novo mesto. V konceptu je predstavljen preplet dveh modelov, in sicer fenomena »Autopoiesis« in »Zaupanja vreden«, kar je predstavljeno v teoretičnih izhodiščih.

Raziskovanja poglabljamo v 7 ključnih namenov:

- Multidisciplinarno in multiplikativno raziskati podeželje, delo in dejavnike odpornosti kmeta kot so-naravnega podjetnika, izhajajoč iz praks na Grmu Novo mesto – centru biotehnike in turizma ter Visoki šoli za upravljanje podeželja Grm Novo mesto, ki posedujeta obravnavano tematsko področje.
- Raziskati in oblikovati program za sonaravna delovna mesta z novimi poklici, ki navdušijo mlade in omogočajo ohranjanje ter razvoj kmetij, pridelavo varne, zdrave, lokalne hrane ter razvoj avtentičnih in butičnih proizvodov v podeželskem prostoru.
- Multidisciplinarno povezati človeka, naravo, delo, družbo, zdravje in izobraževanje.
- Vzpostaviti originalne proizvode, ki omogočajo kakovost življenja in odpornost so-naravnega podjetnika.
- Zasnovati so-naravno podjetništvo na diverzifikaciji podeželskih gospodarstev z novim poslovnim modelom, temelječim na vrednotah in elementih sočutja, ljubezni in solidarnosti v osebni izkušnji.
- Z novimi vsebinami omogočiti podjetnikom dodano vrednost, da tržijo z zgodbo vrta, njive kot učilnice in laboratorije, vse do akademije, kar naj bi izhajalo v vertikalni strukturi vse od vrtcev, osnovnih šol, srednjih šol, fakultet in nadaljnjih poti mladih.
- Ustvariti dodano vrednost, ki se odraža v kakovosti življenja, vseživljenjskem samo-izobraževanju, učenju, kompetencah, spretnostih, veščinah in orodjih za udejanjanje so-naravnega podjetništva pri mladih za

dejavnosti na kmetijah, mikro, malih in srednjih podjetjih v dobi digitalizacije.

Koncept je osredinjen tudi na ključni strateški dokument kmetijske politike – »Strateški načrt skupne kmetijske politike 2023–2027 za Slovenijo«, ki ga je potrdila Evropska komisija prav v času zaključka te raziskave (28. 10. 2022), in ga bo Slovenija začela izvajati predvidoma 1. 1. 2023. Z njim bo v naslednjem programskem obdobju zagotovila dolgoročno prehransko varnost, zeleni preboj in trajnostni razvoj slovenskega kmetijstva, gozdarstva, živilske industrije in podeželja. Ključnega pomena je, da je dokument usmerjen v vsebine zagotavljanja pogojev za odporno in konkurenčno pridelavo in predelavo hrane, predvsem preko ohranjanja proizvodnega potenciala in obsega kmetijskih zemljišč, primernega in stabilnega dohodka kmetijskih gospodarstev ter enakovrednejšega položaja kmetijskih pridelovalcev z odpravo plačilnih pravic. S prilagojenimi pogoji bosta mladim kmetom omogočena zagon in modernizacija kmetij za izboljšanje dohodkovnega položaja, s čimer si Slovenija prizadeva za generacijsko prenovo kmetijstva. Pri tem velja poudariti, da ni uspešnega razvoja kmetijstva in podeželja brez učinkovitega prenosa znanja, inovacij, podjetništva, uvajanja digitalizacije, demonstracijskih projektov, specializiranih svetovanj, usposabljanj idr. Ukrepi skupne kmetijske politike so usmerjeni tudi v varovanje naravnih virov in trajnostno upravljanje z njimi, blaženje in prilagajanje na podnebne spremembe ter ohranjanje biotske raznovrstnosti.

3.2 Ciljna skupina in cilj koncepta

Ciljna skupina:

- Vrtičkarji, osnovnošolci, dijaki in študentje, s poudarkom na simbiozi, medgeneracijskem sodelovanju in usposabljanju.
- Opolnomočiti brezposelne ljudi za so-naravno samo preživetje in jih podpreti za sonaravne podjetnike, za odporno in trajnostno krožno gospodarjenje.
- Opolnomočiti ljudi ob prekvalifikacijah, kot tudi dokvalifikacijah za okrevanje in revitalizacijo posameznika in podjetij po epidemiji koronavirusa (SARS-CoV-2) širših družbenih in globalnih razsežnosti.

Cilji koncepta:

- Integracija so-naravnih kompetenc za delovna mesta prihodnosti v smeri zdrave organizacije za kakovost življenja človeka, za zdravje podjetnika, družine in podjetja.
- Omogočiti, da se že v otroštvu pridobi znanja za so-naravnega podjetnika, z večjo fleksibilnostjo in samo-organizacijo na vseh ravneh.
- Multidisciplinarno zgraditi in vzpostaviti odporni sistem za večjo odpornost podjetnika in njegovo dinamiko, ki temelji na znanju, spretnostih, veščinah, kompetencah in krožnemu gospodarjenju, da se podjetniku omogoča ustvarjanje rednih prihodkov, temelječih na večji osebni originalnosti.

3.3 Pomen in možnosti prenosa znanja v prakso

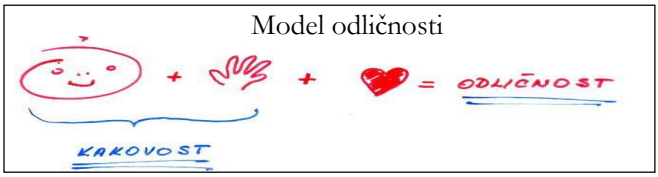
Koncept »Od njive do mize in do akademije« omogoča prenos poslovnega modela tudi na druga področja in v druga okolja. Usmeritve programa s kurikulumi so-naravnega podjetništva je moč zasnovati na osnovi so-naravne ekonomije, teoretičnega in praktičnega znanja, izkušenj iz medgeneracijske izmenjave dobrih praks po svetu ter izkušenj študentov, predavateljev, strokovnjakov in širšega okolja v okviru izobraževalnih institucij – Visoke šole za upravljanje podeželja Grm Novo mesto, Grma Novo mesto – centra biotehnike in turizma ter na drugi strani AS Akademije, ki želi v partnerskem odnosu z ljudmi, skupinami in organizacijami izvajati miselno ustvarjalen in izzivalen proces, da inspirira in doseže čim večje število poslovnih ljudi. Namen AS Akademije je, da predstavljeni deležniki odkrijejo neprepoznane potenciale in jih maksimirajo tako na osebnem področju, kot tudi v poslovnem svetu ter jih odločno tudi živijo. S tem namenom institucije raziskovalne vsebine naslavljajo na podeželska območja in njihove specifične izzive, usmerjene v kakovost življenja ljudi, lokalne pobude, naravno in kulturno dediščino ter razvoj podeželskega gospodarstva.

V programe vseživljenjskega so-naravnega izobraževanja podjetništva je možno umestiti teoretična, praktična in aplikativna znanja, podprta z znanstvenimi dognanji ter izkušnjami iz področij:

- Biotehnologije (avtopoieza v krožnem ustvarjalnem gospodarjenju).

- Razvoja podeželja skozi kmetijski, tehnični in turistični razvoj.
- Socialne tehnologije (tradicionalna znanja, kompetence, spretnosti in veščine z zgodbami in doživetji iz življenja in prakse).
- Informacijske tehnologije (digitalizacija, robotizacija, informacijsko komunikacijska tehnologija, umetna inteligenca, industrija 4.0, 5.0 …).
- Eko-tehnologije (pridelava, obdelava, predelava, komunikacija, interpretacija, raziskovanja, projekti …).
- Naravnih elementov (zemlja, zrak, voda, ogenj, sonce, energija).
- Senzorike in čutil (vid, vonj, okus, otip, sluh).
- Naravnih zakonitosti – podnebni in okoljski izzivi (biološki, fizikalni, fiziološki, kemični pojavi …).
- Prehranska in energetska draginja.

Pri tem bomo usmerjeni v model odličnosti Grma Novo mesto – centra biotehnike in turizma, ki jo pooseblja formula: *»znanje, pamet, modrost + delo, kapital, produktivnost + srce, dušo, ljubezen«,* kar ponazarjamo na Sliki 3: *»Spoštujemo vrednote, kjer ustvarjamo s svojim znanjem, delom in srcem zaupanja vreden odnos.«*



Slika 3: Koncept odličnosti – Gospodarski grozd za podeželje
Vir: Lea–Marija Colarič–Jakše

3.4 Najpomembnejša spoznanja

Človeka v organizaciji raziskujemo iz organsko-humanega vidika, ki vedno težje samo/so-deluje v obstoječem alopoietskem okolju, ki namensko zavira ustvarjalnost človekovega potenciala, kot največjega kapitala. Avtopoieza je naravni princip samo-proizvodnje, značilen v živem svetu. To je notranja harmonija človeka, kot odraz

našega zdravega in svobodnega ustvarjanja v ljubezni akcije, kot nove kulture človeka (Balažic Peček, 2018).

Zavedamo se potenciala človeka, okolja, narave, zemlje, toda ugotavljamo, da so na drugi strani obstoječe organizacije, ki še nimajo celovitega razumevanja socialnega kapitala, ki se začne v pravičnosti in zaupanju ter nadaljuje v verigi ekosistema. Colarič – Jakše (2017) v delu »Sodelovalno mreženje in izraba inovacijskega potenciala v turističnem prostoru« ugotavlja tudi, da je socialni kapital podlaga za razvoj znanja in tudi podlaga za razvoj različnih kompetenc. Pri tem izpostavlja dejstva po Argyrisu in Schönu (1978), da učenje kompetenc ni samo sprejemanje informacij, pač pa se učenje prične, ko posamezniki ugotovijo, da njihovi miselni modeli niso več ustrezni za reševanje obstoječih problemov in morajo razviti nove, zato pa potrebujejo nove socialne mreže. Socialni kapital pa predstavlja osnovo za razvoj novih socialnim mrež, ki ustvarjajo nove ideje in spodbujajo razvoj novega znanja. Vsled temu smo razvili metodologijo z naravnim krožnim principom in naredili koncept z gradniki: človek (odnosi, čustvovanje, razmišljanje, usmerjanje in delovanje), podeželsko okolje, naravni viri in organizacije (podjetništvo) – interakcije v avtopoiezi. Ugotovili smo, da obstoječe organizacije izgubljajo vrednost kakovosti življenja, zdravja in varnosti.

Krog ustvarjalnosti je potrebno začeti s samo-čutenjem kot človeško vrlino, ki se v timu s so-čutenjem in čuječnostjo ustvarja s simbioznimi poklici. Sonaravna njiva deluje po teh principih in ne daje samo zdrave hrane, ampak lahko s simbioznimi poklici ustvarja največjo dodano vrednostjo, kar predstavlja velik potencialni naboj in preboj so-naravnega podjetništva. Predstavljeni koncept prispeva k zavedanju človeka o stanju kakovosti organizacij in usmerja k preobrazbi v samo-organizacijske, sonaravne, so-ustvarjalne time. Predstavlja organizacijo nove dobe – naše prihodnosti, ki bo zmožna preživeti človeka, pri čemer je avtopoietski koncept zelo obetaven za dobrobit vseh. Z boljšo komunikacijo krepimo družbeno odgovornost in izboljšujemo okolje, kar napovedujemo v perspektivi naravne evolucije in osebni rasti človeka, tako v notranjih kot zunanjih procesih (ekosistemih in ekologiji), kar bo prispevalo h kakovosti okolja in so-naravni družbi.

5 Izzivi za prihodnost

Hrana in pijača sta osnovni življenjski dobrini, brez katerih ne moremo živeti, zato ju moramo pridelovati sami v domačem prostoru, in ne prepuščati svetovnim trgom ter dopuščati dolge globalne oskrbovalne verige. Krajšanje dobavnih verig še nikoli ni bilo tako nujno kot v obdobju izredne situacije na področju gospodarstva – pandemije koronavirusa SARS-COV-2, ki je pokazala, kako pomembne so močne in odporne verige preskrbe s hrano in kako pomembno je kmetijstvo v času kriznih razmer. Na eni strani se odraža ekološki pritisk, ki kaže pot v sivo prihodnost, če ga zanemarimo, drugi pa se je pokazal v najnovejši krizi pandemije globalnih dimenzij.

Pomembna je samo-oskrbnost ali nakup surovin, živil, pridelkov in izdelkov na lokalnih kmetijah, kjer je kratka pot »od njive, do mize«. Pri tem je potrebna velika mera povezovanja, sodelovanja, mreženja in trajne usmerjenosti, tako med ponudniki kot tudi prebivalstvom, saj želimo, da ljudje živimo v sožitju in medsebojni ustvarjalnosti, da bomo lahko tudi v mednarodnem prostoru samozavestni, suvereni in odločni – zato moramo biti vedno bolj neodvisni in opremljeni z znanjem.

V Sloveniji, v središču Evrope, je možno vzpostaviti primer simbioze soustvarjanja AS Akademije, ki ima poslanstvo: raziskovanje, revitalizacijo in rast poslovnih skupnosti, z izobraževalno ustanovo Grma Novo mesto – centra biotehnike in turizma v vertikalni izobraževalni strukturi ter Visoko šolo za upravljanje podeželja Grm Novo mesto, ki izobražujeta za poklice prihodnosti in dajeta odgovore na vprašanja širših družbenih razsežnosti, tako na formalni kot tudi neformalni ravni. Na Grmu Novo mesto – centru biotehnike in turizma se opravljajo tudi nacionalne poklicne kvalifikacije za pridobitev certifikatov iz mnogih področij. Izobraževanja na izobraževalnih institucijah, ki so usmerjena v pridobivanje dodatnih poklicnih kvalifikacij, spretnosti, veščin in kompetenc, se izvajajo tudi z ogledi primerov dobrih praks iz področja upravljanja podeželja, turističnega razvojnega menedžmenta in doživetij v slovenskem prostoru. AS Akademija je usmerjena predvsem v poslovni svet, da že mlade podpre s socialnim fenomenom 'Autopoiesis', v povezavi z vsemi ravnmi menedžmenta, organizacije, antropologije, humanistike, zdravja na vseh nivojih, s praktičnimi rešitvami in z oplemenitvijo z življenjsko-kozmično energijo za posameznika, time in organizacije. Pri tem je vodilo vizija AS Akademije: Soustvarjati z lastno energijo preboja, integriteto in modrostjo,

strokovnim znanjem do autopoietic organizacij, sistema in družbe v Sloveniji, Evropi in na Planetu. Vizija Grma Novo mesto – centra biotehnike in turizma: Postati prepoznavna vzgojno izobraževalna in razvojna inštitucija, ki bo imela prepoznavno filozofijo vzgoje, izobraževanja in razvoja. Njegovi ključni strateški cilji so usmerjeni v področja: (1) usposabljanja o pridelavi in oblikovanju varne hrane, zdrave narave in okolja, (2) razvoja organizacijskih in povezovalnih odnosov, (3) razvoja pozitivnega odnosa do narave, soljudi ter v smeri poštenega in iskrenega odnosa do potrošnikov, (4) modernizacije sistema vzgoje, izobraževanja in usposabljanja ter oblikovanja dobrega sistem vseživljenjskega učenja, (5) dostopa vseživljenjskega izobraževanja, usposabljanja in ustreznega svetovanja za vse zainteresirane, (6) sinergističnih učinkov na kakovost izobraževalnega in delovnega procesa ter kakovost proizvodov, (7) odličnosti vzgojno-izobraževalnega procesa idr. Usmeritve pa daje tudi Visoka šola za upravljanje podeželja Grm Novo mesto z vizijo: Postati mednarodno stičišče javnih in zasebnih inštitucij iz Slovenije in EU za razvoj programskih vsebin urejanja podeželja in trajnostne rabe naravnih virov ter s tem najboljši varuhi podeželskega prostora, prehranske varnosti, poseljenosti podeželja in narave ter strateškimi usmeritvami (1) odličnost pedagoškega dela, (2) odličnost aplikativnega raziskovalnega dela, (3) zadovoljstvo zaposlenih, (4) zadovoljstvo študentov, (5) zadovoljstvo odjemalcev storitev, (6) utrjevanje in prepoznavnost v okolju, (7) razvoj novih poklicev kot odgovor na spreminjajoče se potrebe, in (8) internacionalizacija.

V okviru koncepta »Od njive do mize in do akademije« je možno vzpostaviti model izobraževanja za sonaravne podjetnike skozi samo-organizacijsko, so-naravno in družbeno odgovorno podjetništvo, kot vseživljenjski program učenja. Izhajamo iz vizije, da občutno izboljšamo kakovost življenja mladih, da si najdejo simbiozo v komplementarnih posameznikih, da se medsebojno podprejo, si pomagajo, soustvarjajo, sodelujejo in ponovno pridobijo timsko pripadnost, nesebičnost in solidarnost. V tovrstnih so-naravnih simbiozah vidimo moč tima za preživetje in na ta način poskusimo odpraviti stres, ki ga prinaša tekmovalnost in prekarnost. Na so-naravnih delovnih mestih predpostavljamo, da bo so-naravni podjetnik, skupaj s svojim mikro ali makro timom, lahko nosilec simbiotskega so-naravnega gospodarjenja na lokalni ravni, pri tem pa jih z našim konceptom lahko multidisciplinarno in multiplikativno vseobsežno podpremo.

Na takšen način bo lahko slovensko podeželje bolj odporno na spremembe, ki jih prinaša globalni svet in s tem globalizacija, digitalizacija in robotizacija, zagotovljeno bo kakovostnejše sodelovanje in mirnejše, manj stresno življenje. S tovrstnim načinom izobraževanja skušamo izboljšati notranjo ekologijo so-naravnih podjetnikov in posledično predpostavljamo, da se lahko izboljša tudi zunanja ekologija: zemlje, vode in zraka ter posledično kakovost bivanja na podeželju in predvsem, da bi so-naravno podjetništvo zaživelo v mestih.

Literatura

Adam, F., Rončevič, B. & Tomšič, M. (2022). *Socialni kapital – za SRS*. Pridobljeno 15. 10. 2022). http://www.slovenijajutri.gov.si/fileadmin/urednik/dokumenti/sockap.pdf.

Argyris, C., & Schon, D. (1978). *Organizational learning: A theory of action perspective* . Reading, MA: Addison Wesley .

Ambrož, M., & Colarič Jakše, L.-M. (2015). *Pogled raziskovalca: Načela, metode in prakse*. Zora. Maribor: Mednarodna založba za slovanske jezike in književnosti.

Balažic Peček, T. (2018). *Gradniki avtopoieze v 4.0 organizaciji*. (doktorska disertacija). Novo mesto: Fakulteta za organizacijske študije.

Balažic Peček, T. (2019). Avtopoieza med Človekom in robotom v organizaciji prihodnosti. *38. Mednarodna konferenca o razvoju organizacijskih znanosti: Ekosistem organizacij v dobi digitalizacije*, Slovenija, Portorož, 20.-22. marec 2019, str. 75-88, Maribor: Fakulteta za organizacijske vede.

Balažic Peček, T. & Bukovec, B. (2020). *Foundations of Autopoiesis in an Organization: Autopoietic 4.0 Human €Evolution*. Borovnica: Institute of Autopoietic Organization.

Colarič – Jakše, L. – M. (2017). *Sodelovalno mreženje in izraba inovacijskega potenciala na turističnem prostoru*. Novo mesto: Fakulteta za organizacijske študije v Novem mestu.

Ećimović, T. (2016). *Univerzalna vzgoja in izobraževanje in Filozofija trajnostne sonaravne prihodnosti Slovenk in Slovencev*. Izola: Mestna knjižnica.

Evropska komisija. (20. 5. 2020). COM (2020) 381 final. Sporočilo komisije evropskemu parlamentu, svetu, evropskemu ekonomsko-socialnemu odboru in odboru regij. Strategija "od vil do vilic" za pravičen, zdrav in okolju prijazen prehranski sistem. Bruselj.

Granowetter, M. S. (1973). The strength of weak ties. American Journal of Psychology, 78(6), 1360–1380.

Hrovat, T., & Hrovat, A. (2016). Etični kodeks članov gospodarskega grozda »zaupanja vreden«. Grm Novo mesto – center biotehnike in turizma. Novo mesto.

Komat, A. (2017). *Zemlja, voda, seme*. Domžale: Samozaložba in Buča d.o.o.

Kordeš, U. (2004). *Od resnice k zaupanju*. Ljubljana: Studia humanitatis.

Kordeš, U., & Smrdu, M. (2015). *Osnove kvalitativnega raziskovanja*. Koper: Založba univerze na Primorskem.

Lavrič, M. & Naterer, A. (2020) The power of authoritative parenting: A cross-national study of effects of exposure to different parenting styles on life satisfaction. *Elsevier. Volume 116, September 2020, https://doi.org/10.1016/j.childyouth.2020.105274*.

Maturana, H. R., & Varela, F. J. (1980). *Autopoiesis and cognition: The realization of the Living*. London: D. Reidel Publishing Company.

Maturana, H. R., & Varela, F. J. (1998). *Drevo spoznanja*. Ljubljana: Studia humanitatis.

Mesec, B. (1998). *Uvod v kvalitativno raziskovanje v socialnem delu*. Ljubljana: Visoka šola za socialno delo.

Putnam, R. D. (1993). Making democracy work: Civic traditions in modern Italy. Princeton, NJ: Princeton University Press.

Putnam, R. D. (1995). Tuning in, tuning out: The strange disappearance of social capital in America. Political Science and Politics, 28(4), 664–683.Roblek, V. Meško, M., & Krapež, A. (2015). A complexity view of industry 4.0. *Sage Open*. 6 (2). doi:10.1177/2158244016653987

Schwab, K. (2016). *Četrta industrijska revolucija*. Ženeva: World Economic Forum.

Strategije slovenskega turizma 2022–2028, Ministrstvo za gospodarski razvoj in tehnologijo Republike Slovenije (2022)

Strateški načrt skupne kmetijske politike za obdobje 2023–2027 za Slovenijo, ki ga je Vlada RS potrdila na seji 28. 9. 2022. Ministrstvo za kmetijstvo, gozdarstvo in prehrano

Tesla, N. (2013). *Moji izumi (My inventions)*. Ljubljana: Založba Sanje

Veza, I., Mladineo, M., & Gjeldum, N. (2015). Managing Innovative Production Network of Smart Factories. *Science Direct*. 48 (3) 555-560. https://doi.org/10.1016/j.ifacol.2015.06.139

Wang, S., Wan, J., Li, D., & Zhang, C. (2015). Implementing Smart Factory of Industrie 4.0: An Outlook. *Sage Journal*. 12(1). https://doi.org/10.1155/2016/3159805

DOPOLNILNE DEJAVNOSTI NA SLOVENSKIH KMETIJAH– OVIRA ALI PRILOŽNOST

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Sinopsis Dopolnilne dejavnosti na kmetiji so na slovenskih kmetijah vse pomembnejše. Kmetije jih prepoznavajo kot dodaten vir prihodkov. Zato se število kmetij z dopolnilnimi dejavnostmi iz leta v leto povečuje. V letu 2022 je bilo preko 5.000 kmetij z registriranimi dopolnilnimi dejavnostmi. Vsaka kmetija ima lahko registriranih več dejavnosti in tako so kmetije registrirale preko 20.000 dejavnosti. Kmetije se najpogosteje odločajo za registracijo dejavnosti predelave primarnih proizvodov in storitev s kmetijsko in gozdarsko opremo. Sicer se kmetije lahko odločijo za registracijo 133 dejavnosti, ki jih izvajajo kot dopolnilne dejavnosti. Za registracijo se najbolj odločajo manjše do srednje velike kmetije in kmetije na območjih z omejenimi dejavniki. Po pregledu literature in analize dopolnilnih dejavnosti v letu 2022 lahko zaključimo, da so dopolnilne dejavnosti dobra priložnost za stabilizacijo dohodkov marsikatere slovenske kmetije.

Ključne besede: kmetija, dopolnilna dejavnost, območja z omejenimi dejavniki, stabilen prihodek kmetije

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SUPPLEMENTARY ACTIVITIES ON SLOVENIAN FARMS – OBSTACLE OR OPPORTUNITY

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Abstract Supplementary activities on the farm are increasingly important on Slovenian farms. Farms recognize them as an additional source of income. That is why the number of farms with supplementary activities is increasing year by year. In 2022, there were over 5,000 farms with registered supplementary activities. Each farm can have several activities registered, and so farms have registered more than 20,000 activities. Farms most often decide to register the activity of processing primary products and services with agricultural and forestry equipment. Otherwise, farms can decide to register 133 activities that they carry out as supplementary activities. Small to medium-sized farms and farms in areas with limited factors mostly decide to register. After reviewing the literature and analyzing supplementary activities in 2022, we can conclude that supplementary activities are a good opportunity to stabilize the incomes of many Slovenian farms.

Keywords: farm, supplementary activity, areas with limited factors, stable farm income

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1 Uvod

Na kmetijskih gospodarstvih v Republiki Sloveniji poteka pretežno primarna pridelava hrane in reja živali. Za nekatera kmetijska gospodarstva je pomembna dejavnost tudi gozdarstvo. Slovenska kmetijska gospodarstva gospodarijo na eni najmanjših površinah v Evropski uniji, če kmetijska gospodarstva primerjamo po povprečni velikosti zemljišč v uporabi. V Republiki Sloveniji kmetijska gospodarstva kmetujejo na povprečno 7,0 ha kmetijskih zemljišč (Travnikar, 2022). Zaradi majhnega obsega primarne pridelave se vse več kmetijskih gospodarstev odloča za dodatne vire prihodkov, s čimer stabilizirajo dohodek kmetijskega gospodarstva. In ena od dodatnih virov prihodkov so dopolnilne dejavnosti na kmetiji, s čimer kmetije stabilizirajo in ustvarjajo nova delovna mesta. Dopolnilna dejavnost na kmetiji je v Zakonu o kmetijstvu[1] definirana kot dejavnost, ki omogoča rabo proizvodnih zmogljivosti in delovnih moči kmetije ter pridobivanje dodatnega dohodka na kmetiji.

2 Pregled literature

2.1 Pregled zakonodaje

Nosilec dopolnilne dejavnosti na kmetiji je skladno z Zakonom o kmetijstvu lahko nosilec kmetije, član kmetije, ki ima za opravljanje dopolnilne dejavnosti soglasje nosilca ali zaposleni na kmetiji, ki so vpisani v register kmetijskih gospodarstev. Nosilec dopolnilne dejavnosti mora pred začetkom opravljanja dopolnilne dejavnosti pridobiti dovoljenje upravne enote. Na posameznih kmetijah lahko istočasno opravljajo več različnih dopolnilnih dejavnosti, za katere izpolnjujejo pogoje in imajo dovoljenje. Osnovni pogoj za pridobitev dovoljenja za opravljanje dopolnilnih dejavnosti na posamezni kmetiji je vsaj en hektar primerljivih kmetijskih površin v uporabi[2] ali vpis vsaj 10 čebeljih družin v register čebelnjakov[3].

[1] Zakon o kmetijstvu (ZKme), Uradni list RS, št. 45/08, 57/12, 90/12 – ZdZPVHVVR, 26/14, 32/15, 27/17, 22/18, 86/21 – odl. US, 123/21 in 44/22

[2] Za preračun 1 ha primerljivih kmetijskih površin se šteje:

- 1 ha njivskih površin;
- 2 ha travniških površin;
- 0,25 ha trajnih nasadov;
- 0,1 ha rastlinjakov ali
- 8 ha plantaž gozdnega drevja.

[3] Vir: Uredba o dopolnilnih dejavnostih na kmetijah, Uradni list RS, št. 57/15 in 36/18

Na kmetijah se lahko opravljajo številne različne dopolnilne dejavnosti. Skladno z Uredbo o dopolnilnih dejavnostih se lahko opravljajo naslednje skupine dopolnilne dejavnosti:

1. predelava primarnih kmetijskih pridelkov;
2. predelava gozdnih lesnih sortimentov;
3. prodaja kmetijskih pridelkov in izdelkov s kmetij;
4. vzreja in predelava vodnih organizmov;
5. turizem na kmetiji;
6. dejavnost, povezana s tradicionalnimi znanji na kmetiji, storitvami oziroma izdelki;
7. predelava rastlinskih odpadkov ter proizvodnja in prodaja energije iz obnovljivih virov;
8. storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela;
9. svetovanje in usposabljanje v zvezi s kmetijsko, gozdarsko in dopolnilno dejavnostjo;
10. socialno varstvo.

Uredba podrobneje določa vrste dejavnosti v vsaki od navedenih 10 skupin dopolnilnih dejavnosti na kmetiji.

Kmetije, ki želijo opravljati dopolnilne dejavnosti, se morajo registrirati na upravni enoti. Upravna enota dovoljenje vpiše v register kmetijskih gospodarstev. Kmetije z dopolnilno dejavnostjo morajo vsaj 50 % surovin, potrebnih za opravljanje dopolnilnih dejavnosti, pridelati na kmetiji. Prav tako skladno z Uredbo o dopolnilnih dejavnostih lahko ponudbo pri prodaji izdelkov lastne kmetije dopolnijo z izdelki drugih kmetij (delež prodanih lastnih kmetijskih izdelkov in pridelkov mora znašati najmanj 30 %).

Nosilec dopolnilnih dejavnosti na kmetiji mora voditi knjigovodstvo. Letni prihodek na zaposlenega ne sme presegati treh povprečnih letnih plač na zaposlenega v Sloveniji za preteklo leto, razen na območjih z omejenimi dejavniki za kmetijsko dejavnost, kjer je največji letni prihodek lahko višji, in sicer do 5 povprečnih letnih plač na zaposlenega v Sloveniji. Nosilec dopolnilnih dejavnosti je skladno z

Zakonom o dohodnini[4] dolžan poleg oddaje bilance do 31. marca tekočega leta za preteklo leto sporočati tudi dohodek iz dopolnilne dejavnosti na upravno enoto do 30. junija tekočega leta za preteklo leto.

2.2 Registrirane dopolnilne dejavnosti v Sloveniji

Na dan 20. 10. 2022 so bile registrirane kmetijske dejavnosti na 5069 kmetijah (MKGP, 2022), kar je 436 več kot v letu 2018 (Udovč, 2018). Na nekaterih kmetijah je več nosilcev dopolnilnih dejavnosti, skupaj 5.215, v letu 2018 jih je bilo 548 manj.

V letu 2022 so se kmetije lahko registrirale za opravljanje ene od 133 dejavnosti. Kmetije se skladno z Uredbo o dopolnilnih dejavnostih[5] lahko registrirajo za opravljanje posameznih dejavnosti znotraj 10 skupin dejavnosti, ki so:

1. predelava primarnih kmetijskih pridelkov,
2. predelava gozdnih lesnih sortimentov,
3. prodaja kmetijskih pridelkov in izdelkov s kmetij,
4. vzreja in predelava vodnih organizmov,
5. turizem na kmetiji,
6. dejavnost, povezana s tradicionalnimi znanji, storitvami oziroma izdelki,
7. predelava rastlinskih odpadkov ter proizvodnja in prodaja energije iz obnovljivih virov,
8. storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela,
9. svetovanje in usposabljanje v zvezi s kmetijsko, gozdarsko in dopolnilno dejavnostjo,
10. socialno-varstvene storitve.

Skupina dejavnosti Turizem na kmetiji se statistično vodi pod dvema podskupinama, in sicer:

1. turizem na kmetiji, ki je gostinska dejavnost,
2. turizem na kmetiji, ki ni gostinska dejavnost.

[4] Zakon o dohodnini, Uradni list RS, št. 13/11 – uradno prečiščeno besedilo, 9/12 – odl. US, 24/12, 30/12, 40/12 – ZUJF, 75/12, 94/12, 52/13 – odl. US, 96/13, 29/14 – odl. US, 50/14, 23/15, 55/15, 63/16, 69/17, 21/19, 28/19, 66/19 in 39/22

[5] Uredba o dopolnilnih dejavnostih na kmetijah, Uradni list RS, št. 57/15 in 36/18

Znotraj skupine Predelava primarnih kmetijskih pridelkov se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za (MKGP, 2022):

- proizvodnja moke in drugih mlevskih izdelkov,
- peka kruha in potic ter peciva in slaščic,
- proizvodnja testenin,
- peka sadnega kruha (kruha z dodatki sadja ipd.), trajnega peciva, kolačev z dodatki,
- kandiranje sadežev in drugih delov rastlin,
- proizvodnja rastlinskega olja in predelava semen oljnih rastlin,
- predelava in konzerviranje krompirja,
- proizvodnja sadnih in zelenjavnih sokov,
- predelava in konzerviranje sadja in zelenjave,
- proizvodnja vlaknin iz poljščin,
- proizvodnja kisa,
- zakol živali in predelava mesa,
- predelava mleka,
- proizvodnja sladoleda,
- predelava medu, cvetnega prahu, matičnega mlečka, propolisa, in voska,
- predelava zelišč,
- proizvodnja eteričnih olj,
- predelava gozdnih sadežev,
- proizvodnja žganih pijač,
- proizvodnja piva, medenega piva,
- proizvodnja drugih fermentiranih pijač in sadnih vin,
- pečenje kostanja, koruze, semen, oreškov in prodaja tega na stojnicah,
- predelava volne,
- proizvodnja krmil,
- konzerviranje in vlaganje jajc.

Znotraj skupine Predelava gozdno lesnih sortimentov se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- izdelava lesnih briketov in pelet,
- izdelava lesene embalaže,
- izdelava žaganega, skobljanega in impregniranega lesa (deske, tramovi), izdelava drogov, kolov, železniških pragov,
- izdelava enostavnih izdelkov iz lesa,
- izdelava drv ali lesnih sekancev iz kupljenih gozdnih lesnih sortimentov in izdelava lesnih sekancev v predelovalnem obratu ali za proizvodnjo energije iz kupljenih gozdnih lesnih sortimentov.

Znotraj skupine Prodaja kmetijskih pridelkov in izdelkov s kmetij se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- prodaja na kmetiji in prodaja od vrat do vrat,
- prodaja na lokalnem trgu,
- prodaja na drobno po pošti preko interneta,
- prodaja trgovcem na drobno, institucijam in gostinskim obratom.

Znotraj skupine Vzreja in predelava vodnih organizmov se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- vzreja vodnih organizmov,
- predelava vodnih organizmov.

Znotraj skupine Turizem na kmetiji, ki je gostinska dejavnost se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- turistična kmetija z nastanitvijo,
- izletniška kmetija,
- vinotoč,
- osmica.

Znotraj skupine Turizem na kmetiji, ki ni gostinska dejavnost se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- prevoz potnikov z vprežnimi vozili in traktorji,
- ježa živali,
- oddajanje površin za piknike,
- muzeji in tematske zbirke,
- tematski parki,
- apiturizem,
- športni ribolov na vodnih površinah na kmetiji.

Znotraj skupine Tradicionalna znanja na kmetiji, storitve oziroma izdelki se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- lončarstvo,
- izdelava in oblikovanje keramike,
- pletarstvo,
- tkalstvo,
- izdelovanje krpank,
- ročno pletenje in kvačkanje,
- izdelovanje kvačkanih vezenin,
- domača suhorobarska galanterija in nadaljevanje stare suhorobarske dediščine,
- medičarstvo in lectarstvo, dražgoški kruhki, medenjaki, pecivo in slaščice,
- svečarstvo,
- sedlarstvo,
- coklarstvo,
- umetnostno kovaštvo,
- domače tesarstvo,
- domače mizarstvo,
- rezbarstvo,
- izdelovanje intarzij,
- čebričarstvo, sodarstvo,

- kolarstvo – izdelovanje lesenih koles za vozove, delov vozov in vozov v celoti – kmečkih vozov in kočij,
- izdelovanje klekljanih čipk,
- izdelovanje vezenin,
- piparstvo,
- slamnikarstvo,
- izdelovanje narodnih noš,
- izdelovanje umetnega cvetja,
- apnenčarstvo,
- umetnostno kamnoseštvo,
- vrvarstvo,
- izdelovanje bičev,
- izdelovanje maskot,
- izdelovanje replik slovenske kulturne dediščine,
- oglarstvo,
- ročno poslikavanje najrazličnejših predmetov – replike skrinj, panjskih končnic, slik na steklu in drugih izdelkov naše dediščine,
- dekorativno oblikovanje iz naravnih in umetnih materialov,
- ročno izdelane igrače in lutke,
- polstenje,
- izdelava skodel, skrilj,
- krovstvo s slamo, skodlami in skriljem,
- izdelki iz čebeljega voska,
- podkovno kovaštvo,
- izdelava slame za krovstvo,
- aranžiranje, izdelava in prodaja vencev, šopkov in drugih aranžmajev iz na kmetiji vzgojenega cvetja ter travniških in gozdnih rastlin,
- peka kruha in potic na tradicionalni način,
- proizvodnja testenin na tradicionalni način,
- peka peciva in slaščic na tradicionalni način,
- izdelki iz suhega cvetja in dišavnic,
- predelava zelišč in dišavnic na tradicionalni način,
- izdelava mila na tradicionalni način,

- predelava volne na tradicionalni način,
- nega telesa in sproščanje s panjskim zrakom,
- nabiranje smole.

Znotraj skupine Predelava rastlinskih odpadkov ter proizvodnja in prodaja energije iz obnovljivih virov se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- zbiranje in kompostiranje odpadnih organskih snovi,
- proizvodnja in prodaja energije iz lesne biomase,
- proizvodnja in prodaja energije iz gnoja, gnojevke in gnojnice ter rastlinskega substrata,
- proizvodnja in prodaja energije iz sončnega vira,
- proizvodnja in prodaja energije iz vodnega vira,
- proizvodnja in prodaja energije iz vetrnega vira.

Znotraj skupine Storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- storitev delo s traktorjem in drugo strojno opremo,
- storitev vzdrževanje cest in pluženje snega,
- storitev vzdrževanje zelenic,
- storitev sečnja,
- storitev spravilo lesa iz gozda,
- storitev izdelava drv in lesnih sekancev iz gozdnih lesnih sortimentov za proizvodnjo energije,
- storitev izdelava lesnih briketov in pelet,
- storitev gojenje in varstvo gozdov,
- storitev žaganje in skobljanje lesa,
- storitev prevoz mleka, živali,
- storitev točenje medu, polnjenje in pakiranje čebeljih pridelkov in izdelkov ter izdelava satnic,
- storitev zakol živali,
- storitev predelava mesa,

- storitev predelava mleka,
- storitev stiskanje kmetijskih pridelkov za olje,
- storitev proizvodnja sadnih in zelenjavnih sokov,
- storitev mletje žit,
- storitev predelava in konzerviranje sadja in zelenjave,
- storitev pakiranje pridelkov in izdelkov,
- storitev opravljanje posebnih ročnih kmetijskih del in oskrbe živali,
- storitev nadomeščanje na kmetijah.

Znotraj skupine Svetovanje in usposabljanje v zvezi s kmetijsko, gozdarsko in dopolnilno dejavnostjo se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- svetovanje o kmetovanju,
- organiziranje delavnic ali tečajev,
- usposabljanje na kmetiji,
- prikaz del iz kmetijske, gozdarske in dopolnilne dejavnosti,
- svetovanje in prikazi iz kmečkih gospodinjskih opravil,
- svetovanje uporabnikom čebeljih pridelkov in uporabnikom eteričnih olj.

Znotraj skupine Socialno varstvo se kmetije lahko registrirajo za eno ali več dejavnosti, in sicer za:

- celodnevno bivanje odraslih in starejših oseb, ki niso odvisne od tuje pomoči pri opravljanju osnovnih dnevnih opravil,
- dnevne oblike bivanja odraslih in starejših oseb, ki niso odvisne od tuje pomoči pri opravljanju osnovnih dnevnih opravil.

Po podatkih Statističnega urada RS (Krajnc, Šuštar, 2021) je bilo v Sloveniji leta 2020 nekaj več kot 67.900 kmetijskih gospodarstev. Dopolnilno dejavnost na kmetiji ima v letu 2022 registriranih 5.069 kmetij, kar predstavlja 7,6 % vseh kmetijskih gospodarstev. Kot že omenjeno, se kmetije lahko registrirajo za eno ali več dopolnilnih dejavnosti. Vseh registriranih dejavnosti na kmetijah z dopolnilnimi dejavnostmi je 21.856. Od 5.069 kmetij ima le eno dopolnilno dejavnost registriranih

zgolj 1.480 kmetij. Največ kmetij ima registriranih od 2 do 5 dopolnilnih dejavnosti. Kmetija z največjim številom registriranih dejavnosti ima kar 56 različnih dejavnosti. V povprečju imajo kmetije z dopolnilnimi dejavnostmi registriranih 4,3 dejavnosti oziroma 4,2 dejavnosti na nosilca dopolnilnih dejavnosti na kmetiji (nekatere kmetije imajo dva nosilca dopolnilnih dejavnosti, zato je nosilcev dopolnilnih dejavnosti 5.215). Podrobnosti so podane v naslednji tabeli.

Tabela 1: Pregled kmetij z dopolnilnimi dejavnostmi glede na število registriranih dopolnilnih dejavnosti na nosilca dopolnilnih dejavnosti[6]

število dopolnilnih dejavnosti na kmetiji	1	2 do 5	6 do 10	11 do 15	16 do 20	21 do 30	31 do 40	41 do 50	51 do 56
število kmetij	1480	2405	993	216	78	36	5	0	2

3 Pregled registriranih dopolnilnih dejavnosti v Sloveniji

3.1 Struktura kmetij z dopolnilnimi dejavniki

Kmetije registrirajo dopolnilno dejavnost z namenom povečanja in stabilizacije dohodka družine, ki dela na kmetiji. Zato se za registracijo dopolnilnih dejavnosti pogosteje odločajo kmetije, ki delujejo v težjih pridelovalnih pogojih in manjše kmetije. Povprečna velikost kmetij z registrirano dopolnilno dejavnostjo je 17,24 ha, kar je precej več od povprečne velikosti kmetijskih gospodarstev v Sloveniji (MKGP, 2022). Ne glede na to pa je razpon velikosti kmetij z dopolnilno dejavnostjo manjši. Največja velikost kmetije z registrirano dopolnilno dejavnostjo je 666,4 ha, medtem ko je največje kmetijsko gospodarstvo v Sloveniji z okoli 4.000 ha. Povprečno največja kmetijska gospodarstva z registrirano dopolnilno dejavnostjo so v Prekmurski statistični regiji (29,59 ha), kar sovpada s siceršnjo velikostjo kmetij v tej regiji, najmanjša pa v Zasavski statistični regiji (12,08 ha).

Najmanjša kmetijska gospodarstva omejuje pri registraciji dopolnilnih dejavnosti tudi minimalna velikost kmetije, ki je opredeljena v Uredbi o dopolnilnih dejavnostih. Ta namreč določa, da morajo imeti kmetijska gospodarstva vsaj 1 ha primerljivih kmetijskih površin ali vsaj 10 čebeljih družin, razen v primeru registracije

[6] Vir: MKGP, anonimizirani podatki, elektronsko pošiljanje 24. 10. 2022

dejavnosti sušenja zelišč, kjer je ta meja 0,02 ha. Prav tako Uredba o dopolnilnih dejavnostih v drugem odstavku 10. člena te uredbe navaja, da morajo kmetije za opravljanje dopolnilnih dejavnosti pridelati najmanj 50 odstotkov količin lastnih surovin, ostalo pa lahko dokupijo pri drugih slovenskih kmetijah. Iz omenjenih razlogov se najmanjše kmetije ne registrirajo za opravljanje dopolnilnih dejavnosti, zato je povprečna velikost kmetij z dopolnilnimi dejavnostmi večja kot je povprečna velikost kmetijskih gospodarstev v Sloveniji.

Kmetije se v večjem deležu registrirajo za opravljanje dopolnilnih dejavnosti na območjih z omejenimi dejavniki. Kar 87,8 % kmetij z dopolnilnimi dejavnostmi je na območjih z omejenimi dejavniki, medtem ko je na nivoju Slovenije takšnih zemljišč 75,9 % (Travnikar, 2021). V nekaterih statističnih regijah so skoraj vse kmetije z registriranimi dopolnilnimi dejavnostmi na območjih z omejenimi dejavniki, in sicer v Koroški (99,47 %), Notranjsko-kraški (99,47 %), Zasavski (98,00 %) in Goriški statistični regiji (96,05 %).

Tabela 2: Število nosilcev dopolnilnih dejavnosti (DD), število nosilcev dopolnilnih dejavnostmi na območjih z omejenimi dejavniki (OMD), število točk OMD na hektar in na nosilca dopolnilnih dejavnosti, delež nosilcev v OMD in povprečna velikost kmetij z dopolnilno dejavnostjo glede na statistično regijo sedeža kmetije z dopolnilno dejavnostjo

STATISTIČNA REGIJA	število nosilcev DD	število nosilcev DD z OMD točkami	Povprečno število točk OMD/ha na nosilca DD	Povprečno število točk OMD/nosilca DD	Delež nosilcev DD v OMD	Povprečna velikost kmetij z registriranoDD (ha)
GORENJSKA	643	517	221,25	2083,50	80,40%	13,41
SPODNJESAVSKA	215	186	332,90	2341,33	86,51%	12,47
OBALNO-KRAŠKA	201	189	313,27	2729,91	94,03%	18,59
POMURSKA	372	208	202,21	3273,54	55,91%	29,59
SAVINJSKA	928	877	356,81	3288,02	94,50%	13,97
NOTRANJSKO-KRAŠKA	187	186	179,25	3381,98	99,47%	21,03
GORIŠKA	430	413	330,40	3581,23	96,05%	14,96
PODRAVSKA	828	687	343,05	3803,41	82,97%	19,51
JUGOVZHODNA SLOVENIJA	403	383	314,08	3900,63	95,04%	18,66
OSREDNJESLOVENSKA	583	510	276,23	3992,64	87,48%	18,62
ZASAVSKA	50	49	393,88	4393,64	98,00%	12,08
KOROŠKA	375	373	377,19	4578,19	99,47%	14,47

3.2 Demografski podatki o kmetijah z dopolnilnimi dejavnostmi

Povprečna starost nosilcev kmetijskih gospodarstev v Sloveniji je 59,3 leta (Ravnik, 2019). Podatki o starostni strukturi nosilcev in članov kmetijskih gospodarstev z registrirano dopolnilno dejavnostjo pa vendarle kažejo, da je na teh kmetijah starostna struktura ugodnejša. Povprečna starost nosilcev dopolnilnih dejavnosti je 49,19 let, pri čemer je najvišja v Obalno-kraški statistični regiji (51,36 let) in najnižja v Osrednjeslovenski statistični regiji (47,20 let). Podatki nakazujejo, da se za registracijo dopolnilnih dejavnosti odločajo mlajši nosilci kmetij, kar je z vidika razvoja kmetij ugodno.

Nosilci dopolnilnih dejavnosti so pretežno moški, saj je kar tri četrtine vseh nosilcev dopolnilnih dejavnosti moških. Prav tako se večina nosilcev dopolnilnih dejavnosti prostovoljno vključi v pokojninsko in invalidsko zavarovanje. Od vseh nosilcev dopolnilnih dejavnosti, ne glede na nosilstvo kmetijskega gospodarstva (nosilec ali član) je namreč kar 58,9 % nosilcev prostovoljno vključeno v pokojninsko in invalidsko zavarovanje. Na kmetijah z dopolnilno dejavnostjo je v povprečju 4,13 članov. Največ članov je v povprečju v Zasavski (4,52 članov), najmanj pa v Notranjsko-kraški statistični regiji (3,74 članov na kmetijo).

Podrobnejši podatki so predstavljeni v naslednji tabeli.

Tabela 3: Spol nosilcev dopolnilnih dejavnosti na kmetiji, način vključitve v pokojninsko in invalidsko zavarovanje, povprečna starost nosilcev in članov kmetije ter povprečno število članov na kmetiji z dopolnilo dejavnostjo po statističnih regijah

	spol nosilca DD		Vključitev v pokojninsko in invalidsko zavarovanje			Povprečna starost		
STATISTIČNA REGIJA	moški	ženska	prostovoljna	Nosilec KG, KD je edina in glavna dejavnost	Član KG, KD je edina in glavna dejavnost	Nosilca DD	Vseh članov kmetije	povprečno število članov na kmetiji z DD
GORENJSKA	498	145	183	116	38	49,50	47,45	4,29
SPODNJESAVSKA	157	58	50	19	7	50,58	48,98	4,26
OBALNO-KRAŠKA	138	63	46	25	6	51,36	50,20	3,78
POMURSKA	272	100	89	71	15	49,52	49,41	3,94
SAVINJSKA	681	247	303	117	57	48,54	47,64	4,18
NOTRANJSKO-KRAŠKA	152	35	33	12	11	49,28	48,42	3,74

	spol nosilca DD		Vključitev v pokojninsko in invalidsko zavarovanje			Povprečna starost		
STATISTIČNA REGIJA	moški	ženska	prostovoljna	Nosilec KG, KD je edina in glavna dejavnost	Član KG, KD je edina in glavna dejavnost	Nosilca DD	Vseh članov kmetije	povprečno število članov na kmetiji z DD
GORIŠKA	346	84	157	48	17	49,32	48,98	4,00
PODRAVSKA	597	231	234	173	37	48,86	48,85	3,98
JUGOVZHODNA SLOVENIJA	337	66	119	54	12	48,80	48,16	4,20
OSREDNJESLOVENSKA	457	126	167	102	32	49,54	47,20	4,35
ZASAVSKA	36	14	18	3	1	47,94	47,88	4,52
KOROŠKA	280	94	112	63	19	48,49	48,32	4,27

3.3 Registrirane dopolnilne dejavnosti na kmetijah

Podrobnejši pregled registriranih dopolnilnih dejavnosti pokaže, da je v letu 2022 največ dopolnilnih dejavnosti registriranih znotraj skupine Storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela, in sicer 7.493. Znotraj te skupine je tudi najpogosteje registrirana dejavnost izmed vseh dejavnosti, in sicer je kar 1646 kmetij registriralo »storitev delo s traktorjem in drugo strojno opremo«. Več kot 50 % vseh registriranih dejavnosti predstavljata skupini Storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela in Predelava primarnih kmetijskih pridelkov. Podrobnejši podatki so predstavljeni v naslednji tabeli.

Tabela 4: Število kmetij z registrirano dopolnilno dejavnostjo po skupinah dopolnilnih dejavnosti

skupina dopolnilnih dejavnosti	število kmetij	število kmetij v %
predelava primarnih kmetijskih pridelkov	4863	22,22%
predelava gozdnih lesnih sortimentov	1603	7,34%
prodaja kmetijskih pridelkov in izdelkov s kmetij	1179	5,40%
vzreja in predelava vodnih organizmov	40	0,18%
turizem na kmetiji, ki je gostinska dejavnost	1335	6,11%
turizem na kmetiji, ki ni gostinska dejavnost	730	3,34%
tradicionalna znanja na kmetiji, storitve oziroma izdelki	2398	10,97%
predelava rastlinskih odpadkov ter proizvodnja in prodaja energije iz obnovljivih virov	605	2,77%
storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela	7493	34,32%
svetovanje in usposabljanje v zvezi s kmetijsko, gozdarsko in dopolnilno dejavnostjo	1598	7,30%
socialno varstvo	12	0,04%

Podrobnejši pogled registriranih dopolnilnih dejavnosti po posameznih skupinah in regijah nam pokaže precej razlik glede deleža dopolnilnih dejavnosti med statističnimi regijami. Analiza nam kaže, da je največ dopolnilnih dejavnosti skupine Predelava primarnih kmetijskih pridelkov v Podravski statistični regiji, in sicer 19,14 % glede na vse statistične regije. Največ registriranih dejavnosti znotraj skupine Predelava gozdnih lesnih sortimentov je v Savinjski statistični regiji, in sicer kar 21,21% glede na vse statistične regije. Je pa ta skupina dopolnilnih dejavnosti razširjena tudi v Gorenjski statistični regiji z 19,78 % deležem. Skupina Prodaja kmetijskih pridelkov in izdelkov s kmetije najbolj razširjena v Podravski statistični regiji z 26,12 % deležem. Dejavnosti znotraj skupine Vzreja in predelava vodnih organizmov je najbolj razširjena v Jugovzhodni statistični regiji z 27,50 % deležem glede na vse statistične regije. Skupina dopolnilnih dejavnosti Turizem na kmetiji se najpogosteje pojavlja v Savinjski z16,42 % in Podravski statistični regiji z 15,54 % deležem glede na vse statistične regije. Savinjska z 21,15 % in Podravska statistična regija z 19,60 % sta regiji z najpogostejšo registracijo dejavnosti v skupini Dejavnost, povezana s tradicionalnimi znanji, storitvami oziroma izdelki. Skupina Predelava rastlinskih odpadkov ter proizvodnja in prodaja energije iz obnovljivih virov je najbolj zastopana v Savinjski statistični regiji z 22,15 % deležem. Storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela je skupina dejavnosti, ki se izmed vseh statističnih regij najpogosteje registrira na kmetijah v Gorenjski z 16,03 %, Podravski z 15,88 % in Savinjski statistični regiji z 15,60 % deležem. Na kmetijah se najpogosteje registrirajo dejavnosti iz skupine Svetovanje in usposabljanje v zvezi s kmetijsko, gozdarsko in dopolnilno dejavnostjo v statistični regiji Podravje z 18,71 % in Savinjska z 15,83 % deležem glede na vse statistične regije. Socialno varstvene storitve pa se kot skupina dejavnosti najpogosteje pojavlja v Savinjski statistični regiji s 25,00 % deležem glede na vse statistične regije. Podatki z absolutnimi številkami so predstavljeni na naslednji tabeli.

Tabela 6: Delež registriranih dopolnilnih dejavnosti po posameznih statističnih regijah in skupinah dopolnilnih dejavnosti

	predelava primarnih kmetijskih pridelkov	predelava gozdnih lesnih sortimentov	prodaja kmetijskih pridelkov in izdelkov s kmetij	vzreja in predelava vodnih organizmov	turizem na kmetiji	dejavnost, povezana s tradicionalnimi znanji, storitvami oziroma izdelki	predelava rastlinskih odpadkov ter proizvodnja in prodaja energije iz obnovljivih virov	storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela	svetovanje in usposabljanje v zvezi s kmetijsko, gozdarsko in dopolnilno dejavnostjo	socialno-varstvene storitve
ZASAVSKA	20,35%	11,50%	0,88%	0,00%	9,29%	16,37%	0,88%	31,42%	9,29%	0,00%
NOTRANJSKO-KRAŠKA	21,90%	8,42%	7,94%	0,00%	8,66%	7,22%	1,56%	37,91%	6,14%	0,24%
KOROŠKA	15,71%	10,51%	2,50%	0,06%	7,63%	14,02%	3,38%	39,36%	6,82%	0,00%
SPODNJESAVSKA	34,26%	2,39%	5,54%	0,76%	9,32%	7,18%	3,02%	27,58%	9,70%	0,25%
GORIŠKA	23,25%	5,88%	2,68%	0,00%	14,30%	7,51%	2,02%	37,49%	6,86%	0,00%
JUGOVZHODNA SLOVENIJA	19,51%	9,11%	5,34%	0,59%	10,19%	8,36%	2,16%	37,90%	6,74%	0,11%
OBALNO-KRAŠKA	36,94%	0,51%	5,10%	0,00%	20,51%	9,90%	0,92%	15,31%	10,82%	0,00%
POMURSKA	31,81%	1,49%	9,47%	0,00%	9,03%	8,50%	5,70%	25,68%	8,33%	0,00%
OSREDNJESLOVENSKA	19,57%	10,26%	2,80%	0,13%	6,51%	9,44%	2,33%	42,20%	6,77%	0,00%
GORENJSKA	15,22%	10,36%	5,49%	0,20%	8,27%	11,73%	2,94%	39,24%	6,53%	0,03%
SAVINJSKA	21,75%	9,04%	5,00%	0,24%	9,01%	13,51%	3,56%	31,08%	6,73%	0,08%
PODRAVSKA	24,77%	3,83%	8,20%	0,11%	8,54%	12,51%	2,37%	31,67%	7,96%	0,05%

4 Zaključek

Analiza registriranih dopolnilnih dejavnosti na slovenskih kmetijah kaže, da se število kmetij in število dejavnosti iz leta v leto povečuje. Po številu registracij sta najpomembnejši skupini dopolnilnih dejavnosti Storitve s kmetijsko in gozdarsko mehanizacijo in opremo ter ročna dela in Predelava primarnih kmetijskih pridelkov. V posameznih statističnih regijah imajo različne skupine dopolnilnih dejavnosti različen pomen za kmetije v teh regijah. Dopolnilne dejavnosti so registrirane na manjših slovenskih kmetijah (četudi je povprečna velikost kmetij z dopolnilnimi dejavnostmi več kot 2 krat večja od povprečne velikosti vseh slovenskih kmetij) in pogosteje na območjih z omejenimi dejavniki. Povprečno so nosilci dopolnilnih dejavnosti in člani kmetije mlajši na kmetijah z dopolnilnimi dejavnostmi v primerjavi z vsemi slovenskimi kmetijami.

Ob zaključku analize poglejmo še v dohodkovno stran dopolnilnih dejavnosti. Analiza dohodkov dopolnilnih dejavnosti kaže na precejšnje razlike v povprečnih dohodkih iz dopolnilne dejavnosti na kmetijo med statističnimi regijami. Najvišji povprečni dohodki iz dopolnilne dejavnosti na kmetijo so v Zasavski statistični regiji, kjer je povprečni dohodek v višini 5.740,76 EUR, najnižji pa v Koroški statistični regiji v višini 1. 967,03 EUR. Podrobnejši podatki o povprečnih dohodkih so predstavljeni v naslednji tabeli.

Tabela 7: Povprečni prihodki iz dopolnilne dejavnosti na kmetijo v EUR po posameznih statističnih regijah

STATISTIČNA REGIJA	povprečni dohodek iz dopolnilne dejavnosti/kmetijo (v EUR)
GORENJSKA	5.586,32
SPODNJESAVSKA	3.626,99
OBALNO-KRAŠKA	2.557,63
POMURSKA	4.651,42
SAVINJSKA	3.732,54
NOTRANJSKO-KRAŠKA	3.182,34
GORIŠKA	5.553,99
PODRAVSKA	4.628,43
JUGOVZHODNA SLOVENIJA	3.417,03
OSREDNJESLOVENSKA	3.781,59
ZASAVSKA	5.740,76
KOROŠKA	1.967,03

Na podlagi analize podatkov lahko zaključimo, da slovenske kmetije vse bolj prepoznavajo pomen dopolnilnih dejavnosti za stabilizacijo dohodka na kmetiji. Zaradi tega se število dopolnilnih dejavnosti povečuje, prav tako tudi pestrost. In v kolikor bo zaživel novi Zakon o dolgotrajni oskrbi, bo tudi v tem zakonu podlaga za nove dopolnilne dejavnosti socialnega varstva na kmetijah, kjer bo financiranje dejavnosti sistemsko urejeno. Zato lahko zaključimo, da so dopolnilne dejavnosti priložnost za dodaten razvojni potencial strukturno nekonkurenčnih slovenskih kmetij.

Viri in literatura

Travnikar, T. (2022,). Poročilo o stanju kmetijstva, živilstva, gozdarstva in ribištva v letu 2021, Kmetijski inštitut Slovenije

MKGP, (2022) anonimizirani podatki o dopolnilnih dejavnostih, elektronska pošta 24. 10. 2022

Udovč, A. (2018), Analiza stanja dopolnilnih dejavnosti, Univerza v Ljubljani, Biotehniška fakulteta

Krajnc, A., Šuštar, Č. (2021). Prvi podatki iz Popisa kmetijskih gospodarstev, Slovenija 2020, Statistični urad RS

Ravnik, B. (2019). Kako ob naravnih danostih in strukturi kmetijstva v Sloveniji dosegati zadovoljive dohodke v kmetijstvu, 34. tradicionalni posvet Javne službe kmetijskega svetovanja Skupaj za napredek slovenskega kmetijstva in podeželja, Laško, 2019.

HRANA ZA ZEMLJO – FERMENTIRANO ORGANSKO GNOJILO

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Sinopsis Uporaba mineralnih gnojil predstavlja v Sloveniji največji vir vnosa hranil v rastlinski pridelavi. Zaradi vse večje osveščenosti mladih, državnih spodbud za ekološko kmetovanje in tudi zaradi vse bolj naraščajočih cen mineralnih gnojil pa uporaba organskih gnojil v kmetijstvu narašča. Pod organska gnojila štejemo predvsem gnojila, ki se pridobivajo iz rastlinskih in živalskih odpadkov, prav tako tudi podorine. Boljšo oskrbo rastlin s hranili lahko dosežemo tudi z vključevanjem metuljnic v kolobar. Gospod Dušan Portatis Kovač je na podlagi svojih izkušenj in znanja, ki ga je pridobil v tujini, ter z uporabo lokalno dostopnih odpadnih naravnih sestavin, naredil mešanico organskega gnojila, ki s posebnim postopkom fermentacije zagotavlja konstantno vsebnost dušika in ne zahteva dragih postopkov predelave. Tako narejeno naravno organsko gnojilo je bogat vir hranil za rodovitno zemljo in rastline ter pomaga ohranjati zdravje pridelkov. Prispevek opisuje idejno zasnovo, kako izkoristiti odpadne surovine iz slovenskih kmetij in predelave rib ter z nizkimi proizvodnimi stroški narediti kakovostno naravno gnojilo za obnovo rodovitne zemlje, za uporabo v tržnem kmetijstvu ter samooskrbnem pridelovanju hrane.

Ključne besede:
organsko gnojilo,
kmetijstvo,
organski odpadki,
fermentacija,
hrana

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FOOD FOR THE SOIL – FERMENTED ORGANIC FRTILIZER

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Abstract In Slovenia, the use of mineral fertilizers represents the largest source of nutrients in crop production. The use of organic fertilizers in agriculture is increasing due to the increasing awareness of young people, state incentives for organic farming and due to the ever-increasing prices of mineral fertilizers. Organic fertilizers mainly include fertilizers obtained from plant and animal waste, as well as green manure. A better supply of plants with nutrients can also be achieved by including legumes in the rotation. Mr. Dušan Portatis Kovač, based on his experience and knowledge that he acquired abroad, and by using locally available waste natural ingredients, made a mixture of organic fertilizer that, through a special fermentation process, ensures a constant nitrogen content and does not require expensive processing procedures. The natural organic fertilizer made in this way is a rich source of nutrients for fertile soil and plants and helps to maintain crop health. The paper describes the conceptual design of how to utilize waste raw materials from Slovenian farms and fish processing and, with low production costs, to make a high-quality natural fertilizer for the restoration of fertile land, for use in market agriculture and self-sufficient food production.

Keywords:
organic fertilizer, agriculture, organic waste, fermentation, food

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1 Uvod

Z naraščanjem prebivalstva narašča tudi potreba po pridelavi več hrane, kar je v prejšnjem stoletju botrovalo razvoju sintetičnih gnojil, ki so vedno bolj spodrivala naravni način gnojenja obdelovalnih površin. Desetletja uporabe sintetičnih gnojil v kmetijstvu je pustilo posledice ne samo na prsti (zemlji), ki je postala osiromašena, ampak tudi na kakovosti hranil v pridelkih in na odzivu človeka, ki uživa tako pridelano hrano. Pretirana uporaba mineralnih gnojil pušča posledice tudi v okolju, saj se presežek hranil izpere v globje plasti in v podtalnico. S tega vidika je problematičen zlasti dušik, ki se ne veže v tleh in je izredno mobilen (K. Mengel, E. A. Kirkby, 1987).

Dušan Portatis Kovač je inovator, podjetnik, profesionalni kuhar in certificiran zeliščar, ki je veliko časa namenil raziskovanju, kaj ljudje jedo in kako pripravljajo hrano, na področij sveta, kjer ni bolezni, kot jih poznamo v Evropi, saj je opazil, da kljub temu, da ljudje, ki jedo ekološko pridelano hrano, pogosto zbolijo. Za svoje raziskovalne namene je tudi veliko potoval po svetu, največkrat na jugovzhod Indije. Tam je spoznal velike kmetovalce, ki na ilovnati zemlji in z zelo omejenimi viri vode, pridelujejo izredno kvaliteten riž in zelenjavo. To ga je zelo presenetilo in želel je izvedeti skrivnost. Z znanjem iz Indije je pred šestimi leti preizkusil doma narejeno gnojilo na njivi, ki je imela podobno ilovnato strukturo in na njej ni nič zraslo. Na veliko presenečenje vseh sosedov, je bil pridelek tisto leto zelo bogat.

Na podlagi lastnih izkušenj iz svojega dela, z znanjem iz Indije in z uporabo lokalno dostopnih virov, je Dušan Portatis Kovač sestavi novo gnojilo, ki istočasno hrani zemljo in daje optimalne pogoje za rast rastlinam.

2 Primerjava koristi organskega gnojila v primerjavi z mineralnim gnojilom

Vrsto let se je s pospeševanjem predelave hrane postavljalo v ospredje hitro rast in bogat pridelek, posledice pa sedaj občuti izčrpana zemlja, ki za svojo obnovo potrebuje bistveno več časa in hranil, kot če bi za njeno regeneracijo skrbeli sproti. V Sloveniji večino hranil, potrebnih za rast in razvoj, vnesemo v tla preko mineralnih gnojil. Po podatkih Statističnega urada Slovenije (22. 10. 2022) smo v Sloveniji v letu 2021 porabili okoli 124.000 ton mineralnih gnojil. Ta gnojila so vsebovala 44.179 ton

glavnih rastlinskih hranil (dušik, fosfor in kalij). Na podlagi teh podatkov je bil 1 ha kmetijskega zemljišča v uporabi pognojen z 61 kg dušika, 15 kg fosforja in 17 kg kalija.

Veliko razprav je napisanih glede prednosti in omejitev pri uporabi sintetičnih gnojil in organskih gnojil. Obe gnojili ponujata ugodne rešitve na svoj edinstven način in obe gnojili imata tudi svoje pomanjkljivosti. Pri rabi tal za pridelavo hrane ali krme je potrebno le-te uporabljati na način, da zagotavljamo njihovo trajnost, ne glede na vrsto uporabljenih gnojil. Vendar pa organska gnojila pomembno prispevajo k zagotavljanju rodovitnosti tal (Sisay, A. in Sisay T., 2019)

Kratek povzetek prednosti in slabostih obeh gnojil je predstavljen v Tabeli 1.

Tabela 1: Kratek povzetek prednosti in slabosti mineralnih in organskih gnojil

ORGANSKA GNOJILA	MINERALNA GNOJILA
– pridobivanje iz stranskih produktov živih organizmov	– pridobivanje iz naftne industrije
– hranljiva vrednost lahko niha in je splošno nižja v primerjavi z mineralnimi gnojili – mikrohranila, ki so bistvena za rastline, so tipično prisotna	– hranljiva vrednost se lahko prilagodi za posebne potrebe – na splošno ne vsebujejo mikrohranil
– mikrobi v prsti sprostijo hranila – stopnja sproščanja je počasna – rast rastlin daljše časovno obdobje – zahteva manj ponovitev – močno zmanjša možnost izpiranja ali odtekanja vode	– voda sprosti hranila – stopnja sproščanja je hitra in kratkotrajna – hitra rast rastlin – zahteva bolj pogoste ponovitve – poveča možnost prekomernega gnojenja, ki lahko vodi do ožganin, izpiranja in odtekanja
– vsebuje organske snovi – izboljša strukturo tal in zadrževanje vode, mikroorganizmom zagotavlja hrano in poveča izkoristek hranil	– ne vsebuje organske snovi za izboljšanje strukture tal

Vir: Renewable Energy & Sustainability News, 2018

Kot lahko razberemo iz tabele 1, je edina pomanjkljivost organskih gnojil v tem, da je vsebnost hranil, topnost in stopnja sproščanja hranil običajno veliko nižja od sintetičnih gnojil, zato je rast rastlin bolj počasna in pridelek praviloma skromen, po drugi strani pa je ravno to prednost, saj organska gnojila dodajajo strukturo prsti in spodbujajo zdravo rast koristnih bakterij in gliv v zemlji, to pa zagotavlja hrano za rastline dlje časa in razvoj močnega in zdravega koreninskega sistema rastlin (slika

1). Zato se zadnje čase pri obdelavi kmetijskih površin pogosteje uporablja kombinacija gnojenja tako z organskimi kot s sintetičnimi gnojili.

Vendar, če bi lahko izluščili samo dobre lastnosti obeh gnojil, opisanih v tabeli 1, bi lahko sestavili optimalno kombinacijo gnojila, ki bi istočasno koristilo tako za obnovo zemlje kot tudi za zdravo rast rastlinam in njihov bogat in kakovosten pridelke. Prav slednje pa je Dušan Portatis Kovač uspel narediti z inovativnim pristopom pri obdelavi gnojila živalskega izvora (hlevski gnoj) in kombinacijo zelišč, gob in naravnega vulkanskega minerala.

3 Fermentirano organsko gnojilo

Dušana Portatis Kovača je pri proizvodnji koncentriranih hranil za ljudi, brez uporabe umetnih dodatkov, veliko časa posvetil eksperimentiranju in optimizaciji procesov, da bi iz zelišč, sadja, gob in zelenjave pridobil čim več aktivnih zdravilnih in hranilnih učinkovin ter čim manj odpadka. Razmišljal je tudi, kako bi lahko koristno uporabil odpadke iz svoje proizvodnje na domačem vrtu. Po prvem preizkusu gnojilo, ki ga je sam pripravil po recepturi, ki so mu jo zaupali kmetje v Indiji, je ugotovil, da lahko ta recept še izboljša z uporabo ostankov iz lastne proizvodnje, dodatkom določenih vrst rastlin ter gob in iz majhne količine hlevskega gnoja naredi še bolj močno gnojilo, ki bo bolj obstojno predvsem z vidika mineralne strukture in ne bo imelo tako neprijetnega vonja.

Dušan Portais Kovač je izvedel participativno raziskovanje s pridelovalci hrane v Indiji. Raziskovanje je opravil v letu 2017, ko je proučeval pridelovanje hrane v vasici Lachhipur v Zahodni Bengaliji. V tem delu Indije tla za pridelavo hrane glinena in globoka, v njih zastaja voda, sposobnost izmenjave plinov med podzemno in nadzemno plastjo je zelo omejena, zato so takšna tla manj primerna za pridelovanje hrane. Ne glede na to, pa v omenjeni vasici pridelujejo kvalitetno hrano in dosegajo visoke pridelke. Zato je g. Dušan Portais Kovač v fazi raziskovanja opravil več intervjujev, s čimer je želel pridobiti ključne informacije o načinu kmetovanja. Najprej se je srečal z učiteljem »sun yogi« Uma Shankarjem, ki mu je predstavili vasico in njihov način življenja ter kmetovanja. Kasneje se je srečal tudi s kmetovalci, ki so mu predstavili pripravo fermentiranega gnojila, ki kmetovalcem v tej vasici omogoča konkurenčno rastlinsko pridelavo. Na podlagi prejetih informacij je pričel

s pripravo fermentiranega gnojila in ga skozi proces priprave za uporabo tudi primerno dopolnjeval.

3.1 Priprava

Za pripravo gnojila po postopku, kot ga uporabljajo na jugovzhodu Indije, se lahko uporabi svež ali uležan kravji gnoj, lahko tudi gnoj drobnice in konj, ostanke odpadnega listja in zelenjave, gabez, koprivo, preslico in trsni sladkor. Sestavine je potrebno dobro premešati, zaliti z vodo, posodo dobro zatesniti ter pusti določeno število dni, da fermentira. Fermentirano gnojilo se nato precedi in embalira v primerne posode za prevoz in skladiščenje. Dobljeno tekočino se pred uporabo redči z vodo. Za pripravo zemlje na regeneracijo, jeseni po pobranih pridelkih in spomladi pred zasajanjem, se uporabi razmerje 1:3, to je en liter gnojila na tri litre vode. V času rasti, za dognojevanje oziroma zalivanje pa je dovolj 1 dcl gnojila na 12 litrov vode.

Postopek fermentacije organskega gnojila daje čisto in koncentrirano tekoče gnojilo, ki ima veliko prednosti v primerjavi z uporabo klasičnih organskih gnojil, kot so hlevski gnoj in kompost. Prednosti so predvsem:

- enostavna uporaba in skladiščenje,
- hitra absorpcija v zemljo in v korenine rastlin,
- visok delež dušika in drugih aktivnih snovi,
- ni bojazni za kontaminacijo s plevelom ali boleznimi.

3.2 Preizkus

Fermentirano tekoče gnojilo, pripravljeno po postopku, opisanem v prejšnjem poglavju, je Dušan Portatis Kovač najprej preizkusil na njivi, ki je bila nekaj let opuščena, ker lastnik na njej ni več uspel vzgojiti nobene rastline za prehrano. Po prvem uspehu, ko je z gnojenjem in zalivanjem že prvo leto na tej njivi pridelal zavidljivo lepe, okusne in zdrave pridelke, je recept za gnojilo še izboljšal z dodatkom gob in zeolita. Na podlagi znanja in izkušenj je predpostavljal, da bo tako izboljšana priprava gnojila dodala pomembne lastnosti gnojilu, tako da bo poleg hranilnih snovi za zemljo in rastline gnojilo istočasno povečalo tudi zadrževanje vode v podrastju, okrepilo zaščito rastlin pred boleznimi in pospešilo obnovo v primeru poškodb.

Navedene predpostavke temeljijo na poznavanju naravnih procesov rasti in poznavanju lastnosti učinkovin uporabljenih za pripravo gnojila.

Da bi se lahko prepričal ali njegovo gnojilo res deluje bolje kot druga gnojila, je Dušan Portatis Kovač pred petimi leti izvedel preizkus skupaj s tremi pridelovalci povrtnin iz različnih koncev Slovenije. Vsi štirje udeleženci poizkusa so istočasno vzeli sadike čebule, pora, zelja in solate pri istem dobavitelju in jih še isti dan posadili, vsak na svoj košček zemlje. Vsak udeleženec preizkusa je zalival, gnojil in skrbel za rastlin po svoje. Ko so bile rastline primerne za pobiranje, so udeleženci preizkusa prinesli svoje pridelke skupaj in ugotovili razlike. Kljub dejstvu, da so bili vsi trije povabljeni udeleženci preizkusa strokovno usposobljeni in veliki pridelovalci vrtnin, je imel Dušan Portatis Kovač očitno najboljši pridelek, tako po velikosti, barvi, okusu in vonju. To dejstvo je ostale pridelovalce tako navdušilo, da so že naslednje leto preizkusiti novo fermentirano gnojilo tudi na svojih pridelovalnih površinah.

Nova izkušnja, nova znanja in potrditev, da je njegovo gnojilo zelo učinkovito in dobro sprejeto med poznavalci, je g. Dušana Portatis Kovač navdihnilo za nove izboljšave. Tako je na podlagi raziskav kanadskih pridelovalcev organskih gnojil, ki so ugotovili, da so ribji odpadki izredno bogat vir dušika, naredil še eno različico fermentiranega organskega gnojila z dodatkom ribjih ostankov. Tako pridobljeno gnojilo je bolj primerno za uporabo na večjih kmetijskih površinah na prostem, saj ima poleg visoke koncentracije dušika tudi bolj močan vonj.

4 Zaključek

Rezultati prvih poskusov z uporabo novega fermentiranega gnojila so vzpodbudni. Zaradi tega bo g. Dušan Portatis Kovač nadaljeval s testiranjem do sedaj narejene različice gnojila. Prav tako bo preko poskusov ugotavljal njihov učinek in po potrebi še spreminjal recepturo gnojila in način uporabe. Na podlagi pridobljenih novih izkušenj bo nadaljeval s pripravo novih različic fermentiranega organskega gnojila, saj bo preko tega prišel do prototipa produkta, ki bo primeren za masovno uporabo. Zato bo z raziskovanjem nadaljeval in k sodelovanju povabil tudi druge raziskovalne inštitucije, ki bodo pri razvoju v pomoč.

Slika 1: Pridelek z uporabo gnojila v visoki gredi
Vir: lasten

Slika 2: Pridelek z uporabo gnojila na slabo rodovitni prsti
Vir: lasten

5 Povzetek

Predstavljen proces pridelave fermentiranega organskega gnojila je inovacija na področju predelave gnojil, saj v enem izdelku – gnojilu zagotavlja aktivne hranljive sestavine tako za rodovitnost pridelovalne zemlje, kot tudi za bujno in zdravo rast rastlin. Obenem omogoča koristno porabo odpadnega hlevskega gnoja in rastlinskih delov. Dve različici tekočega gnojila ponujata zelo široko možnost uporabe, tako za velike kmetijske površine, kot tudi za manjše vrtove, visoke grede ali balkonske rože.

S strokovnim pristopom in dobro izdelanim poslovnim načrtom, se na podlagi opisanega eksperimenta lahko odpira priložnost za vzpostavitev donosne proizvodnje z nizkimi obratovalnimi stroški. Nenazadnje pa opisan proces omogoča tudi trajnostni pristop za obnovo kmetijskih tal, pridelavo kvalitetne hrane in ohranjanje čistega okolja za prihodnje generacije.

Viri in literatura

Dr. Konrad Mengel, Ernest A. Kirkby, 1987, Principles of Plant Nutrition, International Potash Institute, Bern, Switzerland, 605 str.

Statistični urad Slovenije, Poraba mineralnih gnoji, 2021, https://www.stat.si/StatWeb/News/Index/10519, 22. 10. 2022

Sisay, A. in Sisey T., The Principle Role of Organic Fertilizers on Soil Properties and Agricultural Productivity, Agricultural Research and Technology, 2019

Organic Fertilizer od Synthetic: What's the Difference? Renewable Energy & Sustainability News, Blog, 2018, https://renergy.com/organic-fertilizer-vs-synthetic/, 22. 10. 2022

POTROŠNJA LOKALNO PRIDELANE HRANE V SLOVENIJI V ČASU UKRAJINSKE KRIZE

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Sinopsis Po pandemiji COVID-19 svet ponovno pretresajo izredni dogodki, tokrat v povezavi z ukrajinsko krizo. Ta se odraža na različnih področjih naših življenj, še najbolj pa se v Sloveniji odraža v visokih cenah življenjskih potrebščin in energentov. Zaradi visokih cen le-teh, gnojil in pomanjkanja ter omejitve izvoza nekaterih dobrin so se cene hrane bistveno zvišale glede na raven pred ukrajinsko krizo. Čeprav zavržena količina hrane na prebivalca po podatkih Statističnega Urada Republike Slovenije (SURS) za leto 2020 še vedno dosega okoli 68 kg na prebivalca na leto, se potrošniki začenjamo zavedati pomena dostopa do kakovostne hrane. Slovenija je že tradicionalno orientirana v pridelavo lokalnih živil, zadnja kriza s pandemijo COVID-19 pa je pomen lokalne samooskrbe samo še poglobila. Potrošniki se zavedajo, da so, zaradi prisotnih pretresov in nestabilnosti na trgih, lokalno pridelana živila vedno pomembnejša. S pojavom spletnih tržnic, ki so se razmahnile v času pandemije COVID-19, pa smo naredili korak bližje k digitalizaciji v kmetijstvu. Prav tako nas je zanimalo, ali se potrošniki sedaj bolj odločajo za nakup lokalnih živil preko spletnih tržnic.V članku predstavljamo raziskavo, izvedeno v oktobru 2022, s katero smo želeli preveriti, kakšen je odnos do lokalno pridelane hrane v Sloveniji v času ukrajinske krize in ali so se, glede na predhodne raziskave glede na čas pandemije COVID-19, navade kaj spremenile.

Ključne besede:
ukrajinska kriza,
kratke oskrbovalne verige,
lokalno pridelana živila,
potrošnik,
samooskrba

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Consumption of Locally Produced Food in Slovenia During the Ukrainian Crisis

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Abstract After the COVID-19 pandemic, the world is once again being shook by extraordinary events, this time related to the Ukrainian crisis. This is reflected in various parts of our lives, but in Slovenia mostly in the form of high prices of consumer goods and energy. High prices for these, fertilisers, and shortages, as well as restrictions on the export of some commodities, have led to a significant increase in food prices compared to pre-Ukrainian crisis levels. Although the amount of food wasted is still around 68 kg per capita per year, according to the Statistical Office of the Republic of Slovenia (SURS) for 2020, consumers are becoming aware of the importance of access to quality food. With the emergence of online marketplaces, which took off during the COVID-19 pandemic, we have also moved a step closer towards digitisation in the agriculture. We have also inspected whether consumers are now more likely to buy local food via online markets. In this paper, we present a survey conducted in October 2022 to examine attitudes towards locally produced food in Slovenia during the Ukrainian crisis and whether there have been any changes in habits compared to previous surveys during the COVID-19 pandemic.

Keywords: ukrainian crisis, short supply chains, locally grown food, consumer, self-sufficiency

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1 Uvod

Lokalne in regionalne oskrbovalne verige so v veliki meri odvisne od lokalnih ali mednarodnih nepredvidljivih dogodkov. Vpliv, ki ga imajo tovrstni dogodki na oskrbovalne verige, je neučinkovito delovanje oskrbovalnih verig (Sabates-Wheeler et al., 2008; Harvey et al., 2014).

Trenutno smo v Sloveniji, kakor tudi drugod po Evropski Uniji (EU), priča visoki inflaciji, ki je le ena izmed posledic ukrajinske krize. Ukrajinska kriza se je pričela 24. februarja 2022 z začetkom invazije Rusije na Ukrajino (STA, 2022).

Inflacija je po podatkih Eurostata za mesec september 2022 na letni ravni znašala okrog 9,9 % (Eurostat [Statistics Explained], 2022). Kot posledica različnih ekonomskih sankcij, ki jih je Evropska komisija sprejela proti Rusiji zaradi vojaške napotitve v Ukrajino, so se cene energentov, gnojil in ostalih drugih potrebščin zvišale. Po podatkih SURS-a (2022a) so se cene rastlinskih pridelkov v letu 2022 glede na leto 2021 na letni ravni zvišale v povprečju za 14,8 %. Najizraziteje so se podražila žita (za 77,3 %), precej pa tudi sveže zelenjadnice (za 25,4 %). Sadje se je po drugi strani pocenilo za 12,7 %.

Cene živali in živalskih proizvodov so zrasle za 33,1 %. Živali za zakol so se podražile za 26,5 %. Cene goveda so se zvišale skoraj za tretjino, najbolj pa so se dvignile cene krav. Dražji kot pred enim letom so tudi perutnina (za 20,7 %) in prašiči (za 26,3 %). Cene živalskih proizvodov so bile višje za 38,9 %. Povprečna cena mleka se je dvignila za 47,5 %, povprečna cena jajc pa za 20,0 % (SURS, 2022a).

Dvig cen ni presenetljiv, saj so se cene potrebnih vhodnih materialov (tj. gnojila, krmila, energenti) povišale za 31,5 % napram avgustu 2021. Trend rasti cene hrane je bil viden že v letu 2020 zaradi pandemije COVID-19 (SURS, 2021a), vendar dvig v primerjavi z zdajšnjo krizo ni bil tako izrazit. Pandemija COVID-19 je potrošnike spodbudila o razmisleku o lastni pridelavi hrane, vendar je v času pandemije v ospredje prišla težja dobavljivost blaga zaradi izdanih ukrepov karanten in izolacij, manj zaradi pomanjkanja surovin. Kot odgovor na težave z dobavljivostjo določenih artiklov in spodbujanja lokalne pridelave so se pojavile različne (spletne) tržnice (npr. Go2Farms, Tržnica na Borjaču, Jem domače idr.), ki so ponujale lokalno pridelano hrano z namenom zagotavljanja prehranskih izdelkov v primeru motenih

oskrbovalnih verig. Nekatere izmed njih so se razvile že pred pandemijo COVID-19, večina spletnih tržnic pa še vedno deluje in so v zadnjem času dosegle še večjo prepoznavnost, kar nakazuje, da so vsaj nekateri potrošniki spremenili svoje nakupovalne navade (Željan, 2020). Nadalje lahko prodajo živil lokalnih pridelovalcev preko spletnih tržnic smatramo kot eno izmed možnih oblik digitalizacije v kmetijstvu, ki lahko prispeva k povečani prepoznavnosti lokalnega pridelovalca, okrepi sodelovanje med potrošnikom in pridelovalcem in k uporabi lokalnih živil spodbudi generacije, ki so bolj navajene spletnih nakupov.

Potrošniki tako sedaj čutijo posledice višjih cen hrane, kar je zagotovo pri marsikaterem povzročilo spremembe nakupovalnih navad, saj so potrošniki postali preudarnejši, tudi ko gre za nakup prehranskih izdelkov. Omenjeno je povzročilo razmislek o lastni pridelavi hrane, v kolikor imajo za to primerna sredstva (znanje, obdelovalno površino, kmetijsko mehanizacijo itd.). Prav tako se za naslednja leta napoveduje še dodatno povišanje cen energentov in ostalih življenjskih potrebščin, kar se bo najverjetneje odrazilo še v dodatnem dvigu cene hrane.

V tem članku bomo predstavili rezultate raziskave, ki smo jo izvedli oktobra 2022, da bi preverili, kakšna je potrošnja lokalno pridelanih živil v Sloveniji v času ukrajinske krize. Teze, ki jih želimo preveriti so:

- Ukrajinska kriza je povečala zaupanje slovenskih potrošnikov v lokalno pridelana živila.
- Pridelava lastnih živil se je v času ukrajinske krize povečala.
- Navade potrošnikov se med ukrajinsko krizo glede na krizo s pandemijo COVID-19 niso bistveno spremenile.

2 Lokalno pridelana živila

Pojem lokalno pridelanih živil se nanaša na živila, ki so proizvedena, prodana in porabljena na določenem geografskem območju (Risku-Norja et al., 2008 v Šinko & Lisec, 2021). Različne države sveta pojem lokalno interpretirajo drugače, predvsem v smislu velikosti države oz. teritorija, v katerem jih opazujemo. V Združenih Državah Amerike velja definicija lokalno pridelane hrane za hrano, ki se prodaja v okolici 400 milj (okoli 644 km) od kraja izvora živila oz. države, v kateri je proizvedena (Martinez et al., 2010). V Kanadi se za lokalno pridelano hrano smatra

hrana, ki se prideluje in prodaja znotraj province oz. teritorija ali pa se prodaja čez meje province do 50 km od izvorne province oz. teritorija (Government of Canada, 2022). V EU organizacija Joint Research Center (Kneafsey et al., 2013) smatra lokalno pridelano hrano kot hrano, ki je pridelana, procesirana in prodana v okviru geografskega območja med krajem izvora do maksimalne oddaljenosti, ki znaša med 20 in 100 km. V Sloveniji velja splošna definicija, da je lokalni trg okolje, ki je od porabnika oddaljeno do okoli 60 kilometrov (»Lokalna oskrba s hrano in vrtnarjenje« [NIJZ], 2020), Zakon o kmetijstvu (Ur. L. RS, št. 45/08, 57/12, 90/12 – ZdZPVHVVR, 26/14, 32/15, 27/17, 22/18, 86/21 – odl. US in 123/21) pa opredeljuje lokalni trg kot celotno območje Republike Slovenije (velja za kmetijske pridelke in živila).

V Sloveniji se lokalna pridelava in odkup živil že dalj časa spodbujata z nacionalnim projektom »Naša super hrana«, ki »spodbuja potrošnike, da bi v svoji izbiri, raje kot po drugi, posegali po domači, lokalno pridelani hrani« (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2019a). S tem namenom je bila v Sloveniji od leta 2014 vzpostavljena shema kakovosti, ki opredeljuje domačo, lokalno, v Sloveniji pridelano in predelano hrano (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, b. d.). Da pridelovalci pridobijo certifikat »Izbrana kakovost«, namenjen kmetijskim pridelkom oziroma živilom s posebnimi lastnostmi, morajo zadoščati določenim strožjim kriterijem. Ti kriteriji se lahko nanašajo na sestavo, okolju prijazno pridelavo, kakovost surovin, dobrobit živali, posebno zdravstveno varstvo živali, način krmljenja, dolžino transportnih poti, predelavo, hitrost predelave surovin oziroma čim manj kasnejših obdelav pri skladiščenju in transportu. Z označbo »Izbrana kakovost – Slovenija« so označeni pridelki in izdelki, ki so pridelani in predelani v Sloveniji ter so deležni dodatnih, strožjih kontrol. Kot tak certifikat »Izbrana kakovost« sicer še ne pomeni hkrati tudi ekološke pridelave, k čemer pa je spodbujala dodatna kampanja ozaveščanja Ekološko in lokalno je idealno (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2020). Prav tako je Evropska komisija leta 2020 določila strategijo »od kmetije do vilic«, v kateri je navedeno, da bo »za povečanje odpornosti regionalnih in lokalnih sistemov preskrbe s hrano podprla zmanjšanje odvisnosti od prevoza na dolge razdalje, da bi ustvarila krajše dobavne verige« (European Comission, 2020). Jasno je torej, da si države močno prizadevajo za doseganje čim večje lokalne samooskrbe, saj na ta način pridelovalci in potrošniki spodbujajo lokalno gospodarstvo poleg drugih morebitnih blagodejnih učinkov.

Enthoven in Van der Broeck (2021) sta preverjala upravičenost trditev, ki se ponavadi omenjajo skupaj z lokalno pridelano hrano na osnovi analiz različnih znanstvenih del, ki se nanašajo na območje Severne Amerike in Evrope. Ugotovila sta, da je vpliv lokalnih sistemov pridelave na različne družbene, gospodarske in okolijske dejavnike zelo odvisen od vrste oskrbovalne verige, s pomembnimi razlikami med vrstami izdelkov in države. Avtorja ugotavljata, da ne moremo trditi, da je lokalna hrana že sama po sebi dobra oz. boljša od uvožene. Zdravstveno stanje potrošnikov, ki so vključeni v sistem lokalno pridelane hrane, je sicer boljše in je povezano z večjo porabo sveže, nepredelane hrane – predvsem sadja in zelenjave. Vendar pa točne vzročne povezave ni mogoče sklepati iz obstoječih študij. Edwards-Jones in soavtorji (2008) sicer trdijo, da je kakovost hrane bolj odvisna od časa pobiranja pridelka in tipa predelave kot same razdalje med pridelovalcem in potrošnikom. Z daljšanjem oskrbovalne verige od pridelovalca do končnega uporabnika se sicer zniža vsebnost vitaminov v hrani (predvsem vitamina C, A, B in E) (GOV.SI, 2020). Po drugi strani pa je varnost in kakovost hrane pri lokalnih sistemih pridelave bolj osnovana na zaupanju med pridelovalcem in potrošnikom, saj je načeloma uvožena hrana podvržena strožjim kontrolam (Cerrada-Serra et al., 2018). Prav tako so potrošniki odvisni od sezone oz. časa v letu, ko so določeni pridelki na voljo.

Nadalje Enthoven in Van den Broeck (2021) ugotavljata, da so potrošniki pripravljeni plačati višjo ceno za lokalno hrano v primerjavi z uvoženo, čeprav obstajajo pomembne razlike glede na značilnosti potrošnikov, njihove nakupne navade in tip izdelkov. Na podlagi analize, ki so jo izvedli v Sloveniji (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2019b), so avtorji raziskave prišli do podobnih zaključkov. Prav tako Enthoven in Van den Broeck (2021) ugotavljata, da kmetje čutijo priznanje za svoje delo v okviru lokalnih sistemov pridelave, kar je pogosto glavni razlog za njihovo sodelovanje v sistemu lokalne pridelave in tako predstavlja pomemben sociološki vidik.

Pri ovrednotenju blaženja podnebnih sprememb z zmanjšanjem števila opravljenih kilometrov znotraj lokalnih sistemov pridelave je potrebno upoštevati, da prevoz hrane ni glavni dejavnik podnebnih sprememb (Poore & Nemecek, 2018). Prav tako se emisije toplogrednih plinov iz oskrbovalnih verig s hrano (lokalne in globalne) bistveno razlikujejo glede na usklajevanje dobavne verige, učinkovitosti načina prevoza, ki ga potrošnik uporablja pri nakupu hrane, in učinkovitosti načina prevoza

za uvoz. Za celovito ovrednotenje prispevka toplogrednih plinov je potrebno upoštevati vse deležnike v pridelavi in predelavi živil, pri čemer pa transport predstavlja le okrog 6 % generiranih toplogrednih plinov, medtem ko kmetijstvo predstavlja do 61 % generiranih toplogrednih plinov (Poore & Nemecek, 2018). Predvsem živila živalskega izvora lahko ustvarijo bistveno več emisij toplogrednih plinov kot živila rastlinskega izvora (Our World in Data, 2020). Zaključimo lahko torej, da lokalno pridelana živila niso vedno nujno boljša od tistih, ki niso pridelana lokalno, kar pa je sicer močno odvisno od primera do primera.

3 Pomen lokalno pridelanih živil med ukrajinsko krizo

Podobno kot zdravstvena kriza, ki jo je povzročila pandemija COVID-19, ima tudi ukrajinska kriza za posledico motnje v oskrbovalni verigi, kar se je najbolj nazorno videlo pri izvozu žita v države tretjega sveta. Ocenjuje se, da se bo, zaradi ukrajinske krize, že zdaj rekordna raven akutne nezanesljive preskrbe s hrano močno povečala. V 81 državah, v katerih deluje Svetovni program Združenih narodov za hrano (WFP), naj bi se akutna lakota povečala za dodatnih 47 milijonov ljudi, z 276 milijonov na 323 milijonov – kar predstavlja 17 % dvig, pri čemer se bo najbolj povečala v podsaharski Afriki (Husain, 2022).

V tem primeru je jasno, da samooskrba z živili oz. lokalno pridelano hrano igra zelo pomembno vlogo, vendar je zaradi naravnih razmer v nekaterih delih sveta to zelo oteženo. Kinnunen in soavtorji (2020) ocenjujejo, da je mogoče le okoli tretjino svetovnega prebivalstva oskrbovati izključno lokalno, kar pomeni, da je oskrba s hrano iz drugih regij, držav in celo celin ključnega pomena za globalno prehransko varnost.

Čeprav bo oskrba s hrano na nek način vedno odvisna od zunanjih dejavnikov (gibanje globalnih trgov, cene energentov, vremenski pojavi, nemiri po svetu), pa lahko vsaj v določenem delu lokalni sistemi pridelave hrane omilijo omenjene odvisnosti. Prav tako ima lahko vrtnarjenje, ki je sicer samo ena od možnih oblik lokalne samooskrbe, v času različnih kriz tudi zelo pozitivne učinke na duševno zdravje in lahko celo predstavlja obliko terapije (Gerdes et al., 2022). Slovenci dosegamo glede domače samooskrbe z zelenjavo zadovoljiv delež, saj je po podatkih SURS-a (2021b) v svojem vrtu pridelovalo zelenjavo za lastno porabo skoraj 60 % gospodinjstev v Sloveniji.

Za dosego pozitivnih učinkov na račun lokalno pridelane hrane je pomembno, da se v lokalno samooskrbo začne vključevati že šoloobvezne otroke. Pregledane študije kažejo (Mishra et al., 2022), da se s programom »od kmetije do šole« povečuje nakup lokalno pridelane hrane, kar malim kmetom prinaša višje prihodke. S pomočjo programa »od kmetije do šole« so v pilotni študiji ugotovili tudi povečanje diverzifikacije kmetijskih pridelkov, vključenost skupnosti in nove priložnosti za kmetijska podjetja. S podobnimi programi lahko izboljšamo dobrobit za lokalne šole, proizvajalce, skupnosti in izboljšamo zdravstvene rezultate za šoloobvezne otroke.

3.1 Potrošnja lokalnih živil v Sloveniji

Slovenski potrošniki smo v letu 2021 za hrano porabili okoli 14,4 % vseh svojih izdatkov, kar nas uvršča nekoliko pod povprečje v EU, ki znaša 14,8 % (SURS, 2021a). Čeprav podatkov o tem, koliko Slovenci letno porabimo za lokalno pridelana živila ni, pa na drugi strani obstajajo ocene o tem, koliko povprečno letno slovenski potrošnik porabi za ekološko pridelana živila. Ocena se giblje med 70 in 100 € na leto (IRSA, 2020). Kar se tiče samooskrbe, smo bili v Sloveniji po podatkih SURS-a v letu 2020 z žiti samooskrbni v 88 %, z mesom 84 %, z jajci 95 %, krompirjem 60 %, zelenjavo 48 % in medom 67 % (SURS, 2022b). Glede na obdobje spremljanja od leta 2001 do 2020 smo v Sloveniji na področju samooskrbe z žiti in zelenjave precej napredovali, na področju mesa pa nekoliko nazadovali. Podatki nakazujejo na to, da je sicer še vedno veliko hrane potrebno uvoziti, kjer je zagotovo veliko priložnosti za izboljšave.

Na podlagi študije percepcije potrošnikov živilskih proizvodov iz shem kakovosti (Univerza v Novem mestu, Fakulteta za ekonomijo in informatiko, b. d.) so raziskovalci ugotovili, da so slovenski potrošniki pripravljeni plačati več za živila, nad katerimi se izvaja strog nadzor nad kakovostjo (48 %), ki so proizvedena lokalno (46 %) in na kmetijah (40 %). Dodatno so ugotovili, da največji delež Slovencev kupuje živila slovenskega porekla iz sektorja meso in mesnih izdelkov, mleka in mlečnih izdelkov, ki jim sledi delež iz sektorja zelenjave in sadja, najmanj pa iz sektorja žita in žitni izdelki. O velikem zaupanju do lokalno pridelanih živil glede na raziskavo priča dejstvo, da Slovenci najbolj zaupajo neposrednemu stiku s kmetom (70 %), nasvetom prijateljev, sorodnikov in znancev (59 %) in strokovni literaturi (50 %).

Omenjeno priča o tem, da je zavest o lokalno pridelani hrani pri nas močno razvita, kar se je zagotovo povečalo v času pandemije COVID-19. Raziskava, povezana s potrošnjo lokalno pridelane hrane v Sloveniji, je bila izvedena v letu 2021 (Šinko & Lisec, 2021). Usmerjena je bila v iskanje razlik pri potrošnji lokalno pridelane hrane zaradi pandemije COVID-19. Rezultati so pokazali, da je delež tistih, ki so med pandemijo COVID-19 pričeli z uživanjem lokalnih živil, višji za kar 34 %, število tistih, ki so začeli s pridelavo lastnih živil pa je višje za 7 %.

Spodbudno je tudi dejstvo, da je v Sloveniji pri javnem naročanju živil v javnih zavodih določeno pravilo, ki pravi, da mora javno naročilo vsebovati vsaj 15 % ekoloških živil in najmanj 15 % živil iz drugih shem kakovosti (GOV.SI, 2020).

4 Metodologija

Raziskava temelji na anketnem vprašalniku, ki je bil uporabljen že za raziskavo vpliva pandemije COVID-19 na potrošnjo lokalno pridelane hrane v Sloveniji (Šinko & Lisec, 2021). Vprašalnik je bil sestavljen v spletnem okolju za anketiranje 1Ka Arnes. Anketo smo aktivirali 18. oktobra 2022, z izvajanjem pa smo zaključili 24. oktobra 2022.

Anketni vprašalnik je bil, tako kot tisti iz predhodne raziskave, sestavljen iz 24 vprašanj, izmed katerih je 10 vprašanj namenjenih demografskim podatkom anketiranih (spol, starost, izobrazba, zaposlitev, število članov v gospodinjstvu, tip naselja, regija bivanja, tip prebivališča, porabljen znesek za hrano in neto dohodek). Ostalih 14 vprašanj je bilo namenjenih preverjanju odnosa anketirancev do lokalnih živil in sprememb zaradi ukrajinske krize.

Sodelovanje v raziskavi je bilo prostovoljno, povezavo do anketnega vprašalnika smo med populacijo (prebivalci Republike Slovenije) delili s pomočjo družbenih omrežij in preko e-pošte.

Na nagovor ankete je kliknilo 115 ljudi, 58 izmed teh je anketo rešilo do konca vsebinskega dela vprašalnika, izpustili pa so demografski del. Kljub temu smo jih v analizo vsebinskega dela vključili.

Po koncu zbiranja podatkov smo podatke izvozili v programsko opremo Microsoft Excel in jih statistično ovrednotili, da bi odgovorili na zastavljena raziskovalna vprašanja.

5 Rezultati

5.1 Demografski podatki anketirancev

Po izločitvi nepopolno rešenih anket je ostalo 58 takšnih, ki smo jih lahko vključili v končno analizo. V anketi je sodelovala večina žensk (77,59 %), medtem ko je bilo moških, ki so sodelovali v anketi, le 8,62 %. 13,79 % anketiranih svojega spola ni izdalo. Najmlajši anketiranec je bil star 19 let, najstarejši pa 63 let. Povprečna starost anketiranih je bila 37,84 let s standardnim odklonom 13,11 let. Podrobnejša frekvenčna porazdelitev anketiranih po letih je predstavljena v Tabeli 1.

Tabela 1: Starost anketiranih

	Frekvenca	Odstotek [%]
Do 25 let	5	8,62
25 – 35 let	21	36,21
35 – 45 let	5	8,62
45 – 55 let	10	17,24
55 – 65 let	8	13,79
Nad 65 let	0	0,00
Brez odgovora	9	15,52
Skupaj	58	100

Vir: Lasten vir

Predpostavili smo, da stopnja izobrazbe vpliva na odnos do lokalno pridelanih živil, zato smo v anketni vprašalnik vključili tudi vprašanje o najvišji doseženi stopnji izobrazbe. Najvišji odstotek anketiranih je dosegel univerzitetno izobrazbo (25,86 %), sledijo pa anketirani s srednješolsko izobrazbo (18,97 %). Najmanj je takšnih, ki imajo višješolsko izobrazbo (3,45 %) in tistih, ki imajo zaključeno poklicno šolo (8,62 %). Podrobnejša frekvenčna porazdelitev izobrazbe anketiranih je predstavljena v Tabeli 2.

Tabela 2: Izobrazba anketiranih

	Frekvenca	Odstotek [%]
Nedokončana osnovna šola	0	0,00
Dokončana osnovna šola	0	0,00
Poklicna šola	5	8,62
Srednja šola	11	18,97
Višješolska izobrazba	2	3,45
Visokošolska izobrazba	7	12,07
Univerzitetna izobrazba	15	25,86
Magisterij	10	17,24
Doktorat	0	0,00
Brez odgovora	8	13,79
Skupaj	58	100

Vir: Lasten vir

Anketirane smo vprašali po njihovem zaposlitvenem statusu. Največji delež anketiranih (46,55 %) je zaposlenih, v našo raziskavo pa nismo zajeli nikogar, ki bi bil gospodinjec ali gospodinja. Drugi največji delež anketirancev predstavljajo trenutno brezposelni (13,79 %), ki mu sledijo samozaposleni (10,34 %). Med anketiranimi je bil le en kmetovalec (1,72 %). Podrobnejša frekvenčna porazdelitev zaposlitvenega statusa anketiranih je prikazana v Tabeli 3.

Tabela 3: Zaposlitveni status anketiranih

	Frekvenca	Odstotek [%]
Zaposlen/a	27	46,55
Samozaposlen/a	6	10,34
Brezposeln/a	8	13,79
Upokojenec/ka	3	5,17
Dijak/inja ali študent/ka	5	8,62
Gospodinjec/gospodinja	0	0,00
Kmetovalec	1	1,72
Brez odgovora	8	13,79
Skupaj	58	100

Vir: Lasten vir

Predvidevali smo, da na potrošnjo lokalno pridelanih živil vpliva tudi število ljudi v gospodinjstvu. Najvišje število anketiranih živi v gospodinjstvu s tremi člani (29,31 %), ki mu sledijo gospodinjstva z dvema članoma (20,69 %). V raziskavo smo vključili tudi nekaj anketiranih, ki živijo v gospodinjstvih z več člani (6 in 7 članov gospodinjstva). Podrobnejšo frekvenčno porazdelitev prikazujemo v Tabeli 4.

Tabela 4: Število članov v gospodinjstvu

	Frekvenca	Odstotek [%]
1 član	8	13,79
2 člana	12	20,69
3 člani	17	29,31
4 člani	9	15,52
5 članov	2	3,45
6 članov	1	1,72
7 članov	1	1,72
Brez odgovora	8	13,79
Skupaj	58	100

Vir: Lasten vir

Na možnost pridelave živil doma in na dostopnost do ponudnikov živil vsekakor vpliva tudi lokacija bivanja. Kot je razvidno iz Tabele 5, največ sodelujočih v raziskavi živi v vasi/kraju/trgu s 500–2.000 prebivalci (27,59 %), sledijo pa anketirani, ki živijo v hiši na samem, zaselku ali manjši vasi z do 500 prebivalci (20,69 %). Najmanj anketiranih prihaja iz krajev z med 2.000–10.000 prebivalcev (3,45 %).

Tabela 5: Tip naselja

	Frekvenca	Odstotek [%]
Hiša na samem, zaselek ali manjša vas z do 500 prebivalci	12	20,69
Vas, kraj, trg s 500–2.000 prebivalci	16	27,59
2.000–10.000 prebivalcev	2	3,45
Več kot 10.000 prebivalcev	3	5,17
Maribor	10	17,24
Ljubljana	7	12,07
Brez odgovora	8	13,79
Skupaj	58	100

Vir: Lasten vir

V povezavi s predhodnim vprašanjem je tudi vprašanje o regiji bivanja. V raziskavo smo zajeli največ prebivalcev Osrednje-slovenske regije (22,41 %) in Pomurske ter Podravske regije (17,24 %). Najmanj jih prihaja iz Spodnjeposavske, Gorenjske, Koroške in Obalno-kraške regije (1,72 %). V anketi nismo zajeli nobenega anketiranca, ki bi prihajal iz Notranjsko-kraške in Goriške regije. Podrobnejša frekvenčna razdelitev glede na regijo bivanja je prikazana v Tabeli 6.

Tabela 6: Regija bivanja

	Frekvenca	Odstotek [%]
Pomurska regija	10	17,24
Podravska regija	10	17,24
Koroška regija	1	1,72
Savinjska regija	6	10,34
Zasavska regija	4	6,90
Spodnjeposavska regija	1	1,72
Jugovzhodna regija	2	3,45
Osrednje-slovenska regija	13	22,41
Gorenjska regija	1	1,72
Notranjsko-kraška regija	0	0,00
Goriška regija	0	0,00
Obalno-kraška regija	1	1,72
Brez odgovora	9	15,52
Skupaj	58	100

Vir: Lasten vir

Na zmožnost pridelave lastnih živil vpliva tudi tip bivališča. Kakor je razvidno iz Tabele 7, smo v raziskavo zajeli največji delež anketiranih, ki živijo v hiši z vrtom (41,38 %), sledijo pa anketirani, ki živijo v bloku ali večstanovanjski hiši (31,03 %). Najmanjši delež anketiranih živi v hiši brez lastnih zunanjih površin (3,45 %).

Tabela 7: Tip prebivališča

	Frekvenca	Odstotek [%]
Hiša s kmetijskimi površinami	6	10,34
Hiša z vrtom	24	41,38
Hiša brez lastnih zunanjih površin	2	3,45
Stanovanje v bloku/večstanovanjski hiši	18	31,03
Brez odgovora	8	13,79
Skupaj	58	100

Vir: Lasten vir

Na vprašanje za znesek, ki ga anketirani porabijo za nakup hrane v enem mesecu, nam je odgovorilo le 58,62 % vseh anketiranih. Najmanjši znesek, ki so ga anketirani navedli, je 25 €. Najvišji znesek pa 750 €. Povprečni znesek, ki ga anketirani porabijo za nakup hrane pa je 323,09 € s standardnim odklonom 172,2 €. Podrobnejša frekvenčna porazdelitev je predstavljena v Tabeli 8.

Tabela 8: Znesek za nakup hrane

	Frekvenca	Odstotek [%]
Do 200 €	6	10,34
200–500 €	21	36,21
Nad 500 €	7	12,07
Brez odgovora	24	41,38
Skupaj	58	100

Vir: Lasten vir

Zmožnost za nakup lokalnih živil, ki so velikokrat nekoliko višjega cenovnega razreda kakor znamke velikih trgovcev, je odvisna tudi od finančnega stanja posameznika. Zadnje demografsko vprašanje se je tako navezovalo ravno na neto znesek, ki ga imajo v gospodinjstvu na voljo. Kot je razvidno iz Tabele 9, smo v vzorec raziskave zajeli gospodinjstva, ki imajo nekoliko višji dohodek, saj smo v vzorec zajeli kar 16 gospodinjstev s prihodkom, ki znaša več kot 1.900 € (27,59 %). 22 anketirancev (37,93 %) pri tem vprašanju ni podalo odgovora.

Tabela 9: Znesek gospodinjstva

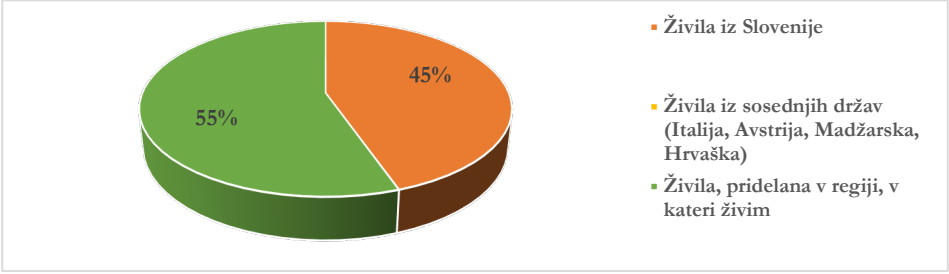
	Frekvenca	Odstotek [%]
Do 500 €	1	1,72
500–700 €	1	1,72
700–900 €	3	5,17
900–1.100 €	4	6,90
1.100–1.300 €	4	6,90
1.300–1.500 €	3	5,17
1.500–1.700 €	2	3,45
1.700–1.900 €	2	3,45
Več kot 1.900 €	16	27,59
Brez odgovora	22	37,93
Skupaj	58	100

Vir: Lasten vir

5.2 Odnos do lokalno pridelanih živil v Sloveniji

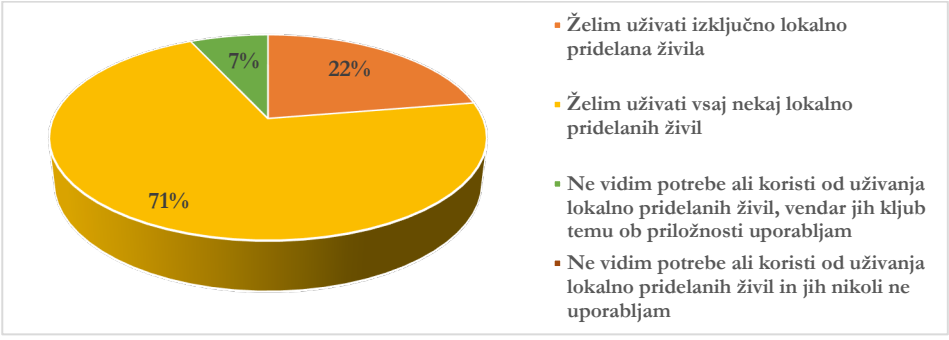
S prvim vsebinskim vprašanjem smo anketirane vprašali, kaj za njih predstavlja lokalno pridelano živilo. Na podlagi analize strokovne literature smo namreč ugotovili, da enotne definicije za »lokalno« ni oz. da se le-ta razlikuje glede na geografsko umeščenost. V Sloveniji je z zakonom o kmetijstvu določeno, da je lokalni trg celotno geografsko območje Republike Slovenije. Kakor je vidno na Sliki

1, lokalno pridelana živila vsi sodelujoči v raziskavi omejujejo vsaj z mejo države Slovenije. Odgovor, da so lokalno pridelana živila »tista živila, ki se pridelajo v regiji, v kateri živim« je izbralo 31 sodelujočih (55 % izmed tistih, ki so odgovorili na to vprašanje), odgovor, da so to »živila, ki so pridelana v Sloveniji«, pa 25 sodelujočih (45 % izmed tistih, ki so odgovorili na to vprašanje). Odgovor »živila iz sosednjih držav« ni izbral nobeden izmed anketiranih. Opaziti je, da tudi anketiranci niso enotni glede definicije lokalno pridelane hrane.



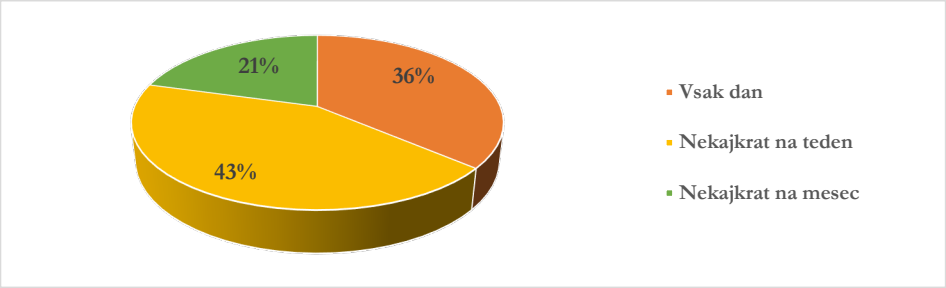
Slika 1: Pomen lokalno pridelanih živil
Vir: Lasten vir

Slika 2 prikazuje, kakšen odnos imajo sodelujoči v raziskavi do lokalno pridelanih živil. Največ odgovorov sodelujočih je bilo, da želijo v svoj jedilnik uvrstiti vsaj nekaj lokalno pridelanih živil – ta odgovor je izbralo 41 sodelujočih (71 % izmed teh, ki so na vprašanje odgovorili). Dobra petina sodelujočih želi uživati izključno lokalno pridelana živila (22 %). Odgovor »Ne vidim potrebe ali koristi od uživanja lokalno pridelanih živil in jih nikoli ne uporabljam« pa so izbrali štirje anketiranci (7 %).



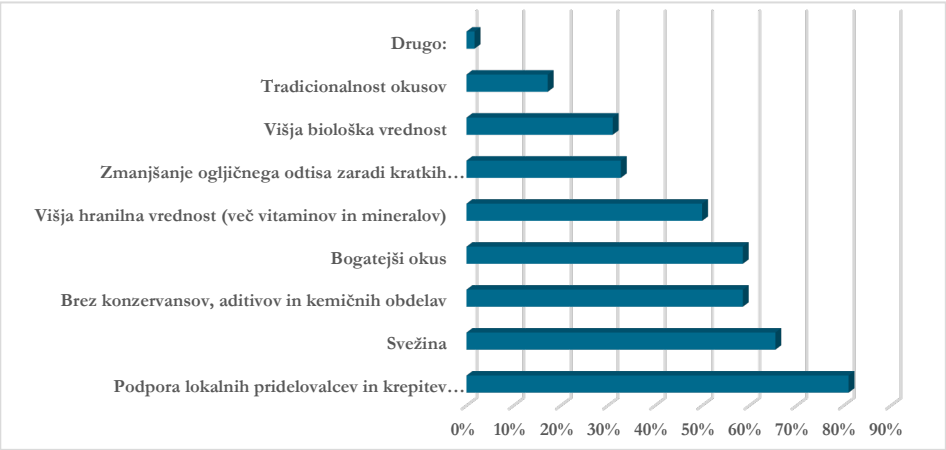
Slika 2: Odnos do lokalno pridelanih živil
Vir: Lasten vir

Slika 3 prikazuje pogostost uživanja lokalnih živil. Vsakodnevno so lokalno pridelana živila na krožnikih 21 sodelujočih v raziskavi (36 % izmed tistih, ki so odgovorili na to vprašanje), nekoliko višji odstotek (43 %) pa jih uživa nekajkrat na teden. Nekajkrat na mesec po njih poseže 12 sodelujočih (21 %).



Slika 3: Pogostost uživanja lokalnih živil
Vir: Lasten vir

Preverili smo, kakšni so razlogi za uživanje lokalno pridelanih živil. Kot je razvidno iz Slike 4, se največ sodelujočih v raziskavi (47 oz. 81,03 % izmed tistih, ki so odgovorili na to vprašanje) za lokalno pridelana živila odloča zaradi podpore lokalnim pridelovalcem in krepitve samooskrbe. 38 (65,52 %) anketiranih uživa lokalna živila zaradi njihove svežine. 34 (59 %) lokalno pridelana živila uporablja, saj so brez konzervansov, aditivov in niso kemično obdelana. Enak odstotek anketiranih lokalna živila uživa tudi zaradi bogatejšega okusa. 50 % vseh sodelujočih se za lokalna živila odloča zaradi višjih hranilnih vrednosti. Nekoliko nižji delež zavzemajo tisti, ki se za lokalno pridelano hrano odločajo zaradi krajših transportnih poti in z njimi povezanim ogljičnim odtisom (32,76 %). Še najmanj pa se za lokalno pridelano hrano odloča zaradi tradicionalnosti okusov le 10 anketirancev (17, 24%). Med druge razloge so sodelujoči zapisali, da se za lokalna živila odločajo zaradi transparentnosti pridelave hrane (odgovor: »da vem, kaj jem«).



Slika 4: Razlogi za uživanje lokalnih živil
Vir: Lasten vir

V povezavi s potrošnjo lokalno pridelanih živil smo v anketo vključili tudi vprašanje, pri katerem so sodelujoči za vsako izmed 18-ih vnaprej definiranih skupin živil (zelenjava, sadje, meso, ribe, kruh, testenine, mleko, jogurti, siri, moka in žita, med, marmelade, sokovi, čaji, vina, žganje, pivo ter jajca) navedli, kje jih kupujejo v zadnje pol leta.

Najvišji odstotek sodelujočih zelenjavo pridela doma (40 %), ravno tako marmelade (48 %). Sadje največji delež sodelujočih kupi v trgovinah, kjer vseeno preverijo, če gre za domačo znamko (38 %). Ko gre za meso, ga največji delež sodelujočih kupi v trgovinah, kjer prav tako potrošniki zasledujejo poreklo domačih znamk (46 %). Skoraj dve tretjini sodelujočih (64 %) ribe kupi v trgovinah, vendar so pri tem pozorni na to, da so ribe domače znamke (čeprav ni nujno, da so slovenskega izvora), enako je s kruhom (48 %), testeninami (64 %), mlekom (64 %), jogurti (58 %), siri (64 %), jajci (34 %), mokami in žiti (66 %), sokovi (40 %), vini (56 %) ter pivom (70 %). V veliki večini prehranskih artiklov sodelujoči navajajo, da izbirajo domače znamke v primerjavi s tujimi. Med 36 % sodelujočih dobi pri sorodnikih ali znancih, ki ga pridelujejo sami, ravno tako žganje (32 %), dobrih 28 % anketirancev pa med dobi na bližnjih kmetijah. Prav tako se za nakup direktno od bližnjih kmetov anketiranci odločijo le redko, kjer je za kategorijo mesa odgovor izbralo 20 % anketirancev. Pri čajih 50 % sodelujočih opravi nakup v trgovinah, pri čemer pazijo na to, da kupijo slovensko znamko čajev, dobra četrtina sodelujočih pa si čaje

pripravi doma. Bolj podrobna distribucija rezultatov je prikazana v tabeli, ki je dodana prilogam.

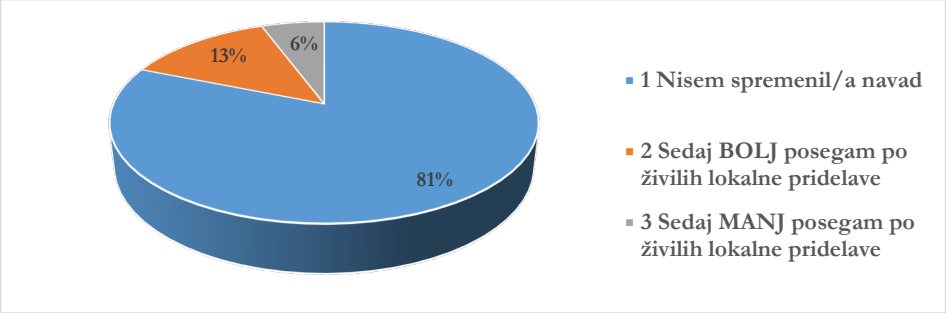
Zanimivo je, da v raziskavo nismo zajeli potrošnikov, ki bi opravljali spletne nakupe pri večjih trgovcih ali tiste, ki opravijo spletni nakup pri ponudnikih, kot je Zeleni zabojček, čeprav smo zajeli generacijo anketirancev, ki dnevno uporablja računalnik. Po drugi strani je vzorec anketirancev relativno nizek. Ne glede na dejstvo, da je spletnih tržnic in posledično dobaviteljev precej veliko, izgleda, da je nakup preko spletnih tržnic še vedno bolj nišne narave in rezerviran za posebne izdelke. Prav tako izstopa dejstvo, da se le malo ljudi odloča za nakup na tržnici (največji delež sicer nosi nakup zelenjave z 12 % anketirancev) ali za trgovine z lokalno ponudbo (le 14 % anketirancev za kategorijo kruh). Podrobnejši rezultati, kje posamezne izdelke v zadnje pol leta kupujejo sodelujoči v naši raziskavi, se nahajajo v tabeli, uvrščeni med priloge.

Pripravljeno je bilo tudi vprašanje, ki je sodelujoče prosilo, da nam zaupajo razlog, zakaj je uživanje lokalno pridelanih živil zanje nepomembno. Ker predhodno nihče izmed sodelujočih ni izrazil, da ne vidi potrebe ali koristi od lokalno pridelanih živil, nihče izmed sodelujočih ni odgovarjal na to vprašanje.

5.3 Spremembe zaradi ukrajinske krize

Velika večina sodelujočih v raziskavi (81 %) meni, da zaradi ukrajinske krize ni spremenila navad glede oskrbe z lokalno pridelanimi živili. Le 13 % (7) sodelujočih zaradi ukrajinske krize sedaj bolj posega po živilih lokalne pridelave, 6 % (3) sodelujoči pa zaradi ukrajinske krize posegajo po lokalnih živilih v manjšem obsegu kakor pred njo (Slika 5).

Sodelujoče, ki so na vprašanje, ali so pri sebi zaznali spremembe zaradi ukrajinske krize v odnosu do potrošnje lokalnih živil, odgovorili pritrdilno, smo prosili, da poleg tabele, kjer so navedli, kje posamezne skupine živil kupujejo v zadnje pol leta, izpolnijo še tabelo, kje so kupovali posamezne skupine izdelkov pred začetkom krize. Na vprašanje je odgovorilo le 10 sodelujočih (tistih, ki so na predhodno vprašanje odgovorili s spremembo navad), podrobnejša distribucija odgovorov za vprašanje pa se nahaja v tabeli v prilogah.



Slika 5: Spremembe navad, povezanih z oskrbo z lokalnimi živili zaradi ukrajinske krize
Vir: Lasten vir

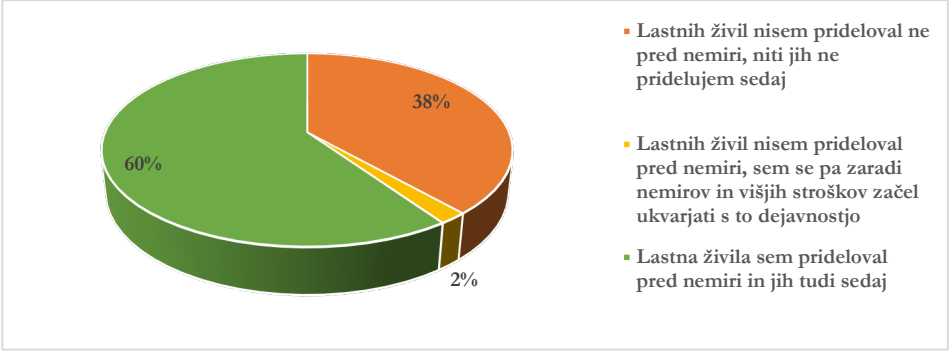
Tabela 10 prikazuje spremembo v odstotkih pri nakupu posameznih skupin živil pred in po začetku ukrajinske krize v Sloveniji (v analizi upoštevanih le 10 sodelujočih). Pri skoraj vseh skupinah živil (razen pri ribah, čajih, vinu, žganju, pivu in jajcih) je zaznati povišano nakupovanje domačih znamk v trgovinah, sploh pri zelenjavi, kruhu in marmeladah. Pri določenih skupinah živil se je zmanjšalo nakupovanje v trgovinah z lokalno ponudbo (kruh, testenine, mleko, jogurti in siri). Negativen trend je zaznati tudi pri nakupu nekaterih skupin živil na bližnjih kmetijah (sadje, med, jajca). Zmanjšal se je tudi delež tistih, ki si določene skupine živil pridelajo sami (zelenjava, sadje, marmelade), se pa je za nekatere kategorije povečal delež živil, ki jih dobijo od svojih sorodnikov/znancev (sadje, jajca). Zanimivo je, da se je skoraj v vseh kategorijah zmanjšal nakup uvoženih znamk določenih skupin živil v trgovinah. Pri spletnih nakupih pa ni bilo opaziti nobenih sprememb, razen pri enem anketirancu v kategoriji čaj.

Vir lokalno pridelanih živil je vsekakor tudi samooskrba. Več kot polovica vseh sodelujočih (60 %) je lastna živila samostojno pridelovalo že pred ukrajinsko krizo in jih tudi sedaj. 38 % sodelujočih ne prideluje lastnih živil, niti jih ni pred krizo. Eden od sodelujočih (2 %) se je zaradi višanja cen hrane začel ukvarjati s pridelavo živil (Slika 6).

Tabela 10: Sprememba v nakupovalnih navadah pred ukrajinsko krizo in v obdobju zadnjega pol leta

	Hipermarketi, marketi in manjše trgovine (domače znamke)	Spletni nakup (večji trgovci)	Spletni nakup (Zeleni zaboj̆ček)	Trgovine z lokalno ponudbo	Tržnice	Bližnje kmetije	Pridelam sam/a	Dobim od sorodnikov/ znancev, ki jo pridelajo sami	Hipermarketi, marketi in manjše trgovine (uvožene znamke)
Zelenjava	30 %	0 %	0 %	0 %	0 %	0 %	-20 %	0 %	-10 %
Sadje	20 %	0 %	0 %	0 %	0 %	-20 %	-20 %	20 %	0 %
Meso	10 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	-10 %
Ribe	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Kruh	30 %	0 %	0 %	-20 %	0 %	0 %	10 %	-10 %	0 %
Testenine	20 %	0 %	0 %	-10 %	0 %	0 %	0 %	0 %	-10 %
Mleko	20 %	0 %	0 %	-10 %	0 %	0 %	0 %	0 %	-10 %
Jogurti	20 %	0 %	0 %	-10 %	0 %	0 %	0 %	0 %	-10 %
Siri	20 %	0 %	0 %	-10 %	0 %	0 %	0 %	0 %	-10 %
Moka, žita	20 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	-10 %
Med	10 %	0 %	0 %	0 %	0 %	-10 %	0 %	0 %	0 %
Marmelade	30 %	0%	0 %	0 %	0 %	0 %	-20 %	-10 %	0 %
Sokovi	10 %	0 %	0 %	0 %	0 %	0 %	-10 %	0 %	-10 %
Čaji	0 %	-10 %	0 %	0%	0 %	0 %	0 %	0 %	0 %
Vina	0 %	0 %	0 %	0%	0 %	0 %	0 %	0 %	0 %
Žganje	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Pivo	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Jajca	0 %	0 %	0 %	0 %	0 %	-10 %	0 %	10 %	0 %

Vir: Lasten vir

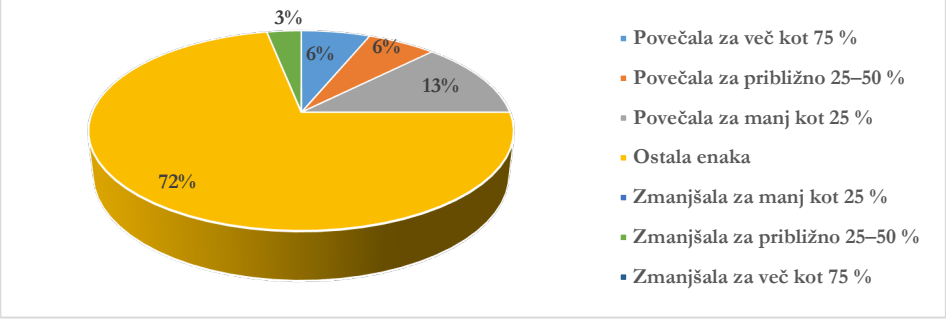


Slika 6: Spremembe v pridelavi lastnih živil zaradi ukrajinske krize

Vir: Lasten vir

Sodelujoče, ki so odgovorili, da so se med ukrajinsko krizo začeli ukvarjati z lastno pridelavo, smo prosili, da nam zaupajo razlog za to odločitev in katera živila pridelujejo. Dobili nismo nobenega odgovora.

Vse sodelujoče, ki so odgovorili, da so se s pridelovanjem lastnih živil ukvarjali pred ukrajinsko krizo in jih še vedno pridelujejo, smo prosili, da nam zaupajo, ali se je njihova lastna pridelava povečala ali zmanjšala. Pri 72 % sodelujočih, ki se z lastno pridelavo ukvarja, je količina pridelave ostala enaka kot pred krizo. Pri 25 % sodelujočih pa se je količina pridelane hrane povečala (Slika 7). Le 3 % anketirancev navaja, da se je zmanjšala za med 25–50 %.

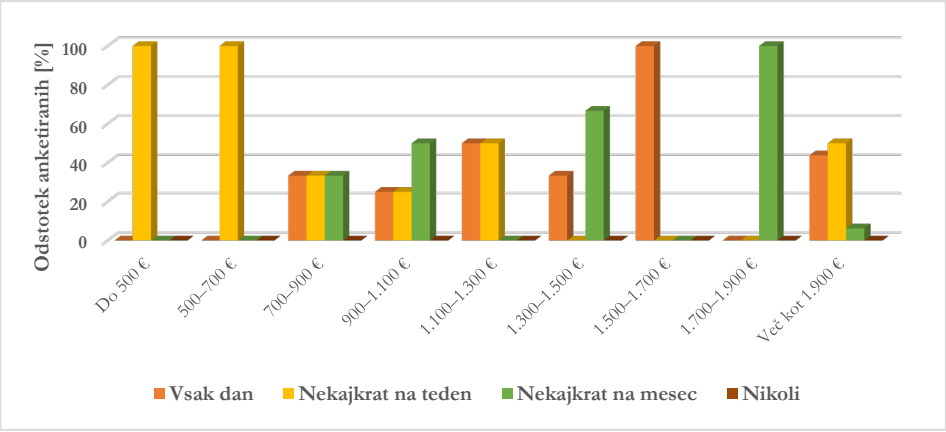


Slika 7: Spremembe v pridelavi zaradi ukrajinske krize
Vir: Lasten vir

6 Diskusija

V raziskavo, ki smo jo izvedli oktobra 2022, smo zajeli 58 prebivalcev Republike Slovenije, ki so v celoti izpolnili pripravljeni anketni vprašalnik o lokalno pridelanih živilih. V vzorcu, ki smo ga zajeli, prevladujejo predvsem ženske. Ženske se tudi navadno v večji meri odločajo za reševanje anketnih vprašalnikov. 44,83 % vseh sodelujočih je starih med 25 in 45 let. V vzorcu prevladujejo zaposleni posamezniki, s čimer je povezan tudi neto dohodek gospodinjstev, kjer prevladujejo gospodinjstva, ki imajo mesečni dohodek nad 1.100 €. Zelo podobna struktura vzorca je bila tudi v raziskavi leta 2021, ki je preverjala spremembe pri potrošnji lokalno pridelane hrane zaradi pandemije COVID-19 (Šinko & Lisec, 2021).

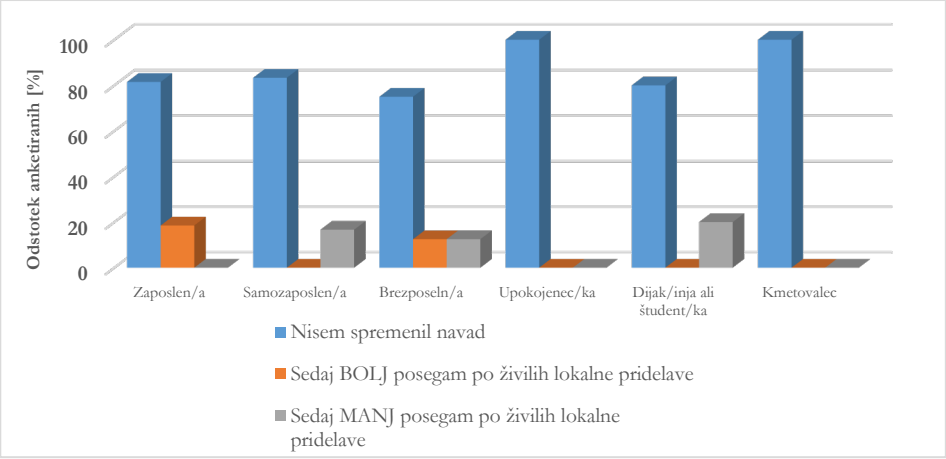
Predpostavili smo, da višina dohodka vpliva na odnos do lokalno pridelanih živil in do pogostosti uživanja le-teh. Slika 8 prikazuje pogostost uživanja lokalno pridelanih živil glede na prihodke gospodinjstva. Ker je število sodelujočih v anketi dokaj nizko in za skoraj 38 % vseh sodelujočih nismo dobili podatka o mesečnem neto dohodku, iz grafa ni možno zaznati trendov.



Slika 8: Vpliv dohodka v gospodinjstvu na pogostost uživanja lokalno pridelanih živil
Vir: Lasten vir

Slika 9 prikazuje vpliv zaposlitvenega statusa na spremenjene navade glede uživanja lokalno pridelanih živil. Tudi tukaj ne opazimo jasnih trendov. Le redki anketiranci so spremenili svoje navade glede uporabe lokalno pridelanih živil, pri čemer zaposleni in brezposelni dosegajo približno isti odstotek povečanega zanimanja za živila lokalne pridelave (18 % in 12 %). Pričakovano je sicer, da tisti brez zaposlitve, ko so cene živil narasle, manj posegajo po živilih lokalne pridelave.

Med tistimi, ki so najbolj spremenili svoje navade glede oskrbe z lokalnimi živili, je največ tistih, ki so zaposleni in sedaj bolj posegajo po živilih lokalne pridelave (18 %). Med tistimi, ki sedaj manj posegajo po živilih lokalne pridelave, so samozaposleni (16 %), brezposelni (12 %) in dijaki/študenti (20 %). Razlog za to je verjetno v tem, da so lokalno pridelana živila nekoliko dražja in tako izven finančnega dosega nekaterih posameznikov.



Slika 9: Vpliv zaposlitve na spremembe glede navad z lokalnimi živili
Vir: Lasten vir

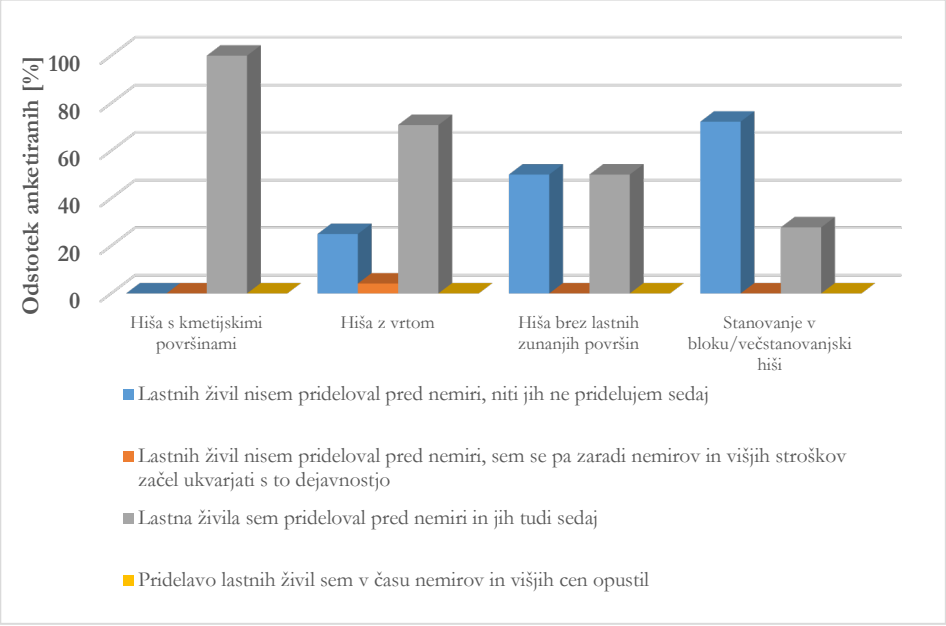
Okoli 60 % sodelujočih (31) v naši raziskavi se je s pridelavo lastnih živil ukvarjala že pred začetkom ukrajinske krize in se s pridelavo ukvarja tudi sedaj. Le eden od sodelujočih pa se je z lastno pridelavo pričel ukvarjati v času krize. Tabela 11 prikazuje pridelavo lastnih živil glede na zaposlitveni status sodelujočih. Največji delež tistih, ki pridelujejo lastna živila, je med študenti (5; 100 %) in upokojenci (2; 66,67 %), kjer ti skupini pridelujeta vsaj nekaj lastnih živil. Več kot polovica (55,56 %) zaposlenih (15) prav tako prideluje vsaj nekaj lastnih živil. Zanimivo je najmanjši delež tistih, ki sami pridelujejo živila med brezposelnimi udeleženci raziskave (4).

Tabela 11: Pridelava lastnih živil glede na zaposlitveni status

	Lastnih živil ne pridelujem [%]	Lastna živila pridelujem [%]	Skupaj [%]
Zaposlen/a	44,44	55,56	100
Samozaposlen/a	50,00	50,00	100
Brezposeln/a	50,00	50,00	100
Upokojenec/ka	33,33	66,67	100
Dijak/inja ali študent/ka	0,00	100,00	100
Kmetovalec	0,00	100,00	100

Vir: Lasten vir

Preverili smo tudi, kako vpliva tip prebivališča na spremembo glede pridelovanja lastnih živil (Slika 10). Med sodelujočimi, ki živijo v hiši s kmetijskimi površinami, (6) ni nikogar, ki lastnih živil ne bi prideloval. Pri tistih, ki živijo v hiši z vrtom (24), je med njimi približno 4 % takšnih, ki so s pridelavo lastnih živil pričeli zaradi visokih stroškov hrane kot posledice ukrajinske krize. Nobeden izmed sodelujočih pa pridelave lastnih živil ni opustil.



Slika 10: Vpliv tipa bivališča na spremembe glede pridelovanja lastnih živil
Vir: Lasten vir

Pred začetkom izvajanja ankete smo predpostavili, da se je povečal delež anketirancev, ki se poslužuje nakupa živil preko spletne tržnice, kot posledica pandemije COVID-19. Glede na pridobljene rezultate spletnega vprašalnika nismo zasledili povečanega povpraševanja, saj se nobeden izmed anketirancev ni opredelil za nakup živil preko spletne tržnice. Nekatere izmed njih sicer služijo le vzpostavitvi stika med pridelovalcem in potrošnikom, spet nekatere druge pa služijo direktnemu nakupu, pri čemer spletna tržnica skrbi za odpremo in transport živil. Možno je torej, da je nekdo, ki je pridobil kontakt preko spletne tržnice opravil nakup osebno pri pridelovalcu in ga tako tudi šteje v to kategorijo.

Po opravljeni analizi potrošnje lokalno pridelane hrane v Sloveniji v času ukrajinske krize in predhodno opravljene analize v zvezi s pandemijo COVID-19 (Šinko & Lisec, 2021) smo prišli do naslednjih glavnih ugotovitev:

- v času ukrajinske krize je 7 % manj takšnih, ki želijo uživati izključno lokalna živila kot v času pandemije COVID-19;
- v času ukrajinske krize je 7,6 % manj takšnih, ki lokalna živila uživajo vsak dan kot v času pandemije;
- v času ukrajinske krize je 13 % več takšnih, ki posegajo po lokalnih živilih (v času pandemije je bila vrednost 34 %);
- pred začetkom pandemije se je s pridelavo lastnih živil ukvarjalo 54 % anketirancev, sedaj ta odstotek znaša okoli 60 %;
- v času ukrajinske krize se je s pridelavo lastnih živil začelo ukvarjati 2 % anketirancev (v času pandemije je bila ta vrednost 7 %);
- anketiranci v večji meri kupujejo živila v hipermarketih kot v času pandemije (zelenjava +11%, moka/žito +16%, siri +12%, meso +17 %, jajca +20 %);
- izrazita je sprememba v nakupovalnih navadah kupovanja jajc, prej je delež direktnega odkupa od kmeta znašal 46 %, sedaj znaša 25 %;
- delež anketirancev, ki nakupujejo v spletnih tržnicah ali preko spletnih trgovin večjih trgovcev z živili se je zmanjšal glede na pandemijo COVID-19.

Ugotavljamo, da se zaradi rastočih cen živil in visoke inflacije nakupovalne navade potrošnikov precej spreminjajo. Če potrošniki prej nismo bilo tako zelo pozorni na domače znamke, se je sedaj delež njihove nabave v določenih kategorijah živil bistveno povečal. Prav tako se je povišala stopnja samooskrbe, pri čemer ocenjujemo, da se bo v naslednjih letih še povečala.

7 Zaključek

V zadnjih treh letih so na naše dojemanje sveta vplivale številne krize. Zadnja, ki je povzročila visoko inflacijo in rast cen osnovnih dobrin, je ukrajinska kriza. Vojna na evropskih tleh ima negativne posledice na globalne oskrbovalne verige, kar se je še posebej pokazalo v primeru izvoza žit. Samooskrba držav tako z energetskimi viri kot tudi z živili postaja vedno pomembnejša.

Postavljene teze lahko na podlagi pregleda obstoječih raziskav in lastne raziskave vsaj delno potrdimo. Ukrajinska kriza je vsekakor povečala zaupanje slovenskih potrošnikov v lokalno pridelana živila, čeprav Slovenci že tradicionalno zaupamo lokalno pridelanim živilom. Temu smo bili priča že pri pandemiji COVID-19 (Šinko & Lisec, 2021), kjer glede na trenutno stanje ugotavljamo, da so se prehranske navade sicer nekoliko spremenile, vendar ne v bistvenem obsegu. Potrošniki smo začeli iskati slovenske blagovne znamke znotraj obstoječih trgovskih verig, prav tako se je okrepilo zaupanje do manjših (lokalnih) kmetov. Nismo opazili povečanega povpraševanja po spletnih tržnicah, čeprav so se le-te številčno okrepile v zadnjem času. Omejitev raziskave je sicer v majhnem številu anketiranih v vzorcu. Raziskavo bi bilo smiselno periodično ponoviti, pri čemer bi bilo poleg potrošnikov potrebno anketirati tudi lokalne pridelovalce ali ponudnike v spletnih tržnicah. Le tako bi bilo mogoče dobiti celostno sliko o tem, ali so se na katerih področjih pojavile večje spremembe. Glede na raziskavo, digitalizacija kmetijstva vsaj na tem področju še ni dosegla svojega maksimalnega potenciala, kjer je zagotovo še priložnost za izboljšavo.

Iz analize anketnega vprašalnika je bilo moč razbrati, da se je pri enem izmed anketirancev v času ukrajinske krize povečala pridelava lastnih živil, sicer pa ni bilo videti bistvenega povečanja samooskrbe na račun krize.

Literatura

Cerrada-Serra, P., Moragues-Faus, A., Zwart, T. A., Adlerova, B., Ortiz-Miranda, D. & Avermaete, T. (2018). Exploring the contribution of alternative food networks to food security. A comparative analysis [Article]. Food Security, 10(6), 1371-1388. https://doi.org/10.1007/s12571-018-0860-x

Edwards-Jones, G., Milà i Canals, L., Hounsome, N., Truninger, M., Koerber, G., Hounsome, B., Cross, P., York, E. H., Hospido, A., Plassmann, K., Harris, I. M., Edwards, R. T., Day, G. A. S., Tomos, A. D., Cowell, S. J. & Jones, D. L. (2008). Testing the assertion that 'local food is best': the challenges of an evidence-based approach. Trends in Food Science & Technology, 19(5), 265-274. https://doi.org/https://doi.org/10.1016/j.tifs.2008.01.008

Enthoven, L. & Van den Broeck, G. (2021). Local food systems: Reviewing two decades of research. Agricultural Systems, 193. https://doi.org/10.1016/j.agsy.2021.103226

European Comission. (2020). Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions: A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system. Najdeno 18. oktobra 2022 na spletnem naslovu https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381

Eurostat [Statistics Explained]. (2022). Inflation in the euro area. Najdeno 19. oktobra 2022 na spletnem naslovu https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Inflation_in_the_euro_area

Gerdes, M. E., Aistis, L. A., Sachs, N. A., Williams, M., Roberts, J. D. & Rosenberg Goldstein, R. E. (2022). Reducing Anxiety with Nature and Gardening (RANG): Evaluating the Impacts of Gardening and Outdoor Activities on Anxiety among U.S. Adults during the COVID-19 Pandemic [Article]. International Journal of Environmental Research and Public Health, 19(9). https://doi.org/10.3390/ijerph19095121

GOV.SI. (2020). Pomen lokalne hrane in načelo kratkih verig v dobavi živil. Najdeno 19. oktobra 2022 na spletnem naslovu https://www.gov.si/teme/pomen-lokalne-hrane-in-nacelo-kratkih-verig-v-dobavi-zivil/

Government of Canada, C. F. I. A. (2022). Origin claims on food labels [fact sheet, guide, reference material]. Najdeno 20. oktobra 2022 na spletnem naslovu https://inspection.canada.ca/food-labels/labelling/industry/origin-claims/eng/1626884467839/1626884529209

Harvey, C. A., Rakotobe, Z. L., Rao, N. S., Dave, R., Razafimahatratra, H., Rabarijohn, R. H., Rajaofara, H. & MacKinnon, J. L. (2014). Extreme vulnerability of smallholder farmers to agri-cultural risks and climate change in Madagascar. Philosophical Transactions of the Royal Society B, 369, 20130089. doi: 10.1098/rstb.2013.0089

Husain, A. (2022). The Ukraine War is Deepening Global Food Insecurity — What Can Be Done? United States Institute of Peace. Najdeno 17. oktobra 2022 na spletnem naslovu https://www.usip.org/publications/2022/05/ukraine-war-deepening-global-food-insecurity-what-can-be-done

IRSA. (2020). Analiza trga z ekološkimi živili v Republiki Sloveniji – Skupna kmetijska politika. Najdeno 19. oktobra 2022 na spletnem naslovu https://skp.si/download/analiza-trga-z-ekoloskimi-zivili-v-republiki-sloveniji?ind=1665045812773&filename=ANALIZA-TRGA-EKO-ZIVIL-V-RS_koncno-porocilo.pdf&wpdmdl=11278&refresh=635630709a2551666592880

Kinnunen, P., Guillaume, J. H. A., Taka, M., D'Odorico, P., Siebert, S., Puma, M. J., Jalava, M. & Kummu, M. (2020). Local food crop production can fulfil demand for less than one-third of the population. Nature Food, 1(4), 229-237. https://doi.org/10.1038/s43016-020-0060-7

Kneafsey, M., Venn, L., Schmutz, U., Balázs, B., Trenchard, L., Eyden-Wood, T., Bos, E., Sutton, G. & Blackett, M. (2013). Short food supply chains and local food systems in the EU. A state of play of their socio-economic characteristics. JRC scientific and policy reports, 123, 129.

Lokalna oskrba s hrano in vrtnarjenje [NIJZ]. (18. junij 2020). Najdeno 20. oktobra 2022 na spletnem naslovu: https://www.nijz.si/sl/lokalna-oskrba-s-hrano-in-vrtnarjenje

Martinez, S., Hand, M., Da Pra, M., Pollack, S., Ralston, K., Smith, T., Vogel, S., Clark, S., Lohr, L., Low, S. & Newman C. (2010). Local Food Systems: Concepts, Impacts, and Issues. Najdeno 18. oktobra 2022 na spletnem naslovu https://www.ers.usda.gov/webdocs/publications/46393/7054_err97_1_.pdf?v=0

Ministrstvo za kmetijstvo, gozdarstvo in prehrano (b.d.). Izbrana kakovost – Slovenija | Naša super hrana – Izbrana kakovost. Najdeno 19. oktobra 2022 na spletnem naslovu https://www.nasasuperhrana.si/za-potrosnike/sheme-kakovosti/izbrana-kakovost/

Ministrstvo za kmetijstvo, gozdarstvo in prehrano (2019a). Kaj predstavlja projekt Naša super hrana. Najdeno 19. oktobra 2022 na spletnem naslovu https://www.nasasuperhrana.si/clanek/kaj-predstavlja-projekt-nasa-super-hrana/

Ministrstvo za kmetijstvo, gozdarstvo in prehrano (2019b). Raziskave o EKO potrošnji in potencialu EKO proizvodnje v Sloveniji | Obvestila, Obvestila in gradiva. Najdeno 20. oktobra 2022 na spletnem naslovu https://www.nasasuperhrana.si/clanek/raziskave-o-eko-potrosnji-in-potencialu-eko-proizvodnje-v-sloveniji/

Ministrstvo za kmetijstvo, gozdarstvo in prehrano (2020). Vseslovenska kampanja ozaveščanja – Ekološko in lokalno je idealno!. Najdeno 20. oktobra 2022 na spletnem naslovu https://www.nasasuperhrana.si/clanek/vseslovenska-kampanja-ozavescanja-ekolosko-in-lokalno-je-idealno/

Mishra, S. K., Khanal, A. R. & Collins, W. J. (2022). Farm-to-School programmes, benefits, health outcomes and barriers: A structured literature review. Health Education Journal. https://doi.org/10.1177/00178969221119290

Our World in Data. (2020). You want to reduce the carbon footprint of your food? Focus on what you eat, not whether your food is local. Najdeno 20. oktobra 2022 na spletnem naslovu https://ourworldindata.org/food-choice-vs-eating-local

Poore, J. & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992. https://doi.org/doi:10.1126/science.aaq0216

Risku-Norja, H., Hietala, R., Virtanen, H., Ketomäki, H. & Helenius, J.(2008). Localisation of primary food production in Finland: productionpotential and environmental impacts of food consumption patterns. Agricultural Food and Science, 17, 127–145. doi: 10.2137/145960608785328233

Rojšek, I. (2001). A comparison of the purchasing and consumption behaviour of Slovenian and other Eastern European consumers. International Marketing Review, 18(5), 509-520. doi: 10.1108/EUM0000000006043

Sabates-Wheeler, R., Devereux, S., Mitchell, T., Tanner, T., Davies, M. & Leavy, J. (2008). Rural disaster risk: poverty interface. Brighton: Institute of Development Studies, University of Sussex.

STA (2022). Mineva sto dni od začetka vojne v Ukrajini. Najdeno 21. oktobra 2022 na spletnem naslovu: https://www.sta.si/3044870/mineva-sto-dni-od-zacetka-vojne-v-ukrajini. https://www.hsph.harvard.edu/nutritionsource/processed-foods/

SURS. (2021a). Cene hrane v letu 2020 višje kot v letu prej. Najdeno 19. oktobra 2022 na spletnem naslovu https://www.stat.si/StatWeb/News/Index/9889

SURS. (SURSb). Stereotip: vrtičkarji. Najdeno 19. oktobra 2022 na spletnem naslovu https://www.stat.si/StatWeb/News/Index/9749

SURS. (2022a). Indeksi cen in odkup kmetijskih pridelkov, avgust 2022. Najdeno 19. oktobra 2022 na spletnem naslovu https://www.stat.si/StatWeb/News/Index/10633

SURS. (2022b). Hrana v Sloveniji. Najdeno 20. oktobra 2022 na spletnem naslovu https://www.stat.si/StatWeb/News/Index/10236

Šinko, S. & Lisec, A. Potrošnja lokalno pridelane hrane v Sloveniji med pandemijo COVID-19. XV. International Conference on Logistics in Agriculture 2021: conference proceedings: [11th November 2021, Online, Slovenia]. ISBN 978-961-286-538-2.

Univerza v Novem mestu, Fakulteta za ekonomijo in informatiko. (b. d.). Analiza pridelave in trženja proizvodov shem kakovosti. Najdeno 20. oktobra 2022 na spletnem naslovu https://fei.uni-nm.si/raziskovanje/programi_in_projekti/analiza_pridelave_in_trzenja_proizvodov_shem_kakovosti/

Zakon o kmetijstvu. Uradni list RS, št. 45/08, 57/12, 90/12 – ZdZPVHVVR, 26/14, 32/15, 27/17, 22/18, 86/21 – odl. US in 123/21.

Željan, K. (2020). Deloindom – Bodo spletne tržnice z lokalnimi pridelki preživele tudi po koronakrizi? Najdeno 20. oktobra na spletnem naslovu https://deloindom.delo.si/vrt-in-zivali/zelenjavni-vrtovi/bodo-spletne-trznice-z-lokalnimi-pridelki-prezivele-tudi-po-koronakrizi

Priloge

Analiza vprašanja: Kako se oskrbujete s posameznimi skupinami živil v zadnje pol leta? Če se pri določeni skupini živil poslužujete različnih načinov za oskrbo, izberite najpogostejšega.

	Hipermarketi, marketi in manjše trgovine (domače znamke)	Spletni nakup (večji trgovci)	Spletni nakup (Zeleni zabojček)	Trgovine z lokalno ponudbo	Tržnice	Bližnje kmetije	Pridelam sam/a	Dobim od sorodnikov/ znancev, ki jo pridelajo sami	Hipermarketi, marketi in manjše trgovine (uvožene znamke)	Skupaj
Zelenjava	14 26,92 %	0 0 %	0 0 %	1 1,92 %	6 11,54 %	2 3,85 %	20 38,46 %	5 9,62 %	4 7,69 %	52 100 %
Sadje	19 35,85 %	0 0 %	0 0 %	2 3,77 %	4 7,55 %	3 5,66 %	12 22,64 %	7 13,21%	6 11,32 %	53 100 %
Meso	23 44,23 %	0 0 %	0 0 %	5 9,62 %	1 1,92 %	10 19,23 %	5 9,62 %	5 9,62 %	3 5,77 %	52 100 %
Ribe	32 61,54 %	0 0 %	0 0 %	3 5,77 %	5 9,62 %	1 1,92 %	0 0 %	2 3,85 %	9 17,31 %	52 100 %
Kruh	24 46,15 %	0 0 %	0 0 %	7 13,46 %	0 0 %	1 1,92 %	14 26,92 %	2 3,85 %	4 7,69 %	52 100 %
Testenine	32 78,05 %	0 0 %	0 0 %	3 7,32 %	0 0 %	1 2,44 %	2 4,88 %	0 0 %	3 7,32 %	41 100 %
Mleko	32 62,75 %	0 0 %	0 0 %	5 9,80 %	0 0 %	5 9,80 %	3 5,88 %	0 0 %	6 11,76 %	51 100 %
Jogurti	29 58 %	0 0 %	0 0 %	5 10 %	0 0 %	5 10 %	3 6 %	0 0 %	8 16 %	50 100 %
Siri	32 61,54 %	0 0 %	0 0 %	4 7,69 %	0 0 %	2 3,85 %	3 5,77 %	2 3,85 %	9 17,31 %	52 100 %
Moka, žita	33 63,64 %	0 0 %	0 0 %	5 9,62 %	0 0 %	4 7,69 %	1 1,92 %	1 1,92 %	8 15,38 %	52 100%
Med	9 17,31 %	0 0 %	0 0 %	5 9,62 %	3 5,77 %	14 26,92 %	2 3,85 %	18 34,62 %	1 1,92 %	52 100 %
Marmelade	10 19,23 %	0 0 %	0 0 %	1 1,92 %	1 1,92 %	1 1,92 %	24 46,15 %	13 25 %	2 3,85 %	52 100 %
Sokovi	20 39,22 %	0 0 %	0 0 %	3 5,88 %	1 1,96 %	1 1,96 %	11 21,57 %	4 7,84 %	11 21,57 %	51 100 %
Čaji	25 47,17 %	2 3,77 %	0 0 %	3 5,66 %	1 1,89 %	0 0 %	13 24,53 %	1 1,89 %	8 15,09 %	53 100 %
Vina	28 56 %	0 0 %	0 0 %	1 2 %	0 0 %	2 4 %	4 8 %	10 20 %	5 10 %	50 100 %
Žganje	19 38,78 %	0 0 %	0 0 %	1 2,04 %	0 0 %	1 2,04 %	9 18,37 %	16 32,65 %	3 6,12 %	49 100 %
Pivo	35 71,43 %	1 2,04 %	0 0 %	3 6,12 %	0 0 %	1 2,04 %	1 2,04 %	0 0 %	8 16,33 %	49 100 %
Jajca	17 32,69 %	0 0 %	0 0 %	1 1,92 %	3 5,77 %	13 25,00 %	7 13,46 %	9 17,31 %	2 3,85 %	52 100 %
Drugo:	10 55,56 %	0 0 %	0 0 %	1 5,56 %	1 5,56 %	1 5,56 %	2 11,11 %	1 5,56 %	2 11,11 %	18 100 %

Analiza vprašanja: Kako ste se oskrbeli s posameznimi skupinami živil pred ukrajinsko krizo? Če se pri določeni skupini živil poslužujete različnih načinov za oskrbo, izberite najpogostejšega.

	Hipermarketi, marketi in manjše trgovine (domače znamke)	Spletni nakup (večji trgovci)	Spletni nakup (Zeleni zabojček)	Trgovine z lokalno ponudbo	Tržnice	Bližnje kmetije	Pridelam sam/a	Dobim od sorodnikov/ znancev, ki jo pridelajo sami	Hipermarketi, marketi in manjše trgovine (uvožene znamke)	Skupaj
Zelenjava	8 72,73 %	0 0 %	0 0 %	0 0 %	0 0 %	1 9,09 %	2 18,18 %	0 0 %	0 0 %	11 100 %
Sadje	8 72,73 %	0 0 %	0 0 %	0 0 %	0 0 %	0 0 %	0 0 %	2 18,18 %	1 9,09 %	11 100 %
Meso	6 60 %	0 0 %	0 0 %	0 0 %	0 0 %	2 18,18 %	1 9,09 %	1 9,09 %	0 0 %	10 100 %
Ribe	7 70 %	0 0 %	0 0 %	0 0 %	1 10 %	0 0 %	0 0 %	0 0 %	2 20 %	10 100 %
Kruh	6 54,55 %	0 0 %	0 0 %	1 9,09 %	0 0 %	1 9,09 %	1 9,09 %	1 9,09 %	1 9,09 %	11 100 %
Testenine	8 72,73 %	0 0 %	0 0 %	1 9,09 %	0 0 %	0 0 %	0 0 %	0 0 %	2 18,18 %	11 100 %
Mleko	8 80 %	0 0 %	0 0 %	1 10 %	0 0 %	0 0 %	0 0 %	0 0 %	1 10 %	10 100 %
Jogurti	8 80 %	0 0 %	0 0 %	1 10 %	0 0 %	0 0 %	0 0 %	0 0 %	1 10 %	10 100 %
Siri	8 80 %	0 0 %	0 0 %	1 10 %	0 0 %	0 0 %	0 0 %	0 0 %	1 10 %	10 100 %
Moka, žita	8 72,73 %	0 0 %	0 0 %	0 0 %	0 0 %	2 18,18 %	0 0 %	0 0 %	1 9,09 %	11 100 %
Med	2 20 %	0 0 %	0 0 %	1 10 %	1 10 %	4 40 %	0 0 %	2 20 %	0 0 %	10 100 %
Marmelade	4 36,36 %	0 0 %	0 0 %	0 0 %	1 9,09 %	1 9,09 %	1 9,09 %	4 36,36 %	0 0 %	11 100 %
Sokovi	7 70 %	0 0%	0 0 %	1 10 %	0 0 %	1 10 %	0 0 %	0 0 %	1 10 %	10 100 %
Čaji	6 60 %	0 0 %	0 0 %	0 0 %	0 0 %	0 0 %	2 20 %	0 0 %	2 20 %	10 100 %
Vina	6 60 %	0 0 %	0 0 %	0 0 %	0 0 %	0 0 %	0 0 %	3 30 %	1 10 %	10 100 %
Žganje	3 30 %	0 0 %	0 0 %	0 0 %	0 0 %	0 0 %	0 0 %	5 50 %	2 20 %	10 100 %
Pivo	6 60 %	0 0 %	0 0 %	1 10 %	0 0 %	0 0 %	0 0 %	0 0 %	3 30 %	10 100 %
Jajca	3 30 %	0 0 %	0 0 %	0 0 %	1 10 %	3 30 %	1 10 %	2 20 %	0 0 %	10 100 %

XVI. International Conference on Logistics in Agriculture 2022 Conference Proceedings

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Abstract 16th International Conference on Agricultural Logistics organized by: Landscape Governance College GRM Novo mesto, Grm Novo mesto – center of Biotechnology and Tourism, the Faculty of Logistics of the University of Maribor, the Municipality of Sevnica and Cooperatice Union of Slovenia. The conference took place in cooperation with Faculty of Electrical Engineering and Computing and Institut of 'Mihajlo Pupin', University of Beograd. The central theme of this year's conference will be "Digitalization of logistics in agriculture". The conference has become traditional and paves the way for a different view of logistics in connection with agriculture.

Keywords: logistics, agriculture, digitalisation, international conferences, proceedings

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16. MEDNARODNA KONFERENCA LOGISTIKA V KMETIJSTVU: ZBORNIK KONFERENCE

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Povzetek 16. mednarodna konferenca Logistika v kmetijstvu, ki jo organizira Visoka šola za upravljanje podeželja Grm Novo mesto, Grm Novo mesto – center biotehnike in turizma, Fakulteta za logistiko Univerze v Mariboru, Občina Sevnica, Zadružna zveza Slovenije, Fakulteta za organizacijske študije v Novem mestu in Vimal Akademija. Konferenca se je odvijala v sodelovanju z Fakulteto elektrotehnike i računarstva in Institutom 'Mihajlo Pupin', Univerze v Beogradu. Letošnja osrednja tema je 'Digitalizacija logistike v kmetijstvu'. Konferenca je postala tradicionalna in posveča pozornost na različne poglede na logistiko v povezavi s kmetijstvom.

Ključne besede: logistika, kmetijstvo, digitalizacija, mednarodna posvetovanja, zbornik

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