COOPERATION IN A SUPPLY CHAIN ON THE EXAMPLE OF JAPANESE COMPANIES LOCATED IN POLAND

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Abstract

For an efficient and effective management of a supply chain a significant impact has a cooperation undertaken by companies establishing communications with other entities forming the common supply chain. The emphasis is both on the relationship established in various areas of a functional supply chain and at different stages of its development. This cooperation may include areas such as: planning and integration processes in the supply chain, transport and storage, shopping and inventory management, distribution and customer service, logistics of production and waste and personnel and corporate social responsibility. The purpose of the article is a comparative analyze of the scope of cooperation undertaken by Japanese companies located in Poland in selected areas of the supply chain. The paper presents the results of research carried out in the form of focus interviews with representatives of the Japanese companies. The research shows that despite a similar range of organizational culture cooperation undertaken in the different areas of the supply chain is various.

Keywords: Cooperation, supply chain, Japanese companies

1. INTRODUCTION

Cooperation of companies and organizations within the supply chain is becoming increasingly important. In the conditions of globalization it can be seen that individual companies no longer compete with each other but the entire supply chains. The desire to increase the ability to compete is one of the factors affecting decisions about the cooperation and they include: the desire to reduce uncertainty and risk in the supply chain, the growing importance of fulfilling needs of customers' requirements in terms of flexibility of supplies or the desire to acquire knowledge and new competence [1]. The purpose of the article is a comparative analysis of the scope of cooperation undertaken by Japanese companies located in Poland in selected areas of the supply chain. The result of the study is a ranking of selected Japanese companies located in Poland in terms of the scope of their cooperation undertaken in different areas of the supply chain. In order to rank the surveyed companies Multiple Criteria Decision Making / Aiding Electre III/IV has been used. The work has been divided into several thematically related sections. The theoretical part presents the essence and areas of cooperation in the supply chain. In the empirical one the material, method and the results of completed studies are presented. In the last part, the authors formulate conclusions and presented further research directions.

2. COOPERATION IN A SUPPLY CHAIN

One of the first definition of cooperation was that developed by Mead according to which cooperation is understood as mutual work for a single goal [2]. Applying this definition to the supply chain can be assumed that cooperation in the area of the supply chain is understood as mutual work of entities having a direct or indirect impact on meeting the needs of the final customer. In the literature many publications concerning cooperation in the supply chain can be found. Most of them concern the cooperation in a selected area of the supply chain, e.g. between a supplier and a buyer [3], [4], [5] or long-lasting cooperation in a strategic

dimension [6], [7]. However, there are few studies that show a broader approach to the entire supply chain in terms of undertaking cooperation in different areas with different entities. Verduijn and van de Loo identified four areas of cooperation in the supply chain related to the integration of information flow [8]. However, developed by them classification indicates areas of cooperation in which there is an integration of the flow of information through the implementation of a variety of solutions in the field of ICT, but it does not show other areas of cooperation, which cannot be integrated using such systems. A slightly different classification of areas of cooperation presented Piltan and Sowlati, who focused primarily on identifying the components of cooperation influencing their success or not. Among these components they distinguished: "information sharing, joint decision-making, risk/ reward sharing and relationship-specific assets" [9]. The above classification shows only components of cooperation, but not functional areas of the supply chain within which there may be cooperation. According to a study by Frohlich and Wesbrook supply chains, where organizations work closely with their suppliers and customers, function much better than those in which this cooperation does not occur [10]. While according to Cao and Zhang for the success of the supply chain provides the cooperation of all the partners [11]. However, a necessary condition for cooperation is mutual sharing of information [12] and trust [13].

On the basis of the literature concerning a supply chain management [14], members of the project team implementing the research project called „Management methods in Japanese supply chains in Poland and Great Britain" have identified the functional areas of a supply chain, within which cooperation can be established. Among them there can be distinguished: 1) Planning, organization and control of processes in the supply chain, which relates primarily to taking action for the integration of the supply chain, 2) Transport and warehousing, which consists mainly of business cooperation with companies from the TSL sector, 3) Purchase and inventory management, which relates to cooperation with suppliers and thus the scope of the mutual transparency of information and trust, 4) Distribution and customer service, which relates to cooperation with customers in the field of sharing data about forecasts, customer surveys or building a strategic partnership based on the principles of mutual trust and information flow, 5) Production logistics, which concerns cooperation with customers in terms of production planning, organizing and controlling, 6) Research and development, including cooperation in carrying out mutual research on product development, improving processes or market research, 7) Waste logistics, which includes any kind of undertaking mutual actions with the co-operators in the logistics of waste, 8) Human resources and social responsibility, which relates primarily to the management of social capital in the supply chain, as well as cooperation with the cooperators in the implementation of the concept of corporate social responsibility. This classification is certainly not exhaustive of all functional areas of the supply chain but includes those affecting its smooth functioning.

3. RESEARCH METHOD

3.1. Multiple Criteria Decision Making / Aiding - Electre III/IV

In the work to analyze the way and extent of areas of cooperation in the supply chain of Japanese companies operating in Poland one of the methods of multiple criteria decision making / aiding was used, which belongs to the family of ELECTRE methods (fr. Elimination Et Choix Traduisant la Realia) - method ELECTRE III/IV. This method was created in the 60s of the twentieth century and its creator is B. Roy.

The basic principle used in the ELECTRE methods is to compare each option with all other decision-making, which allows you to check whether there are grounds for recognition of the option as having an advantage over others. ELECTRE family method is used in a variety of decision-making problems which are: a) issues related to selection of the best (distinctive) decision variants, from the point of a view of a set of criteria, b) ranking decision variants in terms of a set of adopted criteria, b) classification, which is the division of the set of variants classes (categories), organized among themselves in terms of preferences [15], [16]. Due to

the agreed objective of the presented work the main direction in the work of the research was to rank the analyzed companies due to the area of cooperation undertaken within the supply chain.

Applied in this paper Electre III/IV method focuses on the so-called an analysis of variants (***V***) (or objectives - F) with respect to the family defined criteria (***C***). The input data are the weighting of the criteria (a) and thresholds: indifference (q_i), preferences (p_i) and veto (v_i). Use of the method ELECTRE III/IV is related to the performance of a series of tests (compliance and non-compliance) [17], whose aim is to compare each option with all the decision-making criteria. Decisions about whether a given variant exceeds the adopted profiles taken as a result of testing a variety of hypotheses. The calculation procedure used in the ELECTRE III/IV method comprises the following steps [18]:

1) Definition of objectives F and a family of criteria ***C*** combined with an evaluation matrix and the DM's preference model. During this phase the following tresholds are definied: w_i - weights, q_i - indifference, p_i - preference and v_i - veto *(*where: $q_i < p_i < v_i$).

2) Development of: the outranking relation *S(a,b),* which shows the extent to which "*a* outranks *b*" overall, the global concordance indicator *C(a, b)* created in the concordance test weakened by the discordance indexes $D_j(a,b)$ built in discordance test.

3) Computation of the outranking relation *S(a,b).* On the basis of the computation of *d(a,b)* two preliminary rankings (complete preorders) using a classification algorithm (distillation procedure) has been established.

The final ranking has been obtained in the form of the ranking matrix as well as the outranking graph presenting complete preorders. Four options can be observed in the obtained ranking: indifference (I), preference (P), lack of preference (P^-) and incomparability (R).

3.2. Research material

The basis of the analysis presented in the paper was the information gathered during focus groups (study completed in early 2016.) carried out with the representatives of Japanese companies located in Lower Silesia in Poland. The study involved 6 production companies representing the automotive sector (in the study named F1, F2, F3, F4, F5 and F6), which are in the supply chain first tire suppliers for final producer (mainly cars).

The source of information about practices of studied Japanese companies concerning ways and extent of building relationship with the environment was a questionnaire survey that allows you to gather information from different areas of functioning of these enterprises in the supply chain. This information was used to determine the list of criteria and sub-criteria, covering the areas of cooperation of selected companies in the supply chain (**Table 1**).

Table 1 Description of criteria

Criterion	Sub-criterion
C1.Planning, organization and control of processes in the supply chain	C1.1 taking measures to supply chain integration (measured by the number of projects, up to 8 such projects have been identified, 0 - means no action in this regard), C1.2 conducting the measurement and evaluation of the costs and results of cooperation in the supply chain (1 - conducting such actions 0 - no such action).
C2.Transport and warehousing	C2.1 cooperation with companies from the TSL sector (3 - over 10 players, 2 - from 6 to 10, 1 - 2 to 5, 0 - with one), C2.2 the application of the criteria for selecting partners from TSL market (1 - according to such criteria, 0 - no such criteria), C2.3 the use of criteria assessment of partners from the TSL market (1 - according to such criteria, 0 - no such criteria).

Criterion (continue)	Sub-criterion
C3.Purchasing and Inventory Management	C3.1 cooperation in building a strategic partnership on the principles of transparency of information and trust - the percentage of suppliers with whom it such partnership is built (2 - over 50%, 1 - 10-50%, 0 - 10%), C3.2 the implementation of the development program suppliers (1 - to undertake such actions, 0 - no such action), C3.3 the use of the support of suppliers or customers to improve their own systems, purchasing and inventory management (1- to undertake such actions, 0 - no such action).
C4.Distribution and customer service	C4.1 sharing data about estimates, sales, inventory, etc. in the information systems of key suppliers and customers (1 - to undertake such actions, 0 - no such action), C4.2 the number of clients with whom a strategic partnership is built on the principles of transparency of information and confidence (4 - with all 3 - over 50%, 2 - 10-50%, 1 - 10, 0 - no), C4.3 study the opinions and preferences of customers (1 - to undertake such actions, 0 - no such action), C4.4 having a strategy of customer service (1 - yes, 0 - no).
C5.Production logistics and waste and research and development	C5.1 production control in collaboration with customers based on actual demand (1- yes, 0 - no), C5.2 liaising with co-operators in the field of research and development (2 - yes, on a large scale, 1 - yes, on a small scale, 0 - no), C5.3 the frequency of the action in the field of logistics of waste in cooperation with cooperators (5 - all the time on an ongoing basis, 4 - once every few weeks, 3 - once every few months, 2 - once a year 1 - less often than once a year 0 - they are not undertaken).
C6.HR and corporate social responsibility	C6.1 using social concept of business responsibility - CSR (1 - yes, 0 - no), C6.2 taking into account when selecting or assessing the cooperator, his realization of CSR concept (2 - so this is the most important criterion, 1 - yes, but it is not the most important criterion, 0 - no), C6.3 management of social capital in the supply chain (1 - yes, 0 - no).

4. STUDY RESULTS - COMPUTATIONAL EXPERIMENT

In order to make the ranking of enterprises in the areas of cooperation in the supply chain software Electre III/IV was used. The computer experiment required prior normalization of all the sub-criteria and their aggregation on a weighted average. In the next stage a model of Decision Making (DM's) preferences was developed. For the individual criteria there are specified weights (the sum of weights for all criteria was 1) and the thresholds: qi, pi, vi (**Table 2**).

As a result of the computer experiment a final ranking of the analyzed companies was obtained. Taking into account the specific weights and the results of research conducted among companies it is shown that the highest ranked company was F2. The company achieved the highest results in four areas (C1, C3, C5 and C6), including inter alia such sub-criteria: participation in the largest number of projects for the integration of the supply chain, conducting the measurement results of cooperation, building a strategic partnership with both suppliers and customers and the using the concept of CSR in relations with co-operators in the supply chain. The next ranking achieved the company F4, which stood out in the cooperation in the areas of transport and storage purchases and inventory management. Further two (F3 and F6) obtained the third position in the ranking. The lowest ranked was the enterprise F1 and F5. These companies also received the lowest assessment in the relation to most of the criteria. The company F1 received the lowest marks for criteria such as: C1 (planning, organization and control of processes in the supply chain), C3 (purchasing and inventory

management) and C6 (HR and CSR). In contrast, F5 also obtained a very low score in the relation to three of the same criteria as the company F1 (C1, C3 and C6).

Table 2 The model of the DM's preferences characteristic for the Electre III/IV method

Criterion	C1	C2	C3	C4	C5	C6
waga	0.2	0.15	0.15	0.2	0.15	0.15
Indifference (qi)	0.1	0.1	0.1	0.1	0.1	0.1
Preference (pi)	0.3	0.4	0.4	0.3	0.4	0.4
Veto (vi)	0.7	0.8	0.8	0.6	0.8	0.8

In the Electre III/IV method in the final ranking the following relationships between companies (objects) can be distinguished (see Chapter 3.1.): preference (P) - one company F is placed above another (e.g. F2 and F4), indifference (I) - companies are positioned in the same box (e.g. F1 and F5) and incomparability (R) - firms are not interconnected (e.g. F3 and F6).

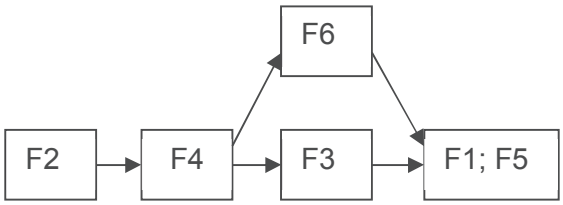

Figure 1 The final ranking of the computational experiment

CONCLUSIONS

Discussed in the article an issue concerning areas of cooperation between enterprises is very important from the perspective of supply chain management. Enterprises cooperate in various functional areas of the supply chain in order to obtain the efficient and effective functioning. However, some of these relationships result from the specifics of an enterprise (such as cooperation with a parent company). The survey carried out among Japanese companies shows that the widest range of cooperation undertaken by them in the supply chain applies to mutual research and development of products. This is due to the fact that the surveyed enterprises are in the supply chain "I-tier suppliers" and thus they produce components for final producers on their behalf and according to their specifications. The fewest surveyed companies build with both suppliers and customers a strategic partnership on the principles of transparency of information and trust. This is certainly an area that needs further improvements. Perhaps the facilitation of establishing such a close and long-term co-operation would be a segmentation of the supply chain, based on which key suppliers and customers would be selected to establish closer cooperation.

Presented in this paper the results of research do not exhaust the issue of the cooperation between enterprises in the supply chain. Undoubtedly, this subject requires further in-depth studies that would identify the factors influencing the scope and way of partnerships in the supply chain.

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