10. Estimation of Economic Effects of Processing of Organic Products in the case of Family Farms

Jonel Subić[1], Marko Jeločnik[2], Vlado Kovačević[3], Biljana Grujić Vučkovski[4]

[1] Institute of Agricultural Economics, Belgrade, Serbia, jonel_s@iep.bg.ac.rs;
[2] Institute of Agricultural Economics, Belgrade, Serbia, marko_j@iep.bg.ac.rs;
[3] Institute of Agricultural Economics, Belgrade, Serbia, vlado_k@iep.bg.ac.rs;
[4] Institute of Agricultural Economics, Belgrade, Serbia, biljana_g@iep.bg.ac.rs

Abstract: Global trends in the sector of agriculture have forced family farms to look for strengthening of their economic sustainability or even for survival in one of the available alternatives for creating added value. Among the adequate possibilities for creating added value at the farm level, both the implementation of organic production system and additional offering of organic food products gained solely from processing of organic agricultural products, could be found. In line with entrepreneurial spirit and creation of additional income at the farm level, the aim of the chapter is reflected in the assessment of economic effects (based on variable costs) obtained by the use of identical capacities in the processing of conventionally and organically produced apples. In other words, a comparative analysis of the effects of substitution of the production input, with the use of processing capacities for the production of apple chips on a family farm, would be performed. According to the topic of the paper, the evaluation of the results should show whether there is a significant advantage in production of apple chips, obtained from organic apples over conventional raw material base. Substitution of used inputs generates increase in the contribution margin for almost 7.8 times, ensuring thus the boost in the overall farm profit.

Keywords: value added; economic effects; family farms; processing of organic products; apple chips.

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1. Introduction

Terms as agriculture, farm(er), rural areas and rural communities assume certain level of dynamism and synergetic action. Throughout the last few centuries their meanings, characteristics, forms, position and importance in society were constantly improved, incorporating into them relevant knowledge, which are valid for the current level of civilizational progress.

Agriculture is among the first and the most important consciously organized activities of people. It is primarily linked to satisfaction of one of the primary human needs – food. So, agriculture could be understood as the overall set of activities that indicate how the crops and domestic animals support the survival of human population in numerous ways. Over the time, apart from providing the food security, it was assigned some other functions e.g., landscape shaping and sustainable exploitation of natural resources, boosting of local economy, maintaining the quality of life of rural communities. Although the meaning of this term is usually limited to crop cultivation and livestock breeding, agriculture involves wide range of activities and sub-activities e.g., cultivation, breeding, domestication, livestock management, agri-food logistic. It is a type of human occupation or a way of life. Today agriculture is considered an essential sector of global economy capable to create the added value required for its further growth and development (Byrne 1955; Harris & Fuller 2014).

Starting from the definition of farming as the organized and targeted land (plant) cultivation or stock raising, the farm could be described as the area of land used dominantly for agricultural activities in order to produce food of plant or animal origin, fibre, biomass, energy and other products or services used in human life i.e., the essential production facility in agriculture. In contemporary agriculture, special focus is given to family farms, which offer decent living conditions for certain family involved in agriculture and enable them to accumulate enough savings for old age. They are usually not dependant on external labour, as all activities are conducted by family members with occasional help from close neighbours during the production peaks. One characteristic is that the farm members are making independently the majority of managerial decisions. Its size is determined by available natural and production resources, number of family members and their ability to efficiently use their own equipment and labour potential over the life cycle of the family. One of the crucial questions related to family farms is their size, which depending on the specific analysis could be determined through various indicators i.e., cultivated land area, number of units of livestock, value of overall farm output or generated incomes, off-farm engagement, etc. (Carlin & Crecink 1979; Garner & de la O Campos 2014; Lewandowski et al. 2018).

Globally, small farms are numerous, regardless of their location either in developed or developing part of the world. Some estimations show that farms with up to 2 ha cover almost 31% of global crop production, along with almost 34% of global food supply, and cultivating up to 24% of worldwide available agricultural land complex (Ricciardi et al. 2018). Small farms are more oriented to food production, maintaining the larger level of crop diversity (large farms are mostly involved in monoculture production), and having the lower post-harvest losses (Dixon et al. 2001). Apart from their role in securing the food security, small farms are very important for reducing the rural poverty, and contributing to local rural communities with the additional income. Overall experience have shown that increase in GDP originating from agro-sector is two times more effective in poverty reduction than the one generated outside of the agriculture (Mahendra 2014).

For example, around 2/3 of the EU farms are smaller than 5 ha (Cook 2018). Some analyses (Huang et al. 2012; Chen & Gu 2020) show that almost 98% of farms in China possess up to 2 ha, mainly due to national regulative on regional migration and land use rights. It is estimated that these farms usually overuse the agro-chemicals in comparison to the larger farms, which is mainly a result of lack of knowledge and managerial skills. It is also observed that small farms with less than 0.6 ha are mostly present in cash crop sector (Huang et al. 2012; Chen & Gu 2020). USA agriculture rests on the family farms, as they have a share of 99% in total number of active farms, while covering 89% of overall agri-production. On the other hand, 90% of all farms are small family farms with annual incomes less than 350,000 USD. They are participating in total value of production at national level with around 24% (Hoppe & MacDonald 2016). In India, 78% of all farms are owning less than 2 ha, while cultivating just 33% of total arable land and producing around 41% of grains at national level (Singh et al. 2002).

Who is managing the farm? Usually, it is manged and run either by the farmer supported by family members or externally engaged labour, or employed agricultural manager. They are responsible for all steps and activities related to crop, livestock or biomass production, food processing, agri-tourism, etc. They are making decisions about any relevant issue in relation to the farm operations e.g., raising living organisms, getting supplies and required inputs, maintaining farm equipment and facilities, selling farm products and services, etc. (BLS 2015).

At the beginning of the century, agriculture was the sector of the economy with the biggest employment rate worldwide, until the services sector took the primacy. Besides the fact that growth of employment in agriculture is reducing, it currently employs over 2.3 billion persons (FAO 2012). Over the time, with the increase in the level of intensification, knowledge transfer and tech-tech progress in agriculture, number of population involved in agri-sector has decreased. Number of people active in agriculture becomes the indicator that divides the countries to rich and poor. For example, 75% of the labour force in Madagascar is engaged in agriculture (representative of the poorest countries), while in countries with developed economy such as Germany or UK just around 1% of citizens is working in agri-sector. Share of labour involved in agriculture in Poland is 13%, which is well above than in UK, although both being representatives of developed world with noted tradition and use of hi-tech in agriculture, as well as in both countries the food production is independent, self-sufficient, or even significantly in surplus (Roser 2013).

Today, the farmer is seen as entrepreneur capable and ready to devise and implement in that moment the best possible production alternative i.e., to choose the alternative that generates the highest added value in regard with the farm businesses. It is expected that he should be well educated and skilful, as well as fully oriented to the application of all sustainability factors and principles of good agricultural practice.

Terms rural areas and rural communities are somewhat hard to explain. Generally, both in developing and developed parts of the world, the term "rural" is defined as being opposed to urban, or as "anti" urban. It refers to sparsely populated territories located outside of the urban areas. Rural areas are providing crucial contribution to the well-being and progress of any country, as they are usually involved in food production, generation of raw materials and ecosystem services. Worldwide, they offer more or less different frameworks for settlements and local communities, available physical and social infrastructure, elements of livelihood, etc. Their linkage with the urban areas is generally complex and multi-layered.

Commonly used criteria in defining rural area are population density and number of inhabitants in certain settlement. Besides, other defining indicators could be the distance from the main roads or urban centres, share of agricultural population or agricultural income, population size, etc. OECD defines rural areas as territory with population density lower than 150 inhabitants/km2 (accepted also by EU but limited to the density of 100 inhabitants/km2), (Bogdanov 2007). At regional level, functional and administrative units are classified depending on how much of the region's population lives in rural communities, where regions with over the 50% of the total population settled in rural communities could be observed as predominantly rural regions (Brezzi et al. 2011). On the other hand, level of mentioned criteria is not so strict, as it slightly varies among countries. For example, in Canada rural area/settlement is determined as the one that has up to thousand inhabitants or population density lower than 400 inhabitants/km2 (du Plessis et al. 2002). In China by small villages are considered settlements with up to 300 inhabitants, while in Australia it ranges from 200 to 999 inhabitants, or in USA up to 2,500 inhabitants or 386 people/km2, etc. (Dasgupta et al. 2014). Around 24% of world's population lives in rural areas[2] (OECD 2020). Majority of global rural population lives in less developed or least developed countries, while almost 70% of the extremely poor inhabitants in the developing countries live in rural areas (Dasgupta et al. 2014). In EU over the 91% of territory could be labelled as rural, in which around 56% of overall population lives. Prefix rurality differs among member states, from Ireland with over 98% of its territory marked as predominantly rural areas, to the Netherlands with around 2% (Štrbac et al. 2011).

Rural communities are an important factor for farms as well as for overall agriculture development. Rural communities usually represent the first level of either administrative,

[2] Globally, during the previous four decades, urban population that lives in cities larger than 50 thousands inhabitants has been increased for more than twice. So, around 48% of global population settles the cities, while almost 28% of global population lives in towns and semi-dense territories (OECD 2020).

economic, social or some other aspect of public support to farm sustainability. So, quality of mutual interaction could lead both to strengthening of their capacities and to creating successful business opportunities.

What is considered as rural community? As previously mentioned, the label rural is generally linked to certain community in regard to the number of the inhabitants, density of population, its dominant focus to agri-sector, or its distance from urban centres. Unfortunately, there is no one-size-fits-all solution, as precondition thresholds could differ from region to region. At the end, the majority of rural communities are clustered in hinterland of urban areas, acting as their resource base (for food, raw materials, labour, natural services, etc.), (Scazzosi & Branduini 2020; AARP 2020).

Farms are one of the key links in global strivings to achieve the entirely sustainable agriculture i.e., agriculture that will enable the use of accessible natural resources to current and upcoming generations under the same volume and quality. So, farm sustainability should be based on its capability to run the business in manner that will secure its durability and lead to its growth under to given socio-economic and natural circumstances. Farm sustainability fully adheres to the general principles of sustainability, by meeting economic, social and environmental objectives simultaneously. Regarding the economic aspect, farm should provide optimal and responsible use of the available technical, natural and human resources, along with securing economic efficiency and financial stability in longer period. In line with social aspect of sustainability it should preserve wellbeing of all farm members, along with being proactive in relations with both participants active in agriculture and members of rural community. Regarding the ecological aspect, farm members should show high level of awareness and responsibility towards the environmental issues in micro and macro surroundings (Sullivan 2003; Menalled et al. 2008; Bachev 2016).

Creation of added value at farm estate is among the factors that preserve the farm sustainability. Added value could be defined as any improvement in product or service characteristics, which have positive economic implications for certain producer (any change that makes products/services more welcome for the use, giving the customers additional impulse to make the purchase). In general, the overall sustainability is more economically than socially or environmentally inclined (primarily oriented toward increase of producer incomes and competitiveness), (Burchell et al. 1985). By implementing the added value, rural entrepreneurs, mostly small farms, greatly benefit from the strengthening of their earning potential, as it creates and later makes stronger economic linkage between the farm practices and the end consumer. Farmers can add the value to certain raw commodities throughout the increase of their utility e.g., by mechanically cleaning and packaging the fruits and vegetables making them ready for consumption). In agriculture, added value mainly refers to the processing activities i.e., the transformation of raw agricultural into the food products e.g., transfer of wheat into the flour or bakery products; transfer of milk or meat into the dairy or meat products; transfer of fruits into the juices, jams, or dried fruits; transfer of olives into the oil; transfer of tomatoes into the juice or sauce; etc. Furthermore, added value could appear as result of redirection of production process along with emphasizing the food origin i.e., switching to production systems in which the changed product characteristics cannot physically be seen e.g., agri-food products gained by organic or integral production, products with known origin or geographical indication, etc. (Crawford 1997; Lu & Dudensing, 2015).

Added value methods usually have notable economic dimension, while, on the other hand, practicing the organic farming emphasizes more the environmental dimension of the product. By switching entirely to organic farming, we will not be in position to feed the world, as switching from extensive type of production to organic production will lead to sharp decline in yields (compared to intensive farming) that by volume do not meet the needs of current population. But for small-scale farms (limited by size of property, or lack of mechanisation), transition to organic farming could boost the expected incomes due to higher prices of organic agricultural products. Furthermore, in order to avoid organic transition timeline (approaching to full organic status of production through the three-year conversion period) small farms could reach the sustainability and embed certain level of added value by the processing of organic food products. There are a lot of processing capacities that could be used both for processing of conventionally or organically produced raw materials at farm level (Kuepper 2006; Krall 2015).

The chapter is based on the main hypothesis that processing of organic agricultural products leads the farm to higher profits than the processing of conventionally produced raw material, having in same time the higher overall sustainability potential (there is notable environmental and social component). Similar research was previously done in production of sauerkraut (processing of cabbage), (Jeločnik et al. 2019b).

In line with that, the main goal of the chapter is the assessment of economic effects (based on contribution margin) gained by the use of unique farm facilities and equipment for the processing of conventionally and organically produced agricultural products. A comparative analysis of effects gained by substitution of raw material used for the production of apple chips, that will serve as the instrument for decision making towards the available processing alternatives at small family farms will be conducted.

2. Methodology and Used Data

Economic analysis is performed for the apple processing organized on a small family farm i.e., production of apple chips. Analysis was based on the data obtained through two in-depth interviews conducted with the farm manager. Observed farm is primarily profiled in fruit processing (mainly fruit drying and fruit brandy production) and in smaller part in apple production. It is located in peri-urban zone of the Belgrade city in Serbia. Analysis relates to the production year 2019.

Initial research was conducted within the project funded by the Ministry of Agriculture of Republic of Serbia (Improvement of knowledge transfer towards the gaining of safe and competitive agricultural products obtained by processing at the small farms within the sectors of milk, meat, fruit and vegetable) during the period 2018-2019. It incorporated the estimation of economic justification of investment in facility and equipment required for apple processing (apple chips production), while focusing on the processing of conventionally produced apples. Previous research shows that investment under assumed circumstances was justified, considering apple processing profitable for the small farm.

In order to earn additional incomes, farm would like to switch the used inputs, and to process organic apples. This idea comes from the facts that both processing activities require identical facility and equipment, and quite a similar production cycle. Additionally, there is constant growth in demand for organic products. Besides, although farm capacities are adequate just for small scale production, and inadequate for export, farmer is aware that there is small but uncovered local market niche of organically produced food products.

It is assumed that undertaken input substitution will initiate slower growth of costs than incomes, initiating the increase in gained gross profit. Organic[3] apples will be purchased locally (delivered to farm gate), while apples conventionally produced at farm will be processed into the apple brandy. Besides economic implications, farmer believes that input substitution will also boost environmental and social components of farm sustainability.

Further, for the verification of the used technological (standard in apple chips production) and methodological framework (use of contribution margin and sensitive analysis), certain

[3] It has to be noted that campaign of apple processing last for up to three months, while rest of the year facility and installed equipment are in function of service of drying other fruit species, vegetables, medicinal and aromatic herbs, etc.

scientific and professional literature was used. All data and results are presented by tables, while all values are in EUR currency.

As mentioned above, economic analysis was conducted under the following methodological framework: analytical calculations based on variable costs (calculating the contribution margin), development of sensitivity analysis and calculating the critical values of production (evaluation of economic success of organizing the processing at the farm in conditions of uncertainty). Besides, in order to see which costs burden the apple processing the most, the structure of variable costs was also presented.

Costs of production – Costs of production are the monetary expression of spending of material goods (inputs and fixed assets), labour, services, public expenditures, etc., required for realization of entrepreneur/company (including farm) business mission (Anđelić et al. 2017). In value they represent variables of physical volume of spending multiplied by price for the unit measure. Overall production costs have two sides fixed and variable. Fixed costs do not change towards the volume of production. Their initiator is the readiness of legal entity to perform a certain production (service), while they remain constant even if there is no any production activity. Variable costs occur with the beginning of production activity. Variable costs differ in proportion to output. Usually they include raw materials, labour and energy costs. They can be proportional, progressive and degressive, while most often being proportional to the volume of production. If there is no production their value is zero. The purpose of the cost analysis (specifically of the variable costs) is to identify groups or individual costs that can be reduced or avoided, which would lead to improvement of business results. According to the above, for certain production process besides the overview of overall costs, their structure is expressed too (Baye 2010; Chen & Koebel 2017).

Variable costs could differ towards the observed production line organized at the farm. Characteristics of variable costs in plant production usually refer to costs of seeds and seedlings, agrochemicals (mineral and organic fertilizers, substrates, pesticides and growth bio-stimulators), fuels and lubricants, external services of mechanization, labor[4], binder, packaging material, water, dripping tapes, mulch foil, variable part of general costs, etc. In livestock production variable costs usually include costs of feed, water, medical treatments and medicaments, fattening cattle, fuels and energy, external services of mechanization and equipment, labour, packaging material, straw or sawdust as litter, variable part of general costs, etc. There are many inputs whose costs have variable character and are linked to certain line of food processing. Usually those are raw agricultural material (grains, oilseeds, fruits, vegetables, meat, milk, honey, etc.), various food additives (salt, pepper, spices, etc.), water, energy, external services of processing equipment, labour, packaging material, variable part of general costs, etc.

Contribution margin - The farm production and market environment are characterized by high variability, and in such conditions, in order to survive and maintain the business activity, farmer is forced to frequently change the production structure at the farm, as well as the volume and method of production within the certain production line. Timely and quick adjustments in production are largely limited by the application of the classical full cost price calculations, as they require the determination of costs from all sources of their occurrence. On the other hand, calculations based on variable costs allow almost immediate assessment of the obtained product ability to cover the costs incurred within the particular production line (Andrić 1998).

[4] In economic analysis labor costs could carry two generally conflicting stands. At one side, depending on the organization of work at the farm, overall labor costs can be considered either fixed or variable. On the other hand, the character of variable costs could be only linked to externally engaged labor, or it may also include the engagement of all farm members (Meyer & Thibadoux 1996; Jeločnik et al. 2011). We support the stand that economic analysis provides a more realistic picture of the financial success of certain production line if the costs of labour also involve the valorisation of all farm members' engagement.

They enable the development of adequate analytical portfolio of the farm which will be in function of more efficient cost management and decision-making, as they allow for quick adjustments in production structure in response to the changes in the farms business environment, as well as the assessment of the farmer's business risk (Vasiljević & Subić 2010). If several production lines are simultaneously practiced on the farm, the sum of the contribution margins gained in all production lines represents the total contribution margin. By reducing the mentioned sum for the total fixed costs realized at farm, the financial result of overall farm business (profit or loss) in predefined time frame will be shown (Pejanović 2009).

As there are many interconnected or mutually conditioned production lines at the farm, generation of overall profit does not imply the profitability of individual production lines. But, gaining the negative or very low value of contribution margin over the several production cycles in certain production line could be the perfect signal for farmer to leave the given production and to focus to those production lines that yield the higher profitability (method enables direct comparing of financial success of two production lines or two levels of production intensity within the certain production line under the equal fixed costs). Therefore, calculations based on variable costs could serve as good instrument for assessing the quality of adopted technology at the farm, or economic effects of changing the intensity or technology of production of some agri-food product at the farm (Jeločnik et al. 2015).

The contribution margin in crop production is mainly calculated per unit of production area, while in livestock production per head of cattle, or in food processing per unit of produced food product.

The financial indicator of production activity based on variable costs is increasingly applied in the analysis of farm business activity. It represents the overall output (value of production) increased for allocated subsidies, and later decreased for all variable costs specific for certain line of agricultural production. Mathematically it could be expressed as (Subić et al. 2019):

$$CM = VP - VC$$

While,

$$VP = (q \times p) + s$$

Where,

CM – contribution margin

VP – overall value of production in certain production line (main and by-products)

VC – variable costs made in certain production line

q – volume of products per unit of production capacity (e.g. per m2, ha, head of cattle, hive, etc.)

p – price of product per unit of measure (e.g., per kg, t, l, piece, etc.)

s – subsidies per unit of production capacity (e.g., per m2, ha, head of cattle, hive, etc.)

Sensitivity analysis – represents the instrument for determining the sensitivity of contribution margin towards the market and production disturbance. Generally, it is not so rare for certain market disruptions to occur, at input or product market, or due to weather accident or technical failure, etc., that could endanger the level of achieved (planned) contribution margin in some production line, e.g. increase in input price could occur or due to shortage in certain input farmer would be forced to use the more expensive substitute, or due to a machine failure he has to pay external services of mechanisation, or after the spring torrential rains or floods he has to re-sow the production parcel by certain grain or vegetable, etc. In all cases the level of contribution margin is additionally pressed by increase in variable costs of production. On the other hand, drop in market price of agri-food product produced at the farm, caused by oversized offer at local market (towards the surplus in local production or uncontrolled import), or drop in yields caused by weather condition or pests could occur, that would reduce the farm incomes and endanger the level of planned contribution margin.

So, the use of sensitivity analysis defines the size of the drop in value of contribution margin due to the decrease in yields or product market price, or due to the increase in variable costs in certain production line. It supports determining which factor affects more the fall in contribution margin value, or what represents the higher risk in gaining the planned contribution margin at farm level (Subić et al. 2010).

Critical values of production – There is no doubt that farmers and their profitability are constantly exposed to various production and market risks that are usually out of their control e.g., natural disaster, extreme weather conditions, significance agri-food price fluctuation, etc. In order to secure their production and incomes they usually practice the risk management at the farm e.g., crop or income insurance, appliance of full agro-technical measures, pest control, agri-food products storing, etc., which is institutionally supported in many cases (Lipinska 2016). Considering large uncertainty in agricultural production and its potentially highly adverse impact on farm business sustainability, the method of critical values of production could serve as practical and easy to use risk management tool. Basically, this method determines the critical values of indicators at income and cost side of a certain line of production at which the contribution margin equals to zero. Method assumes calculation of critical price, critical yield and critical variable costs. Their calculation is based on following formulas (Subić & Jeločnik 2019):

Critical price: $CP = (VC - s) / EY$

Critical yield: $CY = (VC - s) / EP$

Critical variable costs: $CVC = (EY \times EP) + s$

Where,

EY - Expected yield;

EP - Expected price;

s - Subsidy;

VC - Variable costs.

3. Results with Discussion

Small family farm is equipped with orchard of 0.5 ha and processing facility of limited capacity. Among the fruit species apples and plums are dominating. According to reduced area under the orchard, gained volume of fruits limits the market orientation and business sustainability of the farm if it will be sold as fresh, so all produced fruits are primarily directed to processing, mainly to brandy production. Processing involves drying of fruits and production of fruit brandies and brandies with medicinal herbs and honey, as well as the service of drying fruits, vegetables, aromatic and spicy herbs, mushrooms, etc. for external users.

The existing working area used for processing represents panel type montage facility with useful area of over 80 m2, which includes both working and storing space. The facility is electrified, adequately lit, with ventilation system and access to fresh water and sewage system, etc. Regarding the capital equipment there exists an installed mini cold storage, with the overall capacity of 5 t that operates on temperature of 2-4°C, and container dryer with dislocated thermo-generator and two 1,5 kW power fans. Installed drying system does not allow mixing of combustion products and hot drying air. Apples are drying under the operating temperature of 50-60° C. The facility is equipped with the required equipment such are stainless steel trolleys with trays for reception of fresh and dried material, mechanic and electronic weighing scales, stainless steel containers for apple washing and chopped apple soaking into the citric acid, seed remover, chopper, working tables, chairs and carts, various knifes, heat sealing machine, etc.

The campaign of apple drying i.e., apple chips production, usually overlaps with the period of apple arrival, and lasts for 3 months (from August to October). Within that period, three cycles of apples drying are carried out at the farm (cold storage is loaded/emptied three times), during the processing of around 15 t of fresh apples. Bottleneck in apple processing could be represented by daily capacity of the used dryer. During the one working day (12 h) entire cycle of processing (preparation of input, drying and packaging of apple chips) includes 2 production loads (80 kg of fresh apples/load), that is processing of 160 kg of fresh apples/day.

Organisation of apple chips production at the farm estate generally considers following operations: monthly purchase and storing of fresh apples, daily withdrawal of two production loads according to dryer capacity, mechanical cleaning of apples and seeds' removal, chopping of input into the apple rings (4 mm thick) and their soaking in citric acid, setting the apple rings on trays and carts, and bringing the carts into the dryer, drying of fresh material and later cooling of dried apples, packaging of apple chips into the plastic bags and cardboard transport boxes, storing (for up to 6 months) and finally sale of final product. One gross load of fresh apples (80 kg) gives 75 kg of fresh input ready for processing (after removing of seeds and undesirable parts). Process of drying per one load brings out about 10 kg of apple chips. In this sum, around 5% represents the breakage made under the chips' manipulation and packaging, while 9.5 kg represents the final food-product attractive for consumers. So, processing campaign considers 188 loads of fresh apple, or 1,786 kg of well-shaped apple chips and 94 kg of broken apple chips.

For apple chips production, apples of Idared cultivar (apple with medium sweet-sour taste) have been purchased from local fruit growers. Farmer is processing just II class apples, according to the fruit size, which are suitable for chopping. Entire cycle of processing, including administration, input purchase and manipulation, and selling of final products requires engagement of 5 persons (farmer and 4 external employees). Packed products are sold to local buyers at the farm gate. As previously mentioned, before and after campaign of apple processing, facility and equipment are in function of drying of other fruits and plant species suitable for drying (Jeločnik et al. 2019a; Subić & Tomić 2019).

The farmer's intentions are to substitute the used input, or to switch the use of conventionally produced with organically produced apples. The business reason lies in unchanged requirements towards the facility and equipment needed for the apple chips production. The farmer would come to have an additional income (growth in coverage margin) derived from the use of organically produced input, as the overall costs of processing do not follow the increased rate of market price of organic food products. Such a step will certainly contribute to the growth of the overall farm sustainability. In line with the above, decision-making process at the farm required a comparison of the coverage margin values obtained by processing of inputs with different origin. In Table 10.1 and Table 10.2 all incomes and costs are presented, as well as contribution margins gained in conventional and organic apple chips production.

Table 10.1. Contribution margin gained in processing of conventionally grown apples (in EUR, for one campaign of apple processing – 3 months)

Description	Quantity	UM	Price per UM	Total
A – Incomes				
Apple chips	1,880	Kg	-	-
Final product (95%)	1,786	Kg	8.20	14,645.20
Breakage (5%)	94	Kg	5.70	535.80
Subsidies	-	-	-	-
Total A				**15,181.00**
B – Variable costs				
Fresh apples (conventionally grown)	15,000	Kg	0.13	1,950.00
Citric acid	15	Kg	3.05	45.75
Plastic bags (50 gr)	35,800	Pcs	0.02	716.00

Description	Quantity	UM	Price per UM	Total
Plastic bags (5 kg)	25	Pcs	0.17	4.25
Cardboard transport box (5 kg)	360	Pcs	0.40	144.00
Redesign and printing of bags	-	-	-	125.00
Phytosanitary check and content verification	3	Set	115,00	345.00
Labour	2,880	Hour	2.35	6,768.00
Electricity	3	Month	130.00	390.00
Pellet	9,400	Kg	0.16	1,504.00
Utility costs	-	-	-	95.00
Certification and labelling	-	-	-	60.00
Bookkeeping	-	-	-	90.00
Taxes and fees	-	-	-	45.00
Other costs	-	-	-	65.00
Total B				**12,347.00**
C – Contribution margin				**2,834.00**

Source: Authors' calculation based on IAE 2019.

Table 10.2. Contribution margin gained in processing of organically grown apples (in EUR, for one campaign of apple processing – 3 months)

Description	Quantity	UM	Price per UM	Total
A – Incomes				
Apple chips	1,880	Kg	-	-
Final product (95%)	1,786	Kg	35.10	62,688.60
Breakage (5%)	94	Kg	21.50	2,021.00
Subsidies	-	-	-	-
Total A				**64,709.60**
B – Variable costs				
Fresh apples (organically grown)	15,000	Kg	2.12	31,800.00
Lemon juice (concentrated, organic)	75	L	5.51	413.25
Plastic bags (50 gr)	35,800	Pcs	0.02	716.00
Plastic bags (5 kg)	25	Pcs	0.17	4.25
Cardboard transport box (5 kg)	360	Pcs	0.40	144.00
Redesign and printing of bags	-	-	-	125.00
Phytosanitary check and content verification	3	Set	115,00	345.00
Labour	2,880	Hour	2.35	6,768.00
Electricity	3	Month	130.00	390.00
Pellet	9,400	Kg	0.16	1,504.00
Utility costs	-	-	-	95.00
Certification and labelling	-	-	-	105.00
Bookkeeping	-	-	-	90.00
Taxes and fees	-	-	-	45.00
Other costs	-	-	-	115.00
Total B				**42,659.50**
C – Contribution margin				**22,050.10**

Source: Authors' calculation based on IAE 2019.

In order to improve the analysis, the presented data will be explained in detail. As mentioned above, apple chips are sold at farm gate to the known buyers. Final product is sold packed in 50 gr plastic bags, later fold into the cardboard boxes, while chips scrap is sold in bulk, packed in 5 kg plastic bags. Wholesale price of both conventional and organic product (VAT included) is more than 30-50% lower than the store price in local retails or specialized shops (health food stores). Food product based on organically grown apples has almost 4.3 times higher selling price, or almost 3.8 times higher price, if being sold as apple chips scrap (largely used in small specialized pastry shops), than the price of products gained from conventionally grown apples. Unfortunately, the farmer does not receive any direct support (subsidy) related to apple processing, so during one campaign, the overall farm incomes reached in processing of organically grown apples are for more than 426% higher than the incomes gained from the products based on conventionally produced input.

Towards the size of fruits, farmer usually purchases the apples of II quality class. It is not so hard to find local producers that conventionally grown the Idared cultivar. Situation slightly complicates with organically produced fruits, as farmer will buy the fruits just from certified apple growers. Firstly, there are no strong difference between the I and II class, so generally both classes are selling as fresh. Secondly, locally produced volumes are quite limited, so farmer will be potentially forced to buy different cultivars suitable for processing e.g., Idared, Gold Rush, Granny Smith, etc. Resulting from this, as a production cost, organically produced input is around 16.3 times more expensive for farmer than conventional one.

Processing requires the use of citric acid as natural antioxidant against apple chips darkening. For that purpose, usually 1 kg of antioxidant for 1 ton of processed apples is used. Citric acid is purchased from specialized stores for restaurants. In order to fully retain organic formulation of final product, in processing of organically grown apples the organic fresh lemon juice is used as a substitution for citric acid. The used norm is 5 litters of juice for 1 ton of processed apples. Juice is purchased from specialized health food stores.

Final product is packed in plastic bags with printed farm logo, barcode, organic product label and declaration. Apple chips is packed in small 50 grams plastic bags, while chips scrap is packed in large 5 kilograms plastic bags. A hundred small bags with final product are delivered in cardboard transport box. By double packing, the product is secured from breaking, mechanical contamination or pathogens.

Redesign of all printed details (if necessary) and printing of bags usually is done at the beginning and at the middle of campaign. For these purposes, the farmer is using the services of local printing studio.

Product sample is phytosanitary checked, while its content is re-verified at monthly basis. Food quality analysis and food safety control represent the part of farmer's risk management agenda. Mentioned activities are done in laboratory of the nearest Public Health Institute.

In order to ensure the relevance of economic analysis, the paid labour (labour costs) assumes engagement of farmer and four external employees (representatives of rural local community). Working day is split in two shifts. As in processing campaign there are no free days, external labour is involved in all processing activities with 6 hours/day, while farmer is engaged with 8 hours/day as administrative, marketing and processing support. Overall fund of working hours amounts to 2,880 hours, while gross wage is 2.35 EUR/hour (gross wage represents usually paid sum at the local level for this and similar activities).

Electricity is used for running of cold storage, lightening, ventilation, fens, etc. It is paid on monthly basis. Other part of used energy in apple processing (for drying) represents the combustion of pellet in thermo-generator. Drying of one load of apples requires around 50 kg of pellet. Farmer is usually purchasing the eco beech pellet without bark and any combustion additives. Wholesale purchase is conducted in late spring when the prices are generally low (buying for the whole season of processing at the farm).

Utility costs involve costs of fresh water use, sewage and garbage removal. For overall campaign of apple processing around 23 m2 of fresh water is spent. Garbage mostly consists of waste from apple cuttings. These costs are paid on monthly basis.

Besides daily cleaning, detail disinfection of processing facility and equipment is conducting each month. Pest control (setting of bait stations) is done at the beginning and in the mid of the processing campaign.

There is an issue of process certification and food labelling. General stance is that processed food products could be labelled as organic only if all or the majority of ingredients (raw agricultural products as inputs) are organic. Globally, one of the best tools (efficient and relatively cheap for small farms) for ensuring the safety in food chain is implementation of

HACCP system (Hazard Analysis and Critical Control Point). This is even a good solution for organic food sector, as farmers are mostly aware that conventionally used food preservatives, non-organic ingredients, etc. are undesirable or forbidden in production of food product that will be labelled as organic (Stanley et al. 2011; Thulasimani 2019). So, HACCP is introduced at the farm by local branch of global certification company. Costs of certification are paid during the HACCP implementation, while annual checks are not charged. Conservative approach in analysis considers that processing facility is just in service of apple chips production, so overall costs of certification are broken into the several years, where contribution margin is burdened with 20% of overall costs. In line with more complex procedure for HACCP certification of organic food-products, the costs in this case are slightly higher.

In relation to the costs of bookkeeping, it is assumed that processing facility is just in function of apple processing, and these costs are paid on monthly basis to bookkeeping agency. Besides, analysis assumes that the farm is paying some local and national taxes and fees, as well as that apple processing is generating small amount of some other unidentified costs.

Analysis shows that in one processing campaign overall variable costs of production of apple chips based on organically grown apples are more than 345% higher than the variable costs gained in apple chips production based on conventionally grown apples.

After direct comparison of gained incomes and variable costs linked to apple processing, it could be regarded that both models of processing would be economic (after covering of fixed costs) as incomes are almost 23% higher than the variable costs in apple chips production from conventionally grown apples, or even 52% higher in apple chips production from organically grown apples.

Expressed in absolute values, in both models of processing the positive contribution margin is achieved, while it is 778% higher in processing of organically produced apples. It could be assumed that gained contribution margins ensure the farmer with considerable amount of financial assets for covering of remaining fixed costs and obtaining of certain level of profit. Besides, available facility and equipment could be later used for processing of some other plant crops, what will certainly decrease incurred fixed costs and boost the overall farm profit.

The presented food-production lines could be additionally analysed by determining the structure of overall variable costs, as it could be seen in Table 10.3.

Table 10.3. Structure of variable costs in apple processing

Variable costs	Apple chips - conventional		Apple chips – organic	
	Value (in EUR)	Share (in %)	Value (in EUR)	Share (in %)
Fresh apples	1,950.00	15.80	31,800.00	74.54
Citric acid / Lemon juice	45.75	0.37	413.25	0.97
Plastic bags (50 gr)	716.00	5.80	716.00	1.68
Plastic bags (5 kg)	4.25	0.03	4.25	0.01
Cardboard transport box (5 kg)	144.00	1.17	144.00	0.34
Redesign and printing of bags	125.00	1.01	125.00	0.29
Phytosanitary check and content verification	345.00	2.79	345.00	0.81
Labour	6,768.00	54.81	6,768.00	15.86
Electricity	390.00	3.16	390.00	0.91
Pellet	1,504.00	12.18	1,504.00	3.53
Utility costs	95.00	0.77	95.00	0.22
Certification and labelling	60.00	0.49	105.00	0.25
Bookkeeping	90.00	0.73	90.00	0.21
Taxes and fees	45.00	0.36	45.00	0.11
Other costs	65.00	0.53	115.00	0.27
Total	**12,347.00**	**100.00**	**42,659.50**	**100.00**

Source: Authors' calculation based on IAE 2019.

Observing the structure of variable costs certain differences are visible between the two models of apple processing. In apple chips production based on conventionally grown apples the costs of labour are dominating with more than half of the sum of overall variable costs, followed by the costs of fresh apples and pellets. Other costs have negligible share. In apple chips production based on organically grown apples the costs of fresh apples have the share of almost ¾ of overall variable costs. By their sum, as significant could be also considered the costs of labour, while other costs occur with much lower value.

By direct comparing of the used models of apple processing, it could be noticed that although both models are labour intensive, the production of organic food products is notably burdened by the costs of organically produced ingredients, while in case of food products that come from conventional agriculture the labour costs dominate. So, farmer's decision to significantly increase the costs of primary input (substitution of the origin of fresh apples) in order to approach to the market niche oriented to organic food products proved to be economically justified as it would lead to higher incomes and subsequently profits.

Besides, considering that the analysis was based on the engagement of primarily external labour, by the substitution of each external employee with one farm member, family that owns the farm could additionally earn the 1,269 EUR per campaign of apple processing.

In current challenging times, related to global and local socio-economic trends, there is a constant need for analytical approach to the economic effects of product processing at small farms under the conditions of risk and uncertainty. There is high probability that mentioned uncertainty could lead to change in achieved financial result at the farm due to the increase in costs of processing, or due to the decrease in food-product prices throughout its realisation on the market. Considered reason requires determination of the risk level for certain processing lines, in which sensitivity analysis provides an opportunity to identify the factors that affect the most the economic effects of processing, as well as to recognize which processing line is riskier.

Reconsidering the sensitivity of contribution margin toward the market and processing disorders, from Tables 10.4 and 10.5 it can be noticed that the contribution margin in conventional production of apple chips is more sensitive to a decrease in produced volume of final product or drop in products' price than to increase in variable costs of processing.

Table 10.4. Change in contribution margin in conventional apple chips production due to decrease in produced volume or market price of food-product

Fall in produced volume or market price of food-product (in %)	Contribution margin in processing of conventionally produced apples (in EUR)
5.00	2,074.95
10.00	1,315.90
15.00	556.85
20.00	**-202.20**

Source: Authors' calculation based on IAE 2019.

Table 10.5. Change in contribution margin in conventional apple chips production due to grow in variable costs of apples processing

Grow in in variable costs of apples processing (in %)	Contribution margin in processing of conventionally produced apples (in EUR)
5.00	2,216.65
10.00	1,599.30
15.00	981.95
20.00	364.60
25.00	**-252.75**

Source: Authors' calculation based on IAE 2019.

Similar situation occurs in processing of organically produced apples, as it could be observed in Table 10.6 and Table 10.7. In this case, the contribution margin is also more sensitive to decrease in produced volume or drop in food-products' prices than to increase in variable costs of apples processing.

Table 10.6. Change in contribution margin in organic apple chips production due to decrease in produced volume or market price of food-product

Fall in produced volume or market price of food-product (in %)	Contribution margin in processing of organically produced apples (in EUR)
5.00	18,814.62
10.00	15,579.14
15.00	12,343.66
20.00	9,108.18
25.00	5,872.70
30.00	2,637.22
35.00	**-598.26**

Source: Authors' calculation based on IAE 2019.

Table 10.7. Change in contribution margin in organically apple chips production due to grow in variable costs of apples processing

Grow in in variable costs of apples processing (in %)	Contribution margin in processing of conventionally produced apples (in EUR)
5.00	19,917.13
10.00	17,784.15
15.00	15,651.18
20.00	13,518.20
25.00	9,364.23
30.00	9,252.25
35.00	7,119.28
40.00	4,986.30
45.00	2,853.33
50.00	720.35
55.00	**-1,412.63**

Source: Authors' calculation based on IAE 2019.

As considered, contribution margin is generally more sensitive to decrease in volume of production or fall of price of food product than to growth of variable costs of processing. In same time, production of organic apple chips is less risky, as contribution margin in mentioned production changes slower with the change of factors affecting it (contribution margin equals to zero in line with the increase of variable costs for 51.69%, or 22.95%, or if the food product price falls for 34.08%, or 18.67%).

Considering the agri-food processing as the vital part of agricultural complex, it could be also affected by the expressed uncertainty linked to the agricultural production, so it is good for farmer to know what will be the threshold values of certain production parameters that will guarantee the zero or positive contribution margin. Table 10.8 presents this situation.

Table 10.8. Critical values in apple chips production

Description	Apple chips based on conventionally grown apples	Apple chips based on organically grown apples
Expected yield (EY) – in kg	1,880.00	1,880.00
Expected price (EP) – in EUR/kg	8.08	34.42
Subsidy (s) – in EUR	-	-
Variable costs (VC) – in EUR	12,347.00	42,659.50
Critical price: CP = (VC - s) / EY	6.57	22.69
Critical yield: CY = (VC - s) / EP	1,528.09	1,239.38
Critical variable costs: CVC = (EY x EP) + s	15,190.4	64.709.6

Source: Authors' calculation based on IAE 2019.

There are some assumptions related to the production of processed products at the farm under the uncertainty. Uncertainty is considered as fixed variable, where achieved values for all production parameters could be expected in same amounts in future processing cycles. So, according to the previous table, the expected yield represents all produced volumes of apple chips, both the final product packed in small bags and chips scrap. Generally, as the overall product of apple processing is divided into two quality parts (final product and chips scrap), the expected price could be represented with the average price per kilogram of completely produced product.

Critical values of apple processing could be understood as the measures of production and market risks. For the farmer, the threshold value of product price that will ensure positive contribution margin is 6.57 or 22.69 EUR/kg of final product. Related to achieved (expected) selling price (8.08 or 34.42 EUR/kg for final product), the calculated critical prices give the farmer certain manoeuvring space to survive the potential drop in market prices of the final product (apple chips). So, in the upcoming period the market price of apple chips could be decreased for almost 23% (for conventional food product), or for more than 51.5% (for organic food product) and the observed processing line will be still in safe zone related to its contribution to overall farm profit. In other words, it is obvious that processing of organically grown apples related to potential oscillation of market prices is less risky processing model for the farmer.

Similarly, the threshold for the volume of production of processed apples that will secure farm survival is 1,528.09, or 1,239.38 kg of final product. In line with gained (expected) production volume (1,880 kg of final product for both processing models), the calculated critical yields show the strength of observed processing line to handle the decrease in production for more than 23% (for conventional food product), or for more than 51.5% (for organic food product) and to still remain financially positive. According to that parameter, production of organic apple chips is less risky for the farm. It should be noted that in both processing models the critical variable costs represent the level of achieved incomes.

4. Conclusions

Creation of added value represents one of the key factors for the strengthening of overall economic sustainability of small farms. Surely, food processing could be among successful methods for achieving the added value at the farm level. So, apart from the economic aspect, could the creation of added value be in function of strengthening the overall sustainability of small farms? In the chapter one possibility that leads to such situation was presented. The farmer involved in fruit processing was mainly wondering if it would be economically effective to substitute the input used in existing line of processing at the farm (unique processing facility and equipment is used). In relation to that, an economic analysis that assumes the change of conventionally grown apples with the organically grown apples within the apple chips production was performed.

The analysis showed that according to the change in value of incomes (they were increased almost 4.3 times) and value of variable costs (they were increased almost 3.5 times), substitution of used inputs and production of organic apple chips is from economic aspect highly appreciated for the farmer, as it derives the positive change in the value of contribution margin (it was increased almost 7.8 times). Gained increase in contribution margin ensures to farmer much more financial assets for covering the remaining fixed costs, while boosting the overall farm profit.

In relation to the structure of variable costs, there are some essential differences between the observed models of processing. While in apple chips production based on conventionally grown apples the costs of labour are dominating (over 50% of overall variable costs), in apple chips production based on organically grown apples the costs of fresh apples reach the share of almost 75% of overall variable costs. Although the both processing models have unique labour intensity, the expressed difference is generally linked to the much higher market price of organically grown apples.

Considering the impact of uncertainty to agri-food production, by switching to processing of organically produced apples the farmer will be in a position to withstand the bigger drop in market price of final product than expected (23% compared to 51.5%) and still achieve a positive contribution margin. As similar situation occurs with the decrease in production volume of apple chips, considering the production of organic apple chips is less risky for the farm.

In both processing variants contribution margin is more sensitive to decrease in volume of processed apples or to drop in price of final product than to increase in overall variable costs. Meanwhile, production of apple chips from organically grown apples proved to be less risky, as its contribution margin changes slower with the change of mentioned factors.

Besides, by switching to organic production farm will improve its environmental sustainability, as it is assumed that handling organic inputs and organic final products is much more environmentally friendly than orientation to conventional production.

Farmer's entrepreneurial spirit and creation of additional incomes through the change in used inputs are not directly linked to the increase of the farm social sustainability. But, on the other side, considering that engagement of external labour is presented in both models of apples processing, there is surely significant farm impact to the development of local rural community e.g., decrease in local unemployment, promotion of local rural community's image, additional transfers to local rural community's budget, etc.

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Appendix A10. Key terms learned

Agriculture – It is the one of the most important consciously organized activities of human population, run to satisfy one of the primary man need, food availability. With the development of global society its initial function was supplemented with shaping of rural landscape, sustainable exploitation of natural resources, strengthening of local economy, maintaining the quality of life of rural population, etc. So, although the agriculture usually refers to crop production and livestock breeding, it also involves many activities as are land cultivation, domestication, livestock management, agri-food logistic, etc.

Farm – As basic production unit engaged in agricultural production, farm usually represents the area of land used dominantly for agricultural activities in order to produce food of plant or animal origin, fibre, biomass, energy and other products or services used for satisfaction of different human needs.

Farmer – It is a person who manages the farm, alone or supported by family members or external employees, being responsible for all crucial activities toward the crop, livestock or biomass production, food processing, agri-tourism, etc.

Rural areas – they are generally defined as sparsely populated territories located outside the urban areas (usually with less than 100-150 inhabitants per square kilometre), that provides majority of raw materials and agri-food products, and ecosystem services.

Farm sustainability – It represents the ability of farm to operate, survive and grow within the predefined socio-economic and natural conditions, while keeping up for a longer period farms' administrative, economic, ecological and social functions at satisfactory level.

Farms' value-added – Under the specific conditions it represents the optimal portfolio of farms' activities and agricultural practices run by farmer in order to meet consumers' preferences through the offered farm output (produced agri-food products and services).

Costs of production – They represent the monetary expression of spending of material goods (inputs and fixed assets), labour, services, public expenditures, etc., involved in realization of entrepreneur's business mission. They could be observed as fixed (do not change toward the volume of production), or variable (differ in certain proportion to gained output).

Contribution margin – From the context of agricultural production, it corresponds to the difference between the overall output (value of production) increased for allocated subsidies and variable costs derived from specific line of agricultural production or processing organized at the farm.

Sensitivity analysis – It could be defined as the instrument for determining the sensitivity of contribution margin toward the market and production disturbance. It defines the size in fall of contribution margin due to decrease in volume of production or products' market price, or due to growth of overall variable costs linked to certain production line.

Critical values of production – They represent the methods for determining the critical value of price, volume of production and overall variable costs within the certain line of production at which the contribution margin equals to zero.

Ch.10

ESTIMATION OF ECONOMIC EFFECTS OF PROCESSING OF ORGANIC PRODUCTS IN THE CASE OF FAMILY FARMS

Economic sustainability of entrepreneurial initiatives in processing of organic products

OBJECTIVES: The readers will be able to define and identify all incomes and variable costs that appear in certain production or processing line at the farm. By the use of presented analytical tools they will be also able to estimate expected economics effects gained in selected line of agricultural production or processing of agricultural products.

SKILLS: Students have overmastered the use of advanced tool for analytical analysis in decision making process towards the choosing the proper production/processing line at farm level (the production/processing line that will derive the highest possible profit).

QUESTION 1 (PLEASE CHECK THE CORRECT ANSWER)

What aspects of sustainability farm should follow in order to be completely viable?

- ☐ Aspects of economic and social sustainability
- ☐ Aspects of ecological and economic sustainability
- ☐ Aspects of economic, ecological and social sustainability
- ☐ Aspects of ecological and social sustainability

QUESTION 2 (PLEASE CHECK THE CORRECT ANSWER)

What are the most often variable costs linked to food processing?

- ☐ Costs of raw agricultural material, packaging material, energy, property tax, interest
- ☐ Costs of raw agricultural material, food additives, energy, water, packaging material
- ☐ Costs of raw agricultural material, water, packaging material, insurance, rent
- ☐ Costs of equipment and labour

QUESTION 3 (PLEASE CHECK THE CORRECT ANSWER)

What is represented by the contribution margin?

- ☐ Difference between the incomes and overall variable costs derived from the certain line of agricultural production at the farm
- ☐ Difference between the incomes and overall costs derived from the certain line of agricultural production at the farm
- ☐ Difference between the incomes and overall fixed costs derived from the certain line of agricultural production at the farm

QUESTION 4 (PLEASE CHECK THE CORRECT ANSWER)

<u>What defines the sensitivity analysis of the contribution margin?</u>

- ☐ Size of fall in contribution margin due to fall in yields/market price of product, or increase in overall variable costs of production
- ☐ Size of fall in contribution margin due to fall in yields/market price of product, or increase in overall fixed costs of production
- ☐ None of the above

QUESTION 5 (PLEASE CHECK THE CORRECT ANSWER)

<u>What is the right formula for the critical price?</u>

- ☐ CP = (VC - S) / EP
- ☐ CP = (VC - S) / EY
- ☐ CP = (EY x EP) + S
- ☐ None of the above

PRACTICAL APPLICATION OF THE PREVIOUSLY ACQUIRED KNOWLEDGE:
TASK: RELATED TO THE EXAMPLE EXPLAINED IN THE CHAPTER, TRY TO RECONSIDER THE POSSIBLE CHANGE IN PROCESSING OF DIFFERENT RAW MATERIAL (FOR EXAMPLE QUINCE, AS ITS' PROCESSING HAS ALMOST THE SIMILAR TECHNOLOGICAL PROCESS AND REQUESTS AS APPLES) WITH THE USE OF SAME PROCESSING FACILITY AND EQUIPMENT. IN LINE TO PREVIOUSLY PRESENTED ECONOMIC ANALYSIS TRY TO DEFINE ALL INCOMES AND VARIABLE COSTS THAT COULD APPEAR IN ON MONTHLY BASIS IN QUINCE PROCESSING (PRODUCTION OF QUINCE CHIPS, NO MATTER ORGANIC OR CONVENTIONAL). BASED ON THEM CALCULATE THE CONTRIBUTION MARGIN THAT DERIVES FROM THIS LINE OF PROCESSING AT THE FARM. ACCORDING TO PREVIOUSLY LEARNED FORMULAS FOR CRITICAL VALUES OF PRODUCTION, TRY TO CALCULATE THE THRESHOLD VALUES FOR ALL PRODUCTION ELEMENTS THAT ENABLE REACHING OF POSITIVE CONTRIBUTION MARGIN.