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Economic Aspects of Integrating the Supply Chain in the Herbal Industry in Poland

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Abstract:

Purpose: *The main purpose of the article was to assess the level of integration in the supply chain in the herbal industry. The specific objectives were to identify entities operating in the herbal industry and to analyse the relationship between individual links in the supply chain.*
Design/Methodology/Approach: *The research period covered the years 2016-2019. The source material was the primary data. The interviews were conducted with entities representing two links in the supply chain - suppliers of herbal raw materials from field crops and from the natural state of the Lubelskie and Podlaskie voivodeships, as well as a plant for processing herbal raw materials. The Supply Chain Integration's Degree Measure (SCIDM) indicator was used to achieve the main purpose.*
Findings: *The empirical results show that before 2001 the return in the U.S. was high and when the dollar was appreciated, after 2001, the same return became negative and the dollar was depreciated, but after 2004 the returns have growing positively for the U.S., and the returns for the Euro-zone are falling.*
Practical Implications: *It was found that the level of integration in the supply chain in the herbal industry was low, which was influenced by the limited relationships and the type of dependencies between the participants of the chain. The factor contributing to the low level of integration was the significant fragmentation and collection of herbs by hundreds of individual collectors from natural sites. The situation was slightly better on the side of recipients, where the degree of integration was in the middle range.*
Originality/value: *Development of a herbal supply chain model and assessment of its level of integration. Individual links in the studied supply chain were described and the relations between them were identified.*

Keywords: *Agricultural economy, degree of integration, herbal supply chain.*

JEL classification: *F15, Q10, R11.*
Paper Type: *Research study.*

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1. Introduction

The integration of production factors, i.e., land, labor, capital enables the creation of various organizational forms. Changes in socio-economic conditions affect the form and scope of cooperation between suppliers and buyers. Integration organizations and practices are tools that allow coordinating the activities of individual entities, consisting of rationalization of the incurred expenditure concerning the achieved results. Multilateral and in-depth observations made in the early 1980s confirmed that the coordinated actions of individual enterprises allow for a more effective flow of products, information, and financial resources, providing the basis for the concept of supply chain coordination and integration (Stadtler and Kilger, 2008).

To limit the impact of market weaknesses or to benefit from these weaknesses, various forms of cooperation between partners representing various levels in the creation of the value chain are used. Activities are created, such as links with external partners, forms of integration or organization, a strategy of including external entities in the implementation of tasks, hierarchical strengthening under long-term contracts, cooperation with external partners, which constitute indirect organizational solutions between the market and the hierarchy with varying degrees of integration.

In the case of agriculture in Poland, very weak links between individual supply chains are observed, which is a clear weakness and proves a worse competitive position concerning agriculture from Western Europe. While in the case of the main industries, only rudimentary research has been carried out on the level of integration, there is no scientific research concerning niche directions, i.e., herb production and processing. The main purpose of the research was therefore to identify the supply chain of the herbal industry in Poland and to assess the level of its integration.

2. Integration of Food Supply Chains

In the literature on the subject, the supply chain is interpreted in many ways. The main features characterizing the supply chain are the entity structure, object of flow, goals, functional scope, and area of cooperation of the participating entities. Stadtler and Kilger (2008) define the supply chain as „a network of organizations that are involved, through links up and down the chain, in various processes and activities that create value in the form of products and services intended for the end customer". Bozarth and Handfield (2007) define it as "a network of producers and service providers who work together to process and move goods - from the raw material phase to the end-user level". All these entities are linked by the flows of physical goods, the flows of information, and the flows of cash. According to Witkowski, the supply chain is made up of a group of companies implementing joint activities necessary to meet the demand for specific products in all its links, i.e., from obtaining raw materials, through production and distribution, to the final recipient. These activities can be development, production, sales, service, procurement, distribution, resource management, support activities. The supply chain consists of various functional areas: mining, production,

trade, service companies and their customers, between which streams of products, information and financial resources flow (Johansson, 1994).

Supply chain integration can be achieved with a variety of tools and instruments. Different authors point to different sets of integration factors. Moreover, the authors take different levels of detail when isolating them. Harrison and van Hoek (2010) emphasize the exchange of information between partners in specific areas, i.e., in the form of familiarizing partners with production plans as well as the structure and number of stocks. Among the many factors that affect integration in supply chains, there are standardization and unification of solutions, information exchange and use, modern information technologies, strategies, management concepts, trust, partnership, inventory centralization, modern inventory management concepts, joint planning, joint product design, joint investments and ventures, or joint decision making in the supply chain (Harrison and van Hoek 2010, Alfalla-Luque *et al.*, 2013, Jayaram *et al.*, 2010).

The degree of integration can be assessed by determining three aspects such as direction, scope, and level (Kotzab *et al.,* 2005). There are two directions of integration, after the separation of external and internal processes of logistics, inventory management, and material distribution (Walters, 2007) down with suppliers, up with customers (New, 1996). In the second stage, the scope of integration concerning the areas of cooperation with partners in the chain is analyzed. Bezat-Jarzębowska and Jarzębowski (2017) used five areas to construct an indicator of the degree of integration in the supply chain, such as:

1. material flow area, involving vendor inventory management, packaging customization, and shared equipment (Frohlich and Westbrook, 2001);
2. planning and control area including joint planning and forecasting and multi-level supply control (Tsay, 1999);
3. area of organization - a type of cooperation between the buyer and supplier (partnership) (Lamming, 1993);
4. the area of information flow, defining the use of integrative practices concerning information and communication technologies (Electronic data interchange (EDI), bar codes, Material Requirements Planning/Enterprise Resource Planning systems) (Vickery *et al.,* 2003);
5. the area of product development consisting of measuring the degree of sharing information about technical details and process improvements, as well as a joint commitment to product development (Lee *et al.,* 1993, Davis, 1993).

The process of producing food is in the subsystem of the national economy referred to as the food economy. The food supply chain connects three important sectors of the economy: agriculture, food processing, and distribution, which have a significant impact on the level of economic welfare, social and environmental situation of citizens (Czyżewski and Grzelak, 2018). Various activities that make up the economic processes are carried out in the supply chain. The food supply chain is characterized

by a large variety of entities that make up it. It includes producers, suppliers, transport companies, warehouses, wholesalers and retailers, service organizations, and consumers (Gołębiewski and Drejerska, 2017). They constitute a network of organizations involved, through relationships with suppliers and customers, in various processes and activities that create value in the form of products and services delivered to end consumers. Various types of entities can be distinguished in the structure of the food chain (Lazzarini *et al.*, 2001), agriculture, food industry, wholesale, and retail food trade. The literature also includes other taxonomies, for example, agricultural producers, purchase of agricultural products, food industry enterprises, secondary wholesale, retail, final buyers, and support institutions.

According to Lambert and Cooper (2000), when analyzing the structure of food supply chains, the following should be considered: chain participants, their roles and possible chain configurations, organizational structure, and types of contracts, as well as resources (IT, people, technologies) along with the degree of integration between chain participants. Analysis of supply chains can also be made from the point of view of the object of flow criterion.

3. Empirical Results

The main purpose of the article was to assess the level of integration in the supply chain in the herbal industry. The specific objectives were the identification of entities operating in the herbal industry as well as the mapping and analysis of the supply chain diagram of herbal raw materials along with the relationships between its links.

The Supply Chain Integration's Degree Measure (SCIDM) indicator was selected to achieve the main purpose (Jarzębowski *et al.*, 2013). To assess the level of integration in the supply chain, 21 integration scopes were adopted for both suppliers and recipients, each scope could receive from 0 to 3 points in a subjective assessment, i.e. the maximum for suppliers and recipients could reach 63 points. However, the maximum level of integration of the entire supply chain could be 126 as a sum of 63 points from suppliers and recipients. The adopted SCIDM index is therefore measured as the sum of the products of the number of ranges and their levels of advancement on the scale: low - 1, medium - 2, high - 3.

The analyzes were based on the formula below:

$$SCIDM = \sum_{i=1}^{k}\sum_{j=1}^{n} IRS_i * ILS_j + \sum_{i=1}^{k}\sum_{j=1}^{n} IRCi * ILCj$$

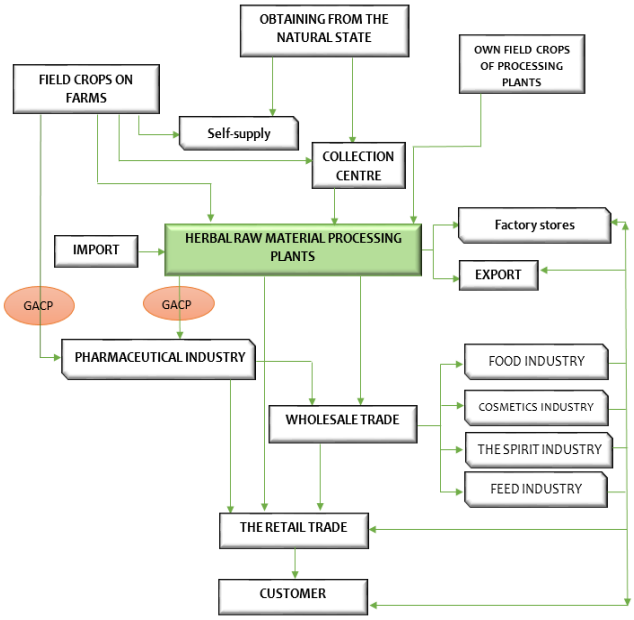
where:
SCIDM – Supply Chain Integration's Degree Measure,
IRS – Supplier Integration Range,
ILS – Supplier Integration Level,

IRC – Customer Integration Range,
ILC – Customer Integration Level,
i – Areas of cooperation, where $i \in (1, \ldots, k)$,
j – Integration activity, where $j \in (1, \ldots, n)$.

The research area covered the Lubelskie and Podlaskie voivodeships. The research period covered the years 2016-2019. The source material was the primary data obtained by the method of a diagnostic survey with the use of the direct interview questionnaire technique. The interviews were conducted with 45 herbal producers from the Lubelskie and Podlaskie voivodeships, 88 herb collectors from the natural state, and representatives of Runo Sp. z o.o. from Hajnowka. The descriptive, tabular, and graphic methods were used to present the research results.

Based on the observations and interviews with entities representing individual links in the herb supply chain in the Podlaskie and Lubelskie voivodeships, a diagram was developed (Figure 1).

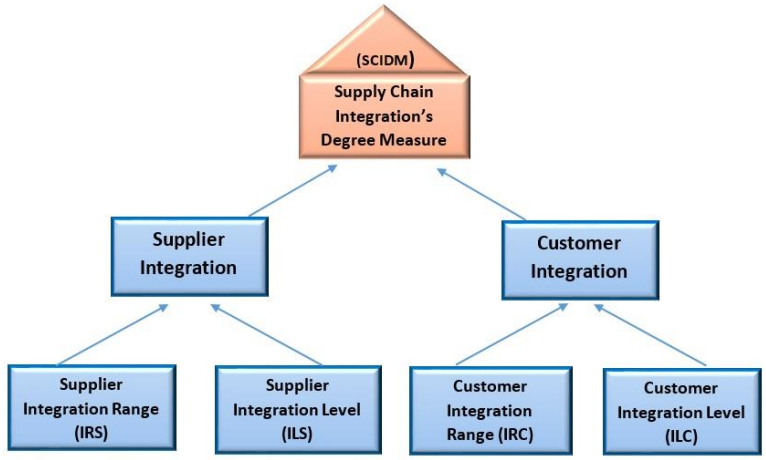
Figure 1. *Structure of the supply chain for processing herbal raw materials*



Source: *Own study.*

In the course of the research, the level of integration of the supply chain in the herbal industry was assessed using the methodology proposed by Jarzębowski et al. (2013) and the indicator of the degree of supply chain integration constructed by them (Figure 2), which is measured as the sum of the products of the number of ranges and their levels of advancement on the scale: low - 1, medium - 2, high - 3.

Figure 2. *The structure of the SCIDM measure*



Source: *Bezat-Jarzębowska and Jarzębowski (2017).*

In the first phase, the determination of the degree of integration consisted in the identification and description of areas and scopes of integration in the supply chain (Table 1) and the assessment of their advancement levels (Table 2).

Table 1. *The areas of the level of integration within the SCIDM indicator - content description*

Integration areas	Integration scopes	Identified activities on the part of suppliers	Identified activities on the part of recipients
Planning of activities	Style	Ad hoc planning of activities with farmers and regular with collectors	Systemic planning of activities
	Level	Focusing on single projects + additional training	A comprehensive approach
	Contents	Operational plans	Tactical plans
Process control	Measures	Ongoing raw material quality control performed on the processing side	The level of the applicable indicators, e.g. quality, is the result of the implemented certificates
	Ability to change processes	Suppliers do not influence changes to the recipient's processes. The processing plant creates and adjusts the processes to the current market needs	The course of processes depends on common arrangements between processing and recipients of the raw material
Communication	Range of communication	Limited to occasional contacts (farms) or through purchasing (collectors)	Comprehensive communication, including on the exchange of information on current production capacities or in the field of demand planning
	Ongoing communication	Incidental, e.g. informing suppliers about cases of poor quality of a batch of raw material	Continuous
	Type of communication	One-sided towards suppliers	Bilateral

	Electronic communication	Absence	Product identification systems, IT systems
Shared risk/rewards	Loss tolerance	No risk-sharing and no profit sharing. Farmers undertake production at their own risk, being able to limit it, for example, through crop insurance	The sharing of risk and possible profits is at a minimum level, e.g. in periods of overproduction, the recipients of final products can take more products to the warehouse than they currently need. However, these are not systemic solutions, but only reacting to the current needs of partners, preceded each time by negotiations
	Increased commitment	Ad hoc measures, no system solutions	Ad hoc measures, no system solutions
Trust and commitment	Trust	Confidence at a low level - each batch is tested and assessed for quality and suitability for further processing	Trust at a higher level - based on the certification system
	Commitment to the success of others	Neither side shows interest in the success of the other	Taking into account the care for the sales market and regular supplies of raw material, both parties care about the mutual success and remaining on the market of each party. The win-win strategy dominates
Contract style	Time range	Oral contracts with farmers, short-term civil law contracts with collectors	Long-term contracts
	Subject	Applies to simple tasks such as the period of cooperation or the scope of work (limited to obtaining raw material)	Multifaceted, including, for example, the rights and obligations of the parties, the possibility of joint actions, possible risk-sharing, or the conditions for pursuing claims
The scope of cooperation	The importance of cooperation	Minimum cooperation consisting of purchasing the produced or harvested raw material	Cooperation focused on information exchange, joint market analyzes
	Added value	The added value is wider access to knowledge, as training courses are organized, especially for collectors	Joint procurement of funds for the development of herbal products, joint submission to tenders
	Key activities	Apart from purchasing raw materials, there are no common activities	Creating a market for herbal products, marketing activities promoting the fashion for the use of herbs
Joint investments	Financial	Absence	Absence
	Technological	Absence	Absence
	HR	Training with collectors	Absence

Source: *Own study based on Jarzębowski et al. (2013).*

Within the 21 ranges adopted and described above, their advancement level was assessed on a low, medium, and high scale, assigning weights 1, 2, 3, respectively, as presented in Table 2.

Table 2. *Areas of the level of integration within the SCIDM indicator – analysis*

Integration level areas	Integration scopes	Suppliers				Recipients	
		Farms		People obtaining the raw material from the positions of natural "collectors"			
		Scope of integration	Integration level	Scope of integration	Integration level	Scope of integration	Integration level
Planning of activities	Style	yes	1	yes	2	yes	1
	Level	yes	1	yes	3	yes	2
	Contents	yes	1	yes	2	yes	2
Process control	Measures	yes	2	yes	1	yes	2
	Ability to change processes	yes	1	yes	2	yes	2
Communication	Range of communication	yes	1	yes	1	yes	2
	Ongoing communication	yes	1	yes	1	yes	2
	Type of communication	yes	1	yes	1	yes	2
	Electronic communication	no	-	no	-	yes	2
Shared risk/rewards	Loss tolerance	no	-	no	-	yes	1
	Increased commitment	yes	1	yes	1	yes	1
Trust and commitment	Trust	yes	1	yes	1	yes	2
	Commitment to the success of others	no	-	no	-	yes	1
Contract style	Time range	no	-	yes	1	yes	2
	Subject	no	-	yes	1	yes	2
The scope of cooperation	The importance of cooperation	yes	1	yes	2	yes	2
	Added value	yes	1	yes	1	yes	2
	Key activities	yes	1	yes	1	yes	1
Joint investments	Financial	no	-	no	-	no	-
	Technological	no	-	no	-	no	-
	HR	no	-	yes	1	no	-
SUM		**14**		**22**		**31**	

Source: *Own study.*

The SCIDM index for the adopted variables could range from 0 to 126 (suppliers could obtain a maximum of 63 points and recipients also a maximum of 63). For comparison, three ranges for the analyzed measure were defined: $0 \leq 42$, $43 \leq 84$, $85 \leq 126$,

informing about a low, medium, and high level of supply chain integration, respectively. In the case of the analyzed supply chain of the herbal sector, the SCIDM index took the value from the second level 49 (arithmetic mean of the results obtained by suppliers plus the point value of recipients), which meant the integration of the entire chain at an average level. It is worth noting that this value is close to the upper limit for the low level.

Next, the shaping of the partial values of the integration index for suppliers and recipients was analyzed separately. For this purpose, three ranges of the index were adopted: $0 \leq 20$, $21 \leq 42$, $43 \leq 63$. The main subject of research in the paper were suppliers for which the integration level was 18, which meant a decidedly low integration. When decomposing the degree of integration of suppliers to farms and collectors, it turned out that the former participate in the chain integration the least among the respondents. The situation was slightly better on the side of recipients, where the degree of integration was in the medium range.

4. Summary and Concluding Comments

In the surveyed voivodeships, the supply chain in the herbal industry was identified. It was found that the degree of chain organization, especially chain integration, was at a low level, which was influenced by limited relations and the type of dependencies between the chain participants. The least integrated were herb producers who supplied the raw material without even symbolic forms of systemic cooperation with processing in most cases. The individual links in the chain function as separate units.

Thus, there are no additional benefits and no economic bonuses for joint action. Locally, the market has features akin to a monopoly, with one processor dictating conditions to other players, especially suppliers. Few farms have drying chambers and can store products. The lack of local competition does not encourage recipients to establish binding cooperation with suppliers. Apart from oral arrangements, no written agreements, contracts, or other forms of legal relationships are used. The raw material is usually obtained through collection points and direct deliveries. The factor contributing to the low level of integration is the significant fragmentation of farms growing herbs and the acquisition of herbs by hundreds of individual collectors from natural sites.

It can be assumed that Poland has a chance to become a leader in the production of herbs in Europe, and some regions of the country may use herb production as an element of smart specialization. A favorable circumstance is a growing demand for herbal raw materials and changes in the awareness of consumers who are looking for traditional and ecological methods of nutrition and health care. Therefore, there is an increasing demand for products containing herbs, which affects the development of their production. Due to the limited possibilities of obtaining these raw materials from natural sites, they must be produced on farms. Their production gives great opportunities for the management of production factors in small farms. From the point

of view of sustainable development, this is a direction that allows the departure from monoculture crops, favoring biodiversity, and, importantly for farmers, may become an important alternative source of income. The problem that has been observed and a barrier to the development of the entire industry is the low degree of its integration.

The industry is evidently at an early stage of development, where each link cares only about its interests. Considering the potential of the herbal industry for the development of the region and the improvement of the socio-economic conditions of a significant part of the population, it is reasonable to develop a strategy for the development of the herbal industry in the Podlaskie and Lubelskie voivodeships, which would redirect appropriate forces and funds to the development of the Polish "herbal area".

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