

# Enterprise Activity Modeling in Walnut Sector in Ukraine

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Business modeling of the enterprise activity in the oil and fat sub-complex for deep walnut processing was carried out. The stages of production and marketing activities of the enterprise from the garden planting or the purchase of the processed raw materials to the sale of the processed raw materials and products obtained from walnut processing depending on the chosen business model were considered. A comparative analysis of profitability of the enterprise activity and absolute values of income and profitability indicators under various business models of the enterprise activity were shown. The most cost-effective business-model entailed the combination of walnut production and its processing, which will provide profitability of up to 4640.32% in the 20th year of the project implementation. The results of the given study are intended for the agricultural enterprises of central region of Ukraine.

business model

profitability

walnut production

walnut processing

## 1. Introduction

In the context of global climate change and through new trends in the agri-food market, over the past two decades, there has been a tangible increase in the demand for the production and consumption of nuts. Official data testifies to the relevance of growing nuts. Thus, according to the annual report of the International Nut and Dried Fruit Council Foundation (INC) over the past 10 years, global nut production has grown steadily and in the 2019/20 financial year amounted to 4,600,000 t <sup>[1]</sup>.

The main types of nuts include the so-called “Big Five”: walnuts, almonds, pistachios, cashews and hazelnuts. In terms of harvest, almonds and walnuts are the leaders, accounting for 31% and 21% of world production, respectively, followed by cashews (17%), pistachios (14%) and hazelnuts (12%). The remaining 5% comes from the production of pecans, macadamias, Brazil nuts, and pine nuts <sup>[2]</sup>.

Currently, walnut production in Ukraine is a profitable type of entrepreneurial activity at the level of farms, which appeared to be a systematic business in the country during the last years. The area of industrial walnut plantations in Ukraine is growing dynamically every year. According to the data of the Ukrainian Walnut Association, the most annual growth of walnut plantations in Ukraine falls on the creation of industrial hazelnut orchards and is more than 1000–1400 ha annually. The actual area of planted gardens in 2020 is about 3000 ha. Thus, in the central Ukraine region, there are a number of small farms that grow walnuts on 10–15 ha of land and perform their primary processing. Hence, since 2015 hundreds of hectares of modern, intensive gardens of walnuts and hazelnuts were

planted using the technologies of inter-row planting until the garden reaches its estimated capacity. According to the International Nuts and Dried Fruit Council Foundation <sup>[1]</sup> the cost of the processed raw materials, i.e., walnut kernels, intended for further use in the agro-food chain, varies in the European market from 4 to 9 EUR/kg. The cost of food products obtained due to walnut kernel processing in the oil and fat sub-complex reaches EUR30 per l of the packed walnut oil, and it may also increase by 5–10 EUR/kg of walnut kernel if the cost of products obtained as a result of processing the waste of the main production is taken into account <sup>[1]</sup>.

At the same time, the marketing of products of the oil and fat sub-complex for deep walnut processing in Ukraine and in its central region, in particular, is still much localized; producers have no direct access to foreign markets as well as they are not integrated in value chains. So that only small batches of produce are exported in a direct way. However, the international demand for edible oils and other food products obtained as a result of walnut processing is increasing, as SuperArgonom noticed <sup>[3]</sup>. According to SuperArgonom's data, every year Ukraine produces over 100,000 t of walnuts; two-thirds of this yield is exported. The world consumption of nuts shows a positive growth trend. According to INC, as of May 2018, the global number of nut consumers reached 1 billion, in 2030 it is predicted to increase to 1.8 billion, and in 2040, the number of nut consumers will double to 2.8 billion. Almonds and walnuts account for half of the total consumption of nuts in 2018 worldwide (30% and 20% of the world share, respectively), the share of hazelnuts is 12%. European countries consume 26% of the global share, followed by North America (23%) and Asia (20%) <sup>[3]</sup>.

The Statista organization claimed that the global market for walnut oil is growing at a moderate pace due to its wide range of applications <sup>[2]</sup>. The world market for walnuts is rather specific, since the production remains extensive, and the area potentially suitable for land cultivation is limited, as a result walnuts may ripen normally on the territory that occupies 6–14% of the planet. The land resources of Ukraine are included in these statistics. According to the statistics presented by the International Nuts and Dried Fruit Council Foundation, Ukraine holds a strong position among the top ten largest exporters of nuts in the world <sup>[1]</sup>. Information on the imports and exports introduced by Tridge shows that Ukraine is a net exporter of oilseed crops and oils, refined edible oils, various wastes, residues, and other products <sup>[4]</sup>.

Consequently, all the above mentioned demonstrate that Ukraine will be involved in the process of diversifying the world market of nuts, oils, and fats, as well as in the innovation process in the oil and fat sub-complex. Almost the entire territory of Ukraine has favorable climatic conditions and suitable soils for growing nuts and obtaining a high-quality product. Considering the duration of walnut orchards fruiting, as well as the fact that our state has more suitable areas for growing nuts than other countries, the rapid development of this area is absolutely justified. According to our observations, the oil and fat sub-complex for deep walnut processing is at the stage of formation and it is characterized by small production volumes (a small number of farmers growing industrial gardens), as well as few processing enterprises (several private entrepreneurs with a limited production capacity of 10 to 100 L per day). Income receipts are made by sole proprietors; however, cooperation between them is not established. The initiated study aims to offer a comprehensive and integrated business model for the development of the oil and fat sub-complex for deep processing of walnut.

## 2. History and Development

The study by and O. Lyulyov <sup>[5]</sup> illustrated that currently, researchers are greatly interested in the problems of environmental management, food security, development of new technologies and products of nut industry worldwide that are highlighted in a number of scientific papers. For instance, M. Kachel et al. studied the biodiesel production on the basis of selected oils of natural origin using <sup>[6]</sup>. R. Botta et al. devised the genetic tools in order to ensure the supply of hazelnut <sup>[7]</sup> that corresponds with multiple connected studies of the post-harvest practices <sup>[8]</sup>, storability improvement <sup>[9]</sup>, etc., in the given sector. Likewise, sustainable development and its prospects include a number of measures encouraging agricultural entrepreneurs to be involved in social activities <sup>[10]</sup>.

There is a worldwide discussion about the possibilities of expanding the potential of the raw material base <sup>[11]</sup> of walnuts in particular <sup>[12]</sup>, and the utilization of raw materials in the agro-food value chain to enhance the competitiveness of products. In the given sense there were different aspects studied: the development of the logistic strategies as well as the place and structure of logistic costs <sup>[13]</sup>, eco-industrial parks maintenance, circular economy projects <sup>[14]</sup>, savings in diverse segments of the supply chain <sup>[15]</sup>, quality assessments of delivery <sup>[16]</sup> and many others. In particular, for the oil and fat sub-complex for deep walnut processing and the development of functional food products, the latest studies include: investigations on oil content in kernels <sup>[17]</sup>, the effective use of the by-products of walnut production for the removal of hazardous materials <sup>[18][19]</sup>, the researches on functional properties of walnut protein <sup>[20]</sup>, production processes energy consumption <sup>[21]</sup>, maintenance of the organized quality management systems <sup>[22]</sup> etc.

The sub-complex analysis (SA) is an effective approach to gain a full understanding about the different connected stages of product or service transition from the raw material base to production and to the final consumer <sup>[23][24]</sup>. SA and enterprise activity modeling are the sources of information for value chain stakeholders at different levels. E. M. Nang'ole et al. <sup>[25]</sup> provided a set of guidelines and manuals for the analysis of the agricultural value chain from the perspectives of SA. The PMC Research Center and Batumi Shota Rustaveli State University of the Autonomous Republic of Ajara in their report elaborated the in-depth description of walnut production and sales process <sup>[26]</sup>. The study of N. A. Qammer and S. H. Baba while discussing the modernized supply chain of walnut, has boiled down to the fact that the given chains involve heavy investments and that the value addition of walnut in the processing units are exclusively targeted for export markets <sup>[27]</sup>. W. Bourne studied the production and marketing conditions for walnut and underlined the great potential of walnut production and processing in terms of gross margin taken <sup>[28]</sup>. G. Pandey and S. K. Shukla dedicated their study to the walnut industry in India in the light of cultural practices, growing regions and marketing trends <sup>[29]</sup> that determines the multiple connections in the sub-complex of walnut production. A. Szelag-Sikora et al. provided the comparative analysis of the farm's production systems from the perspectives of the technologies implemented that allowed her to evaluate the different aspects of plant nutrients management <sup>[30]</sup>. Next, Shamra P. et al. investigated the walnut processing industry and the potential value of the added products that brought her to the point of quality procuring <sup>[31]</sup>. So, the versatile approach to the sub-complex analysis provides a number of opportunities for further researches. For this reason, the sub-complex can be determined by the raw material, that is processed by its enterprise, or by the end product/service intended for the certain market <sup>[32][33][34][35][36]</sup>.

There was proposed the provision of economic substantiation of the expediency of planting industrial, intensive walnut gardens by the local researches. Their suggestions allowed for the peculiarities of indigenous grades of walnut trees, while focusing on possible yield [37][38][39][40]. It is equally important that there are a lot of different aspects of deep walnut processing that are considered widely and should be allowed for further researches, such as: walnut production technology [41][42]; genetic resources [36][43][44]; walnut peeling processes [45][46][47]; walnut processing waste valorization that emphasizes the high interest in providing technological non-waste processing considerations [48][49].

### 3. Conclusions

As a result of the analysis of profitability of the enterprises of oil and fat sub-complex for deep walnut processing, it can be concluded that the enterprise is highly profitable, according to the obtained data, due to obtaining the added gross profit. Profitability is higher when a farmer increases value added and sells walnut oil and cake. The passive growth of profitability of walnut farms can be caused by an increase in the current price for walnut kernel and products of its processing. The active development of the business is possible through the creation of its own brand, entering the consumer market and use of the B2C model.

To achieve the set goals, the approach of the sub-complex analysis was used, which has given an opportunity to obtain a systematic view of the various stages of interaction associated with the creation of products beginning with the procurement of raw materials and ending with the production of consumer goods. This approach enables to obtain results that are useful for both the participants of the agro-food value chain at different levels and subjects engaged in decision-making. Thus, the sub-complex analysis approach provides the basis for sectoral actions. The prospect of the agro-food chain ensures that these actions will not be limited by the local level. This will facilitate relations with the global (internal) economy. Such relations include infrastructure improvement, affordability of loans, marketing tools, and a range of services required for trade.

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