



The Food Value Chain of Buckwheat in Serbia

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1. THE VALUE CHAIN OF BUCKWHEAT IN SERBIA

1.1 Buckwheat in Serbia

Although buckwheat cultivation in the world was doubled in the last decade, in Serbia buckwheat is cultivated on relatively small areas (Popović et al., 2014). Out of the total area of Serbia (8,840,000 ha) agricultural land is located on 5,734,000 ha, out of which 4,867,000 ha are arable land. In Serbian agriculture, the leading place belongs to crop production. Cereals, especially corn and wheat, have a dominant place in the structure of production, about 31% [Statistical Yearbook of the Republic of Serbia, 2018].

Buckwheat was traditionally grown in former Yugoslavia in Slovenia where it presents raw material for traditional products. Interest for production of buckwheat among the producers from Serbia expanded from the beginning of 21st century (Glamočlija et al., 2011), initiated with growing interest among consumers for buckwheat based products, as the products with increased nutritional value. Consumption of buckwheat is associated with various health benefits (hypocholesterolemic effect, suppression of colon and mammary carcinogenesis, constipation, gall stone, etc.) due to numerous nutritional benefits, high flavonoid content, particularly rutin and quercetin, high content of antioxidants, resistant starch, vitamins, proteins, minerals and dietary fibres (Sakač et al., 2011). Buckwheat is interesting also as also gluten free raw material. All emphasized aspects contributed to development of remarkable existing buckwheat based products in Serbia.

Buckwheat can be successfully produced in Serbia because buckwheat yield can be significantly higher than the average world yield of 1,350 kg/ha (Popović et al., 2014). Buckwheat can be grown as a main crop or as a subsequent crop after mowing winter fodder plants. The time and manner of harvesting depends on the purpose of its cultivation (Sredojević et al., 2020).

The offer of buckwheat based products at the market in Serbia consist of numerous diverse products: natural, dehulled and roasted grain, white and dark flour, semolina, variety of bakery products, dough sheets for preparation of traditional pies, pies with different fillings including cheese, meat, leafy vegetables, frozen doughs and bakery products, puff pastry, snacks, different shapes of buckwheat pasta, buckwheat flakes, buckwheat tea, buckwheat honey, pillows from buckwheat husk, etc (Figure 1). At the market there are products with organic certificate and from conventional production. Products in the offer are almost exclusively from domestic producers. Interest of consumers in buckwheat-based products is large and it is steadily increasing generating stable and increasing demand for these products. Even though buckwheat has enormous potential to be utilised as a functional ingredient in various foods, its consumption in Serbia is still below dietary recommendation mainly due to a distinct bitter taste (Škrobot et al., 2022).



Grain



Flour



Bread



Snack



Pie



Pasta



Dough sheets



Flakes

Figure 1 – Part of buckwheat based products offer at Serbian market

In mountainous regions buckwheat yields per hectare are at the level of 1 to 1.2 t/ha while in Pannonian plane, with application of contemporary methods of intensive agricultural production, it can be over 2 t/ha. There is no official statistical data about current buckwheat production in Serbia, but according to the recent research (Sredojević et al., 2020) in Serbia buckwheat is cultivated at about 300 hectares.

Data obtained from Customs administration show that annual import of buckwheat to Serbia is over 1,000 t. The main destination from which buckwheat is imported is Russia with 80% to 95% of buckwheat originating from this country as presented in Table 1.

Table 1 - Import of buckwheat to Serbia in last 5 years

Year	Imported quantity, kg	Share of import from Russia, %	Other countries from which import was realised
2017	867,194	83	Denmark, France, Greece, Hungary, Poland
2018	1,023,530	93	France, Greece, Hungary, Italy, Poland,
2019	1,155,615	89	Greece, Hungary, Poland, Sweden, Ukraine
2020	1,014,056	80	Bulgaria, Greece, Hungary, Poland,
2021	1,398,879	95	Bosnia and Herzegovina, Bulgaria, Greece, Poland, Slovenia

On the basis of data from Customs administration of Serbia certain quantities of buckwheat, including part of imported quantities are exported from Serbia with export in last five years ranging from 60 to over 400 t. The main destination for export is Bosnia and Herzegovina to which 40% to almost 100% of annual export is delivered. The data for buckwheat export from Serbia is provided in Table 2.

Table 2 - Export of buckwheat from Serbia in last 5 years

Year	Exported quantity, kg	Share of export to B&H, %	Other countries to which export was realised
2017	59,057	72	Bulgaria, Montenegro, Slovenia, Kosovo
2018	302,861	93	France, Montenegro, North Macedonia, Kosovo
2019	274,102	99	Montenegro, North Macedonia,
2020	116,460	44	Montenegro, Slovenia
2021	404,306	92	Montenegro, North Macedonia, Kosovo

1.2 Results

1.2.1 Description of the buckwheat value chain

Buckwheat value chain with involved valuechain actors in Serbia was mapped as presented in Figure 2.

Buckwheat value chain and buckwheat production and processing are in Serbia in **maturity stage** of product life cycle.

Seed for production of buckwheat are available from domestic producers, but it is also imported by the farmers.

There are a few buckwheat producers in Serbia with areas at which production is realised ranging from under 1 ha to over 30 ha. Production is partly realised in mountainous regions with concentration of production mostly in hilly-mountain areas in Eastern (Stara planina) and of South-western part of the country (Zlatar, Zlatibor, Tara, Javor, Rudnik, Pešter, Sjenica, Jastrebac and Čačak) at altitudes of 1,100 m (Sredojević et al., 2020). Part of production is also realised in Northern Serbia in Pannonian plain.

In some parts of the country producers are organised and have their associations, like the association “Zlatarska heljda” (Buckwheat from Zlatar mountain).

Farmers producing buckwheat at larger areas have also their own equipment for primary processing of buckwheat. They also use husks obtained after sifting of flour for production of pillows filled with buckwheat husk. In this case they sell dried and cleaned grain or preferably buckwheat flour to healthy supplies shops. It can be estimated that more than the half of buckwheat production is from this group of producers. One of the leading producers with integrated production of buckwheat and its primary processing is Agro Zlatar, Nova Varoš.

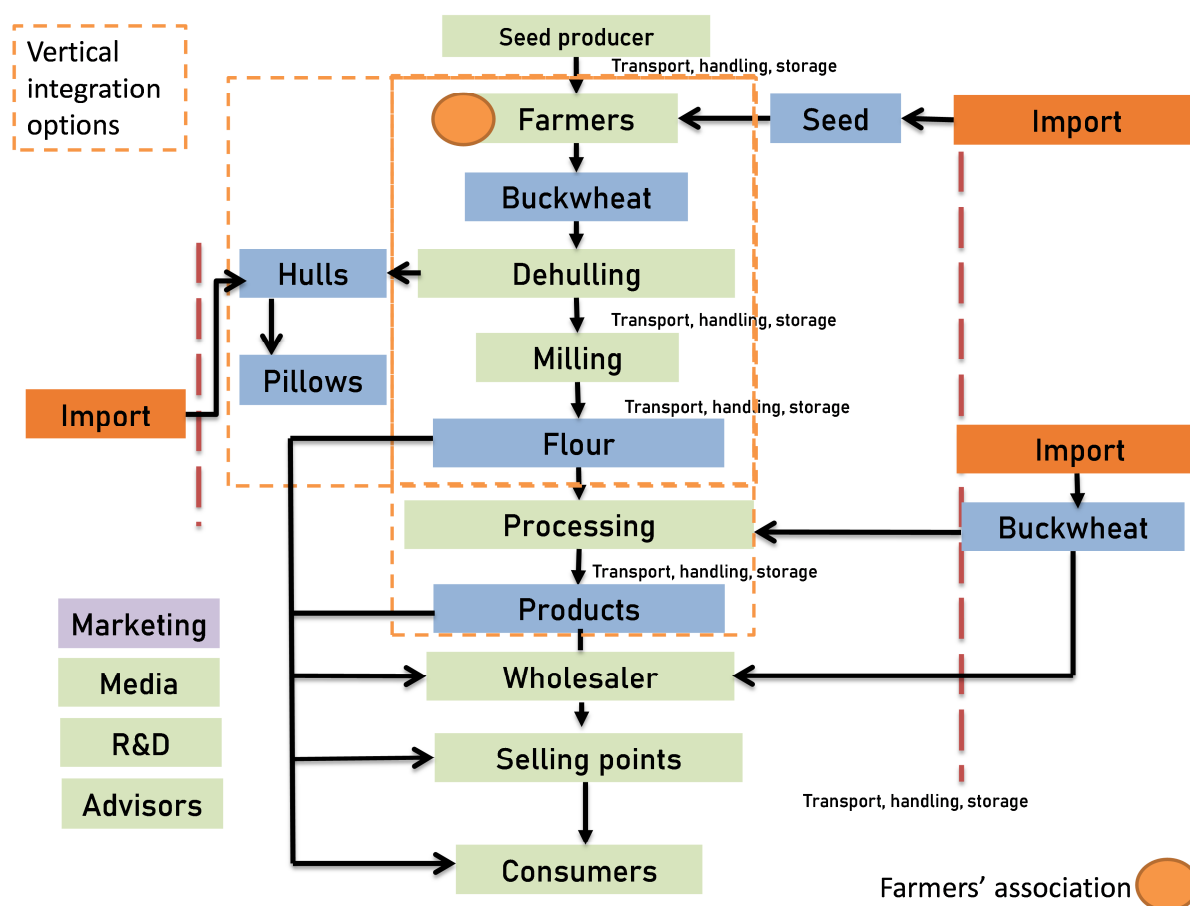


Figure 2. Mapping of buckwheat food value chain in Serbia

Additional quantities are produced by small producers realising production of buckwheat at small areas of 1-2 ha. They do not have conditions for buckwheat drying, cleaning and dehulling and they use buckwheat for their own need or try to sell produced grain to the processing companies. However, there are no collection points specialised for accepting and storing buckwheat, while collection points dealing with mainstream grains are not interesting in collecting small quantities delivered by individual agricultural producers.

There is a number of companies involved in buckwheat processing into milling products in Serbia. They usually have equipment for further processing of buckwheat flour into pasta, flakes or bakery products. Some of the most important ones are:

- Hemijakomerc, Novi Sad (grain, flours, semolina, pasta, pillows) (<http://www.hemijacom.rs/>)
- Interpak, Kraljevo (grain, flour, pasta, bran, semolina) (<http://www.interpak.rs/>)
- Vega, Čenta (flours, grain) (<https://vega-adm.rs/>)
- Italico, Bečej (dehulled grains, flours, flakes) (<https://www.italico.rs/>)
- Heljdaprotein, Požega (flour, pillows) (<http://www.heljdaprotein.com/>)
- Bioheljda, Užice (dehulled grain, flours, pasta, frozen pies, dough sheets) (<https://bioheljda.rs/>)
- Pešterska heljda, Pešter (grains, flour, honey, pillows, husks) (<http://www.pesterskaheljda.com/>)
- Slavuj, Umka (grain, roasted grain, flakes) (<https://www.slavuj.rs/>)

Additional step in processing of buckwheat is production of ready-to-use mixtures for bakers and for home-made bread which includes buckwheat. Producers of such products are large companies involved in production of bakery mixtures and additives. They buy buckwheat flour from

abovementioned producers, and they have widely spread distribution networks towards bakeries that use their products including mixtures containing buckwheat flour.

In this way buckwheat flour finds its place in production assortment of many bakeries in Serbia. Bakeries produce mainly mixed buckwheat bread and other bakery products which contain about 20 to 30% of buckwheat flour while the rest is wheat flour.

There is also a number of companies processing buckwheat flour into baked products with longer shelf life that are used as snacks or as substitute for bread. In this group of producers, the largest producer is company Basket, Golubinci (<https://basket.co.rs/>) which produces different forms of snacks.

The production of pillows for different purposes and other products filled with buckwheat husk is also developed. The producer of these items is, beside farmers and mills, also Roza Knežević, entrepreneur from Sombor importing buckwheat husk.

Distribution of buckwheat products to the market, which is similar for all other products from the category of so called “healthy food products” is organised through well-developed network of healthy food stores which are mainly supplied by healthy food wholesalers. There are also departments for healthy food products in almost every supermarket.

The main wholesalers are:

- Lučar, Novi Sad (<http://www.lucardoo.co.rs/>)
- Nutricija, Zemun (<https://nutricia.rs/>)
- Viva Tref, Belgrade (<https://nutricia.rs/>)
- Boneda, Belgrade (<https://boneda.rs/>)
- Biouna, Novi Sad (<https://www.bio-una.com/>)
- Biošpajz (<https://www.biospajz.rs/>)

There are numerous web pages offering online sales of diverse buckwheat products, including the ones operated by producers and the ones operated by healthy food online shops

Buckwheat production in Serbia is far from sufficient for the needs of well-developed buckwheat products market and growing pool of consumers using buckwheat products in their daily diet, so main quantities of buckwheat for processing originate from import.

There is a number of researchers involved in research activities regarding buckwheat processing. The investigations are mainly supporting the claims regarding nutritional value of buckwheat, innovative buckwheat products or characterization of buckwheat products. In recent years research within several PhD thesis were dedicated to buckwheat, buckwheat based products and their nutritional value and quality (Sedej, 2011; Škrobot, 2016; Nešković, 2021) as well as a number of papers published on the issue of buckwheat and its products (Sakač et al., 2011; Škrobot et al., 2022; Torbica et al., 2010). Monograph “Buckwheat: raw material for functional food was published in Serbian language by the group of authors from Institute of food technology in 2012 (Sakač et. al., 2012).

There is a lot of support to increase of interest among consumers for buckwheat and buckwheat based products by the media with huge number of articles by newspapers or by associations involved in healthy life style promotion available online.

1.2.2 Overview of the interviews completed

The primary search for entities involved in buckwheat production and processing in Serbia was performed using data available at the internet. From this source the following participants in buckwheat value chain in Serbia were identified:

- Buckwheat breeder, producer and trader
- Buckwheat producers
- Association of buckwheat producers
- Buckwheat processing companies
- Wholesales
- Healthy food distributors

Based on obtained data the list of interviewees was outlined. Due to the fact that research was conducted during the COVID 19 pandemic, in order to avoid direct contact, interviewees were mainly contacted through the telephone calls. Buckwheat value chain actors having deeper knowledge and understanding of the issues in buckwheat value chain were visited and face to face interviews were conducted.

The overview of number of interviews per value chain actors¹ is provided in table 3. In the table the method (face to face or telephone) used for conduction of the interview is indicated.

Table 3. Overview of the number of interviews performed for each buckwheat VC actor.

VC actors	Numbers of interview	Method
Breeder, seed producer and trader	1	
Farmers	2	  
Processing	3	    
Processing of byproducts	1	
Wholesaler	1	 
Seller	1	
Advices and research	2	 
Association of producers	1	



Interview conducted in face to face communication with application of preventive measures regarding COVID 19 pandemic



Interviews conducted in telephone conversation

¹ Interviews with companies with multiple roles in value chain are presented in the table as multiple interviews

1.2.3 Breeder

Total amount of buckwheat seed in Serbia in 2020/21 year, according to the seed certification data base is 5.6 t.

In Serbia there is one producer of certified buckwheat seed (Institute of field and vegetable crops, Novi Sad). According to data obtained from their expert for buckwheat, the production of buckwheat seed is **about 3-5 t annually which is far from enough** for estimated buckwheat production, and even further from buckwheat production potential arising for convenient natural conditions and large market capacity for buckwheat products in Serbia.

Identified problems:
Insufficient seed production
Utilization of non-certified seed

Institute of Field and Vegetable Crops in Novi Sad, Serbia, produced four buckwheat varieties “Novosadska”, “Godijevo”, “Bamby” and “Češka” (Pržulj et al., 2012) but current seed production exists only for buckwheat variety “Novosadska”. There are no ongoing activities in buckwheat breeding and development of new varieties. According to the results (Popović et al., 2014) from field trials, buckwheat variety “Novosadska” is characterised with potential to yield almost 3 t/ha under convenient climatic conditions and application of appropriate production technology. About 80-100 kg of seeds per ha are needed for sowing.

Buckwheat seed “Novosadska” is sold to the farmers directly from the Institute of field and vegetable crops: <https://nsseme.com/proizvodi/alternativne-kulture-i-organska-proizvodnja/alternativne-kulture/>. Institute of field and vegetable crops is public research institution which in former times had monopoly at seed market of Serbia, but nowadays due to strong competition of seed producers from abroad it mainly cuts its costs, with minor cultures being the first for which breeding activities were stopped.

Institute of field and vegetable crops has **expertise** and **excellent infrastructure** for production of high quality seed, but the reason for which they do not produce higher quantities is the lack of demand for seed. From their viewpoint the reason for low demand is the fact that producers mainly use their own seed from previous harvest in buckwheat production.

Buckwheat producers according to the information obtained in the interviews, buy certified buckwheat seed once in several years and use it until the plant loses its properties (it “goes wild” as they say). The reason for avoidance of buying of certified seed is related to the producers’ efforts to reduce production costs.

Beside buckwheat variety Novosadska, among widely spread varieties are also autochthonous varieties “Golubica” and “Siva golubica” which are characterized by good growth and a solid tree height of 90-100 cm (Pržulj et al., 2012). Some farmers practice multiplication of seed of autochthonous buckwheat varieties and selling of the seeds online (<https://staresortesemena.com/proizvod/heljida-autohtona-srpska/>). Some farmers also import seed from other countries like Russia, Ukraine or Sweden, usually in small quantities (100-200 kg), without the certificate, for their own needs.

1.2.4 Input suppliers

Buckwheat is among farmers and experts considered to be crop with low demands for agro-technical measures in production. Irrigation is applied in the case when buckwheat is grown as a side crop (Gadžo et al., 2015). No chemical protection measures are used against insects. Due to the high content of rutin that gives the buckwheat plant a slightly bitter taste, insects do not attack this crop. Against pathogens, only preventive measures are applied, such as disinfection of seeds and

cultivation of buckwheat in the crop rotation (Popović et al., 2013). Grain-eating birds can cause far greater damage to plants.

However, if producer decide to use fertilisers or pesticides distribution network for supplies for agricultural production is very wide and easily accessible for any farmer with excellently supplied selling points in almost any village. At Serbian market wide assortment of fertilisers, herbicides and pesticides is available. However, when it comes to buckwheat production the main problems are lack of information about optimal dosage of fertilisers, as well as about required protection measures. Due to lack of knowledge buckwheat producers, particularly in the case of production in plain apply excessive amount of nitrogen fertilizers to buckwheat crops resulting in intensive development of green mass without beneficial, or with negative effects on grain yield.

Identified problems:

Lack of knowledge

High prices

Problematic quality

Additional problem is also high price of supplies from import with guaranteed quality which poses additional significant costs in production. There is also a number of small domestic producers of pesticides and herbicides that supply the market with the products with lower price, but the quality and concentration of such products is not guaranteed.

1.2.5 Knowledge providers and services

Knowledge about buckwheat production and its availability in Serbia are quite scarce. Although there are agricultural extension services covering the whole area of Serbia advisors are not thoroughly informed about buckwheat production requirements and in most cases are not able to support improvements in buckwheat production, so the producers are learning from their own mistakes.

Identified problems:

Knowledge creators not linked -with value chain actors

In the Institute for field and vegetable crops there is a department for alternative crops with experts oriented towards research related to buckwheat production and breeding of new varieties. However, they are not connected sufficiently with the producers.

Research related to buckwheat processing technology is directed towards optimisation of production of final products like bread or pasta and nutritional profiling of buckwheat products. There is not research regarding buckwheat purification, dehulling or milling.

The network of accredited laboratories supporting buckwheat testing starting from seed certification, over testing of grain quality, analysis of flour of final products exists and covers testing of all aspects of buckwheat products quality and safety.

1.2.6 Producer

In Serbia there are several large producers of buckwheat who have production at 10 or more hectares, and a number of small producers having production at 1-2 ha. Buckwheat must usually be harvested before it reaches moisture content appropriate for storage, particularly in mountainous region. In such cases, moisture content of harvested buckwheat is at harvest 18 % or more and thus

drying is needed in order to decrease moisture to the level of 14-15% which enables safe storage of produced grains.

Large producers are usually equipped for preparation of buckwheat for safe storage and they have adequate storage facilities. Sometimes they also provide services of buckwheat drying and purification for small producers but this is the matter of bilateral cooperation rather than **horizontal linkage** which would support small producers in general.

Due to the lack of equipment for drying small producers use primitive technique for drying of buckwheat by turning it over with shovels on concrete surface. In this way, particularly when weather conditions are humid or rainy moisture content of grains is not reduced timely. High moisture content of buckwheat grains supports development of microflora, and possibly production of mycotoxins. Small producers also do not have the equipment for grain purification of buckwheat grain so the buckwheat from producers from Serbia, particularly the small ones, is not clean and it contains a lot of weed seed and other impurities which bring down the price of their products at the market.

Identified problems:

Low yields

Lack of equipment for drying

Lack of adequate horizontal linkage

Lack of appropriate support from the government

Buckwheat producers, particularly the large ones that diversify their production to different crops, are equipped with adequate machinery for soil preparation, application of agro-technical measures and harvesting.

There is also a difference between motives for buckwheat production between producer from mountainous regions and from the plane. In the mountains the climate is more convenient for buckwheat production with lower temperature, more humidity and rainfall which are convenient for buckwheat. However, soil in mountainous regions is of lower quality and does not enable achievement of high buckwheat yields. The yield of buckwheat in these regions can be up to 1- 1.2 t/ha or even less.

Production of buckwheat in the plane is performed because buckwheat can be grown as the subsequent crop after mowing winter fodder plants. With appropriate agro-technical measures in convenient years buckwheat yield can be over 2 t/ha. However, without irrigation which in the most cases is not enabled, in years characterized with lack of rainfall, yields can be significantly lower.

However, producers from lower altitude terrains consider buckwheat as the crop which with the identically high inputs provides lower yields, while the prices at the market are not sufficiently differentiated in comparison to mainstream crops like wheat or corn.

Farmers perceive that there is no appropriate support from the government through public policy measures directed at stimulation of buckwheat production in Serbia.

In the region of Southwestern Serbia, including Mountain Zlatar and surrounding mountains the association of buckwheat producers was established in 2013. The association is led by the leading buckwheat producer from this region (and in Serbia in general) Jekoslav Purić who has own production of buckwheat at over 30 ha. Association was in 2014 funded by local authorities with 10,000 EUR for purchase of drying equipment.

Producers of buckwheat in Serbia are facing a problem that there are no customers interested in their product and thus, in spite of buckwheat consumption increase, the decrease in produced quantities of buckwheat in Serbia is also obvious. Producers of buckwheat in Serbia manage to place their products to the market in one of the following manners:

- Through occasional cooperation with buckwheat processing firms

- Through processing of buckwheat into flour in own small capacity milling plants and selling flour to the wholesalers, healthy food stores, directly to the customers in their vicinity or through internet offer on social networks

There are some efforts to label the products as organic, but again certified organic buckwheat from import is more competitive in comparison to buckwheat from domestic producers due to above emphasized problems.

1.2.7 Collection centre

There is no collection centre in Serbia specialised for buckwheat collection and storage, while collection centres dealing with staples like wheat, corn or barley are not interesting in operating with small quantities and large number of buckwheat producers. This situation results in a fact that each producer has to find the way towards the downstream value chain actors by himself. Absence of collection centre with necessary equipment for grain purification, drying and storage result in a kind of interruption of value chain at the point between producers and users of buckwheat, i.e. buckwheat processing industry and consumers.

Identified problems:

Non-~~in~~existence of collection centre for buckwheat

1.2.8 Processing firm

The step of buckwheat processing can be **divided in two distinct phases** with different positions and different roles in buckwheat value chain in Serbia.

The first group of value chain actor in processing step for buckwheat value comprises of companies oriented towards primary processing of buckwheat grain: milling and dehulling. There are only few companies equipped for dehulling of buckwheat grain, while in the case of buckwheat milling there are dozens of companies which, beside other grains mill also buckwheat. However, none of these companies is specialised for buckwheat processing i.e. buckwheat rather represents one of raw materials among all others like wheat, corn, rye, oats etc.

Identified problems:

Low quality of buckwheat produced in Serbia

Main quantities of buckwheat- for processing are imported

The second group of value chain actors are the ones oriented towards buckwheat flour processing. There are hundreds of companies processing buckwheat into bakery products, snacks, pasta, dough sheets, pizza crusts, puff pastry, frozen bakery products etc. However, for these companies buckwheat flour also presents one out of many diverse raw materials used in production of diverse assortment of products.

The production of items like pillow filled with buckwheat husks is also developed. Usually, it represents side activity of primary buckwheat processors, but here is also a company specialised in buckwheat pillow production with innovative solutions like addition of aromatic plants in the pillow, making different shapes of pillows etc. However, buckwheat husks for this activity are imported from Ukraine. The reason for import of husk according to the data obtained in the interview is that none of the buckwheat processors in Serbia is equipped with high performance dehulling equipment which provide clean husk.

The cases of **vertical integration** of primary and secondary buckwheat processing, including in some cases also vertical integration with buckwheat production, or even with buckwheat seed production are also present. Registered combinations of vertical integration are the following:

- Certified seed production, buckwheat grain production, dehulling and milling (ZZAgrodunav)
- Buckwheat production, dehulling, milling, pasta production (Hemija komerc)
- Milling, pasta production (Interpak)
- Dehulling, flakes production (Italico)
- Production, milling (Agro zlatar)

The **link towards bakeries**, among which production of bakery good with addition of 20-30% of buckwheat flour is widely spread, are the producers of ready to use mixtures for baking industry. There are several strong companies involved in production of ready to make mixtures for baking industry in Serbia with well-developed distribution network towards bakers and strong position at the market. Due to the strength of both, existing domestic companies and strong companies in this sector from abroad **entry barriers in this segment of flour processing are high**.

In Serbia there are more than 5000 bakeries and significant share of them includes buckwheat based product in their assortment resulting in **perfect competition at the market of finalised bakery products**, including buckwheat based products.

Almost all **value chain actors in the processing step**, including the ones involved in primary processing phase, stated that they **predominantly use imported buckwheat** as raw material, and that they buy buckwheat from producers from Serbia only occasionally. As the reason for such behaviour the fact that buckwheat from domestic producers is of significantly lower quality was emphasized. They stated the following problems regarding domestic supply of buckwheat:

- It is delivered in small lots and the quality of lots from different producers varies
- Microbiological safety is problematic and large microbial count in grain results further in shortening of shelf life of their products
- There are lot of impurities in delivered grain
- Grain is of lower quality in terms of smaller grains, as well as presence of damaged grains and insufficiently developed grains

Value chain actors state that **imported buckwheat** is characterised with **much higher and uniform quality** while there is no difference in price. Additional **convenience for buckwheat import**, which is realised primarily from Russia, is related to **transport** because trucks used for transport of Serbian apples to Russia, which will otherwise have to drive back to Serbia empty, are used for transport of buckwheat.

Producers of bakery products by rule have their own logistics for delivery of products to the selling points.

Buckwheat processors are quite **good linked with institution** providing knowledge, advices, supporting development of new products as well as with accredited **laboratories** for testing of safety and quality of products, and the products are tested regularly and declared in accordance to regulations.

In Serbia there are **Regulations** in which requirement for buckwheat product regarding their safety and quality are clearly defined.

1.2.9 Retailing

There is a difference between retail part of value chain for primary and for final buckwheat processing products.

Major share of retail of buckwheat and primary products of its processing is performed with participation of wholesalers that distribute products further to healthy supplies shops and healthy food departments in mega markets as the common selling points for buckwheat and primary products of its processing i.e. flours, semolina and flakes. Wholesalers are also importing buckwheat.

Identified problems:
Competitive position of small domestic producers at the market.
Dominance of wholesalers

The case of vertical integration of primary processing of imported buckwheat and wholesale activities is quite common.

Value chain actors from the step of primary buckwheat processing use different distribution channels and different customers:

- Major quantities of flours are delivered to wholesalers
- Somewhat lower quantities are sold to bakeries and bakery mixture producers
- Quite small quantities are sold directly to consumers

Large producers of products of primary buckwheat processing mainly sell their products through distribution chain including the wholesaler (more than 70%). Small producers for whom barriers for delivery of good to wholesalers are high due to insufficient quantities struggle to sell their product directly to the consumers using diverse distribution channels:

- Sales in the store attached to small milling processing plant
- Selling directly to healthy supplies shops.
- On-line sales

There is a lot of healthy supplies shops in Serbia, and they are the main sales point where consumers look for primary buckwheat products. There is a number of companies having the network of healthy supplies shops but there are also a lot of entrepreneurs running small healthy supplies shop business. Networks of healthy supplies shops are also in many cases vertically integrated with wholesale and they have clear competitive advantage over small healthy food businesses.

Finalised bakery and similar products from buckwheat are delivered to the consumers through the following distribution channels characterizing distribution of bakery good in Serbia in general:

- Own stores attached to bakeries
- Own network of bakery stores covering area which is supplied with bakery products by the baker
- Retail chains

Export of buckwheat or buckwheat products from Serbia is sporadic. Mainly imported buckwheat grains are re-exported, while the products are distributed predominantly at domestic market.

1.2.10 Use of E-commerce

Utilisation of E-commerce in healthy food distribution is quite common in Serbia. Buckwheat and its milling products are also quite commonly distributed through specialised internet shops along with other “healthy” food products.

1.2.11 Marketing strategy

Value chain actors involved in buckwheat value chain in Serbia do not perform almost any marketing activities.

However, buckwheat consumption is in Serbia widely promoted by different actors advocating healthy eating. There is enormous number of statements and articles on internet with recommendations and recipes for utilisation of buckwheat products in daily diet.

Among consumers consumption of buckwheat products is widely accepted and increasing. For some consumers the obstacle for buckwheat based products consumption is bitter taste which they might have and noticeable graininess due to the presence of the part of the husk originating from whole grain flour.

1.3 Discussion

In Serbia mature value chain of buckwheat products exists with steady or even increasing demand for buckwheat based products among consumers. Serbia has also convenient conditions for buckwheat production which can be realised both in mountainous and plain regions of the country but knowledge about optimal production technology is missing, or at least it is not adequately captured among buckwheat producers.

However, there are no particular public policy measures aimed at stimulation of buckwheat production. Thus, buckwheat production, after initial increase during the first decade of 21st century initiated by increased demand for buckwheat products which are widely promoted by media and researchers to be healthy, nowadays stagnates or even decreases.

The main problem in buckwheat value chain in Serbia is non-existence of collection centre for buckwheat resulting in the fact that producers are left on their own to solve the problem of grain drying, purification and marketing. This fact, together with non-existence of substantial and meaningful cooperation among producers results in the interruption of buckwheat value chain between producers and processors. Horizontal linkage of producers with pro-active role of buckwheat producers association in establishment of collection centre might be feasible solution for this issue.

However, in the current situation processors solved their increasing needs for buckwheat through import of buckwheat mainly from Russia, while producers struggle to place their products directly to the market or, disappointed with current position give up buckwheat production.

Insufficient seed supply on one side, and orientation of producers to sowing of seed from their own production is also among major burdens of buckwheat value chain in Serbia.

The market of buckwheat product is dominated by strong wholesalers and producers of ready to make mixtures for bakery products while small producers and shop owners struggle to survive at the market.

There is evident interest among research and development institutions for buckwheat but their activities do not target burning problems of buckwheat value chain actors and thus do not have significant impact in the value chain.

1.3.1 Past challenges & successes of the value chain

The major challenge in buckwheat value chain in Serbia is **non-existence of collection centre** for buckwheat which results in disruption of value chain from the producers towards processor. Such situation is the reason for decrease of interest of producers for buckwheat production and abandoning of its cultivation. Thus the actions targeting this issue are needed. Producers in the main buckwheat production regions should be educated regarding the importance of horizontal integration and activities toward building and equipping of joint collection centres should be initiated. In this way missing link of value chain from producers to processing and market will be established.

Utilisation of non-certified and non-treated seed, accompanied with non-defined optimal production technology is the next challenge in buckwheat supply chain resulting in low yields of buckwheat. Measures should target also the utilisation of **certified seed** including increase of offer which should include multiple varieties with defined recommendation for optimal production conditions and production technologies. Recommendations for **fertilisation and application of other agro-technical measures** should be defined too. In this way increase of yields will be achieved which will contribute to increase of farmers' profit.

In the production step inability of producers, particularly the small ones to dry and to prepare grains for market in appropriate way represents additional challenge which puts buckwheat from domestic producers in inferior position in comparison to competitors from abroad. Having in mind that there are a lot of small producers, equipping of each producer separately cannot be suggested as acceptable option, but rather, as already emphasized, horizontal linkage of producer and establishment of joint collection centres should be promoted.

The challenge in processing step of buckwheat value chain in Serbia is the predominant utilization of imported buckwheat as the raw material. Addressing all of abovementioned challenges in appropriate way will, largely contribute to increase of competitive position of domestic producers and address in this manner the challenge of import of buckwheat instead of utilization of buckwheat from domestic producers.

Superior position and domination of wholesalers at the market could be also considered as a challenge in buckwheat value chain which results in entry barriers for small players. Enforcement of entrepreneurs in both processing and retail step of value chain for introduction of innovative products and application of innovative marketing and sales approaches might be the way to address this issue.

The fact that abundant **research activities** regarding buckwheat production and processing **are not targeting the problems in buckwheat value chain** are the next challenge. This value chain analysis should be used as the base to redefine and refocus research activities towards solving of real problems in value chain.

1.3.2 Current and foreseen challenges and chances of the value chain

Detailed overview of the main challenges in buckwheat value chain in Serbia with recommendation for strategies to be undertaken and identification of potential benefits for actors in the value chain are provided in Table 4.

Table 4. Summary of the challenges, strategies and potential benefits for each value chain actor.

VC actor	Main challenges & opportunities (order: most important first)	Strategies undertaken/to undertake	Potential & benefits for the actor in the VC chain
Input suppliers (breeders, seed producers, seed traders)	<ul style="list-style-type: none"> Farmers use non certified seed Non-utilised capacities for seed production and processing 	<ul style="list-style-type: none"> Education of producers Production of sufficient seed quantities of different varieties Characterisation of varieties in defining the most appropriate production practices in dependence of environmental conditions Public policy measures -- subsidies for seed purchase 	<ul style="list-style-type: none"> Utilization of certified seed in production Increased yields
Input suppliers (researchers)	<ul style="list-style-type: none"> Research topics not targeting problems in buckwheat value chain 	<ul style="list-style-type: none"> Refocus research Initiate projects with and for the value chain actors 	<ul style="list-style-type: none"> Utilisation of existing expertise for solving of existing problems in value chain in optimal manner
Input suppliers (fertilisers)	<ul style="list-style-type: none"> Recommendation for fertilisation for buckwheat not defined 	<ul style="list-style-type: none"> Conduct test production trials in order to define recommendations for fertilisation in dependence of production conditions 	<ul style="list-style-type: none"> Increase of yields Higher competitiveness of domestic producers
Producers	<ul style="list-style-type: none"> Lack of collection centres Low yields Lack of equipment for drying and purification Lack of knowledge about optimal production technology 	<ul style="list-style-type: none"> Transfer of knowledge regarding buckwheat production technology Establishment of collection centres Public policy measures – subsidizing buckwheat production 	<ul style="list-style-type: none"> Increasing yields Increasing quality and safety of buckwheat offered by domestic producers Increasing number of producers
Collection centres	<ul style="list-style-type: none"> Inexistence of collection centres 	<ul style="list-style-type: none"> Horizontal linkage of producers – proactive associations Building and equipping of joint collection centres in the main production regions Public policy measures. support for building and equipping collection centres (IPARD¹) 	<ul style="list-style-type: none"> Establishment of missing link of value chain from producers to processing and market
Processors	<ul style="list-style-type: none"> Highly predominant utilisation of imported buckwheat 	<ul style="list-style-type: none"> Public policy measure – signs denominating that products are from domestic raw material 	<ul style="list-style-type: none"> Increased interest for buckwheat from domestic producers
Retail	<ul style="list-style-type: none"> Dominant position of strong wholesalers 	<ul style="list-style-type: none"> Enforce entrepreneurs for innovative marketing and sales 	<ul style="list-style-type: none"> Enrichment of offer of product at the market

¹ EU Instrument for Pre-Accession Assistance for Rural Development

1.3.3 Limitations

Research was conducted including uniformly actors from all stages of buckwheat value chain in Serbia, as well as actors with different perspectives and competitive positions within each step of value chain. Thus, present analysis can be considered as objective presentation of value chain in Serbia in past years.

However, one of the main drivers of presented value chain is import of high-quality, low-price buckwheat from Russia. Due to changed situation with import from Russia the findings in this report are based on situation before the start of the war in Ukraine. New situation caused increase of buckwheat prices and orientation of buckwheat importers to new markets like for example Kazakhstan, but due to daily changes regarding this issue no consistent findings can be presented in relation to this issue.

1.4 Synthesis

Buckwheat value chain in Serbia is in maturity phase of product life cycle but it is not working for the benefits of buckwheat producers in Serbia. Buckwheat producers in Serbia do not have appropriate knowledge regarding production nor have they appropriate advisory support. Production of certified seed, although technically feasible, is insufficient due to lack of demand because farmer use seed from their own production influencing in this way additionally to decrease of yields in spite of convenient climatic conditions. Producers are not equipped for drying and primary processing of seed and due to application of primitive primary processing technology their crops are characterized with problematic quality and safety of buckwheat which they offer to the market.

Processing of buckwheat, both primary processing (milling, dehulling) and production of final products for consumers (bakery products, pasta, frozen pastry, snacks, dough sheets etc.) is very developed but the processors use predominantly buckwheat imported from Eastern Europe, primarily Russia. Due to problems with safety and to non-uniformity of quality they are reluctant to buy buckwheat from domestic producers.

The main obstacle disabling improvement of position of buckwheat producers is inexistence of collection centres for buckwheat and the main efforts should be targeting establishment of collection centres in main buckwheat production regions, preferably as joint undertaking by producers and their associations.

At the market wholesalers have dominant role and pose barriers for entry of small entrepreneurs. Chance for small actors in downstream part of buckwheat value chain in Serbia might be introduction of innovative products, as well as innovative marketing and sales approaches.

Quite extensive opus of research targeting buckwheat exists in Serbia, but research activities are not focused on the main challenges in the value chain and should thus be refocused.

The example of buckwheat value chain in Serbia demonstrates clearly that orphan crops can take position as significant ingredient in daily diet of consumers and become the part of mainstream consumption. Persistent action regarding identification, testing and evidence based promotion of beneficial properties of buckwheat in daily diet during quite long period resulted in enormous increase of interest of consumers for buckwheat containing products.

However, there is also the other side of the medal. Neglecting of development of production capacities resulted in non-competitive position of domestic buckwheat producers and, as consequence domestic production of buckwheat which expanded with the increased demand for

buckwheat products was almost completely substituted with not always cheaper but certainly, higher quality and better uniformity imported buckwheat.

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