EFFICIENCY OF FOOD CHAINS – THEORETICAL AND METHODOLOGICAL FRAMEWORK[1]

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Abstract: The aim adopted in the paper was to review methods for assessing the organizational aspects of supply chains and to carry out their critical evaluation. The selected approaches of supply chains' assessment, published in leading Journals dealing with logistics and supply chain management, were analyzed. Literature studies, interviews, analysis of processes in the chains were used for analysing of dependency between the individual stages of supply chain and identifying the integration of entire supply chain. An important issue was to determine the possibility of assessing the integration of supply chains in selected sectors of agribusiness by using approaches presented in the paper. Basing on the data from enterprises from a selected sector of food processing several approaches discussed in the paper were adopted to evaluate the configuration and organizational aspects of supply chains. These organizational aspects of supply chains were related to the efficiency of enterprises from a selected food processing sector.

Keywords: supply chain management, food supply chains, efficiency, integration

1. Introduction

A characteristic of a network arrangement is that many transactions are carried on simultaneously. Individual parties cooperate in a complex contractual pattern to define production characteristics as well as rules to share property rights over the income flow. For instance, the quality of a good or service might be the result of cooperation between many agents. Therefore, the value created must be shared based on some rule that permits the continuity of the relation [Zylbersztajn 2004]. It is crucial because of the fact that currently the responsibility for high products' and services' competitiveness does not concern individual entities but on many agents operating in a entire supply chain. Thus, the increase of competitiveness is the aim of all the stages of supply chains. In the literature one can find possibilities of increasing of supply chain's competitiveness. One of them is integration (or cooperation) of involved companies, and the second one is a better coordination of materials', information's and financial flow [Lee 1998].2 The search for answers with regard to how economic agents cooperate in production is a part of organization theory and the theory of the firm. Unlike the Walrasian perspective which aims to explain how costless market transactions allocate resources in production, organization theory search for explanations of how complex contracts are designed and governed [Zylbersztajn 2004].

On the basis of the theoretical considerations and results of the empirical analyzes it may be stated that increasing the integration level in the sectors of food processing industry enables to improve efficiency of the companies operating in them [Jarzebowski 2013]. Therefore, the review of me methods for assessing the organizational aspects of supply chains and its critical evaluation was made in the paper. The selected approaches of supply chains' assessment, published in leading Journals dealing with logistics and supply chain management, were analysed. Literature studies, interviews, analysis of processes in the chains were used for

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[2] In this aspect enterprises have to cope mainly with organizational barriers, strategy adjustment and acceleration of flows within the supply chain.

analysing of dependency between the individual stages of supply chain and identifying the integration of entire supply chain.

2. Reasons for integration of companies

In the context of the analysis of various forms of integration - organizational solutions that exist between market and hierarchy - reasons for integration of companies were analyzed. One should refer to the weaknesses of the market while considering the prevalence of various form of integration. This is confirmed by the theory of K.J. Arrow [Arrow 1969]. One of the elements of creating various forms of integration is the market failure that is reflected in transaction costs, uncertainty, increasing revenues in terms of scale, opportunism and lack of confidence, external effects, specificity of capital, social inequality and information (knowledge) flow [Noga 2009, pp. 160]. Organizational solutions are referred in this context as opportunities to use or limit market weaknesses.

The motives for the different types of integration between companies were considered in six different aspects [Jarzebowski 2013].

- Firstly, the crucial aspect is to know whether economies of scale can be achieved when different individual players join to form a joint company using joint resources. Under the conditions of certainty and due to the combination of several factors an effect arises that is greater (thanks to the technology) than the sum of individual effects generated by individual production [Reichwald and Koller 1955].
- Secondly, decreasing transaction costs are the reason for integration with other entities [Noga 2009, pp. 141].[3] Accordingly to R.H. Coase various forms of integration are created while using the capabilities of "winning" with the market due to elimination of transaction costs generated by the market [Noga 2009, pp. 201].
- Under the conditions of uncertainty more joint benefits of integration can be identified. K.J. Arrow showed that combining several combinations of factors in one company under certain conditions can give an effect of insurance.
- Preventing or reducing opportunistic behavior aims to establish links between companies [Gruszecki 2002, pp. 216]. Opportunism persuaded the contract's participants (partners) to minimize their contribution what creates uncertainty in the execution of the contract and the reduction of this uncertainty requires monitoring and thereby generates costs [Gruszecki 2002, pp. 216].
- Delegating the tasks and duties to third parties can be the reason for creation different forms of integration. Many processes (tasks) within the whole supply chain, from raw material to customer, are made less and less in the company and more often are conducted in a form of symbiosis with other entities.
- The creation and development of different forms of organization leads to the benefits of the agency (possibilities to manage) [Noga 2009, pp. 70], and thus agency's costs are decreased. By the costs of agency A. Noga understands costs of control and motivation that helps the subordinate entity to achieve the goals of superior entity. Minimizing the costs of the agency - in accordance to mathematical agency theories - is most effectively carried out as a result of decentralization (as many powers as risks) [Noga 2009, pp. 157] what can be achieved by transferring the risk to other market participants within the framework of various forms of cooperation.

3. Methods of assessment the integration of companies

One can find different approaches in the literature, in which integration is assessed by three aspects, namely: direction, scope and level (they should reflect the construction of integration). Firstly, one is able to distinct top-down integration with suppliers, bottom-up integration with customers, internal and external integration.

Direction of integration

Accordingly to New one makes a distinction between directions of integration [New 1966].

[3] By transaction costs A. Noga understands the financial difference achieved due to reaching to cheaper (than currently held by the company) sources of acquisition of production factors or products [Noga 2009, pp. 70].

Criterion / aspect	Description
Top-down integration with suppliers	Integration practices connected with suppliers of raw materials, goods and services.
Bottom-up integration with clients	Integration practices with clients of goods and services produced at a given supply chain stage.
Internal integration	Integration within one company.
External Integration	Integration with other organizations..

Secondly, authors analyzed the scope of integration (areas of cooperation). The following areas may be distinguished:

- Material flow [Frohlich and Westbrook 2001],
- Planning and control [Tsay 1999],
- Organization (type of cooperation) [Lamming 1993],
- Information flow [Vickery et al. 2003],
- Product development [Lee et al. 1993; Davis 1993].

Range of integration

Authors described and analyzed different scopes of integration (cooperation areas).

Criterion / aspect	Description
Material flow	Vendor Management Inventory (VMI) and adjustment of the way of packing and are common solutions.
Planning and controlling	Examples: joint planning and forecasting, Multi-Level-Supply-Control and plans concerning commitment. More advanced practices are based on coordinated supply chains.
Organization	Specification of the type of cooperation between buyer and supplier (partnership), for example JIT II conception. The specificity of the accounting type managers, planners dedicated to one buyer.
Information flow	Integration practices in relation to information on communication and technology (ICT). For example modern techniques of electronic data interchange (EDI) and barcodes, or using MRP/ERP type models.
Product development	One can measure the degree of sharing of information on technical details, joint commitment to product development and process improvement.

Thirdly, **level of integration -** The degree of integration development may be measured as a number of activities in a given range. The more advanced and challenging practices are applied, the higher level of integration. For example a relatively high level of integration can be achieved in terms of planning and control while using Multi-Level Supply Control [Kotzab et al. 2005].

In the literature one can find approaches characterized by forms of domination by the partner [Baur 1990]. Depending on what is the scope of the agreement, a dominant partner can have week or strong influence on the business partner [Gerpott 1993].

Forms of domination

There are many ways of influencing the decisions made by the business partners [Baur 1990].

Criterion / aspect	Description
Contracts	Threat of the breach of contract in the case of low activity.
Quasi-vertical integration	Ownership of the production factors.
Vertical quasi-integration	The importance of the customer to the total income.
De-facto-vertical integration	Geographical location of suppliers.
Licenses	The possibility of know-how withdrawal.
Partial integration	The (warranted) possibility of full integration of a particular production stage.
Capital involvement	Own production.

Authors also draw attention to the level of integration of information technologies, e.g. by area of operation, i.e. R&D, purchasing, sales, market research [Reichwald and Rupprecht 1992].

Integration of information technologies

The use of inter-organizational information and communication technologies may support cooperation and coordination of activities within many operational areas [Reichwald and Rupprecht 1992].

Criterion / aspect	Description
B+R	Information exchange, coordinated or joint R&D, development and use of joint infrastructure.
Purchasing	Joint purchasing, transportation, (partially) automated warehousing.
Production	Replacement of components and spare capacity production, construction and exploitation of joint production facilities.
Sales	Information exchange (e.g. customer database), mutual acquisition of distribution and/or services for customers, joint promotion, PR or events supporting sales, creation of joint services (e.g. Info-line).
Market research	Exchange of information and results, joint market research, creation and use of joint units for market research, joint development of support systems, joint observation of the market.

Supply chains can also be assessed in terms of other aspects, as:

- **Duration of cooperation** - Duration of cooperation with partners in the supply chain [Imai and Itami 1984].
- **Decision making process -** Decisions taken after consultation with partners of the supply chain / decisions imposed upon partners [Imai and Itami 1984].
- **Interdependence between partners -** Level of reliance on business partners. Hierarchical organizational forms are characterized by a higher ratio of the mutual relationships between partners than in a case of more market forms of organization [Williamson 1990].
- **The scale of ad-hoc process of partners' selection -** The share of transactions with partners that were selected on ad-hoc basis in a number / value of transactions in general [Malone, Yates and Benjamin 1986].
- **Impact on partners -** Possible ways of impact / influence on partners [Schneider 1988].
- **Partnership model -** Benefits of cooperation (efficiency, customer service, marketing benefits, stability / increase in profits), factors of cooperation (corporate compliance, management concept, ability to

cooperate, symmetry), additional factors (exclusiveness, joint competitors, geographical proximity, history of cooperation, joint end-customer) [Lambert 2008].

- **The nature and extent of protection against opportunistic behavior -** Contracts, contractual penalties, their nature and scope [Kappich 1989].

The Global Supply Chain Forum of the USA offers a comprehensive method for measuring the degree of integration. The authors of the conception define **six types of relationships between partners,** from joint ventures to full vertical integration (self development and production). One can distinguish three types of integration (partnership type I, II and III), defined as: business relationships based on mutual trust, openness and joint risk. Partnership type I, II and III are characterized by low, medium and high level of integration (see Figure 1).

Figure 1. Types of cooperation in the supply chain

Source: Lambert 2008.

There are three types of partnership [Lambert et al. 1996]:

- **Type I** - Involved organizations recognize each other as partners and coordinate their activities and planning to a limited extend. This type of partnership is usually short-term and involves only one or a limited number of functional entities in each organization involved in a transaction.
- **Type II** - Organizations are characterized by progress on going from tasks' coordination to their integration. The partnership has a long-term perspective. Several departments and organizational entities in companies are involved in the partnership.
- **Type III** - organizations are characterized by a significant level of operational integration. Each of the sides sees the other side as an extension of their own business. Usually there is no planned end date of the partnership.

4. Assessment of integration in a selected food supply chain

An important issue was to determine the possibility of assessing the integration of supply chains in selected sectors of agribusiness by using approaches presented in the paper. Basing on the data from enterprises from a selected sector of food processing several approaches discussed in the paper were adopted to evaluate the configuration and organizational aspects of supply chains. These organizational aspects of supply chains were related to the efficiency of enterprises from a selected food processing sector.

The integration assessment was carried out on the basis of data from the Monitor Polski B. The sample covered 94 companies of grain processing sector from across Poland in the year 2013. The selection of a specific sector was made because of different production technologies in different food processing sectors. The data was reported as revenue/expenditure denominated in PLN in constant prices.

The integration level measured by the SCIDM ratio and the integration type in the grain processing sector (in a division into size groups) of were assessed. As it is shown in the table 1, large enterprises were characterized by the highest integration level (SCIDM ratio was equal to 178). The SCIDM ratio level for grain processing companies ranged from 87 (micro companies) to 178 (large companies).

Table 1. Average efficiency ratio, average SCIDM ratio, integration type in 2013

Group	Average efficiency ratio	Average SCIDM ratio	Integration type (D. Lambert)

Grain processing	Micro	0,41	87	1,9
	Small	0,46	110	2,1
	Average	0,48	125	2,6
	Large	0,58	178	2,6

Source: Own work.

It was observed that the average efficiency ratio increased with the increase in the average SCDIM ratio for each size groups. A similar relation was visible in the case of the integration type, i.e. with the increase in the average SCDIM ratio the companies were characterized by more sophisticated integration types.

5. Conclusions

The paper includes significant considerations regarding the economic theory's development and its empirical verifications. It was based on the well-established economic theories, starting from the mainstream theory and Adam Smith, the master of the classical school, through the market equilibrium and economic development, as well as work of R.H. Coase and O.E. Williamson, up to the selected theories of enterprises. The functional market weaknesses were presented on the basis of the critical relation to the assumptions of the market equilibrium (including the theoretical justification). Limitations or use of these weaknesses, according to the theoretical relations, cause the existence of various integration forms.

An important aspect of collaboration in the supply chain is to find a proper form of cooperation between partners which was emphasized in the studies of D.M. Lambert, M.A. Emmelheinz and J.T. Gardner [Lambert et al. 1996]. In an environment characterized by a scarcity of resources, increasing competition, increasing customer requirements and ever-increasing pace of changes, cooperation and integration in the supply chain create opportunities to build competitive advantage.

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