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## Elimination of supply chain coordination's obstructive factors with the help of contracts

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### Abstract.

The biggest problem of supply chain coordination is to define the exact factors, which influence negatively the cooperation. Because the rest of the coordination problems can be traced back to basic cooperation gaps. No willingness to share information, no willingness to cooperate, different goals are defined by each partner, and there are many mismatches in the ordered quantities, which could be derived from for example the different production cycles, replenishment times, or delivery times. These problems more or less – it depends on the different specifications and strength of them – influences the coordination of supply chain members. To handle this problem, the literature recommends the use of various supply chain contracts. Frequent types of contracts are presented by the paper and with the help of some good practices, the specifications of contracts' application are also known. The goal of the paper is to present a decision-support model. This model focuses on the elimination of the determined obstructive factors of coordination with the use of different contracts.

**Keywords:** Coordination Mechanisms, Decision-Support Model, Supply Chain Contracts, Supply Chain Coordination, Supply Chain Management

### 1. Introduction

Corporates in the market are no separated units, whether they are multinational or SME companies. They are part of a bigger system, where the value-creating processes of the companies are connected to each other. This system is called the supply chain (Christopher, 2005). The chain will be sustainable and efficient if the members implement the supply chain conception into their corporate philosophy (Jadhav et al., 2019). This movement is the first step to establish the supply chain management of the chain members. With this philosophy, companies can be motivated to develop a system- and process-oriented approach; companies are able to manage the supply chain as a system, enable a faster and more efficient flow of information and materials, which helps companies adapt to the dynamically changing market demands and fluctuations in demand (Mentzer et al., 2001).

Above a certain level of cooperation, companies plan and manage their resource utilization together, because these partners aim to maximize the individual profit and the profit of the whole or at least a section of the supply chain and at the same time. To reach this level of cooperation is different. There are the big data – it is hard to handle, need modern IT structure



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–, the dynamic changes of customers’ make the adaptation harder – to change the parameters of products needs to change the technologies –, and the supply chains have more and more members – the global network of suppliers, manufacturers, warehouses, distribution centers, wholesalers, retailers. Therefore the communication, the coordination of processes, and the decisions of these members are problematic, but supply chain management can help.

## 2. Supply chain coordination – literature review

Supply chain management includes every planning, managing processes, coordinating, and collaborating mechanisms between the chain members (CSCMP, 2013). From the definition of CSCMP, it is clear that coordination is the responsibility of supply chain management.

Supply chain management supports the companies to reach their own individual goals – usually includes the own profit-maximization and the cost-reduction –, and to define a common goal to make the whole chain to be more efficient. Besides these factors, supply chain management offers to connect the processes by coordinating the decision-makers. The condition of supply chain coordination is the decision-makers make decisions in favor of the whole supply chain’s interests (Gupta & Weerwat, 2006). That is the reason why supply chain coordination helps to modify the objectives, the goals of individuals in the line of the whole supply chain goals (Kumar et al., 2016).

There are many fields and types of supply chain coordination. According to Arshinder & Deshmukh (2008), supply chain coordination could be determined with the help of empirical case studies, across the functions of corporates, or the interfaces of the supply chain, and the coordination mechanisms.

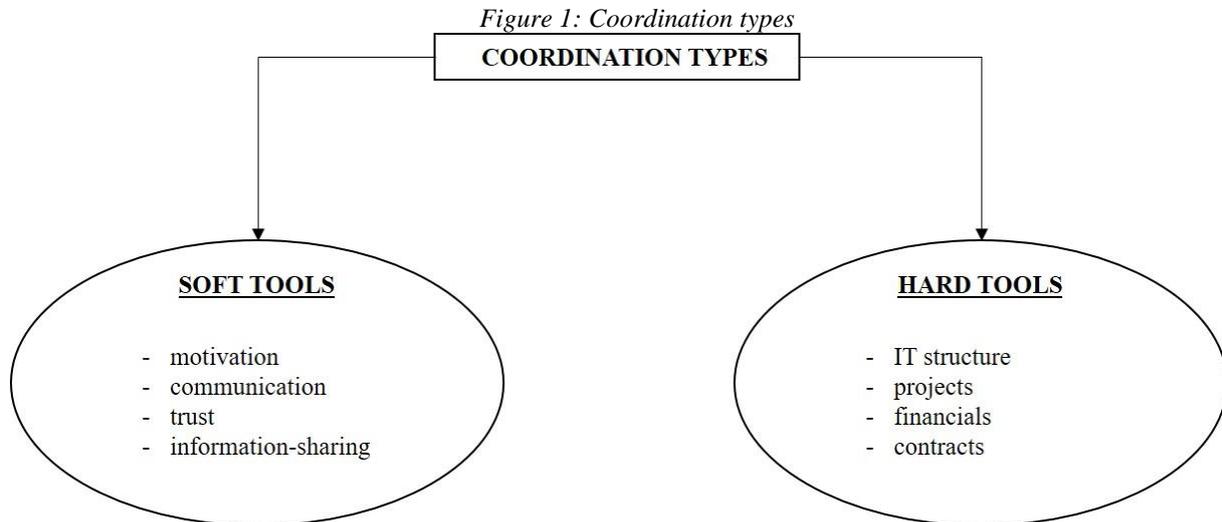
Coordination mechanisms include the IT structure, the willingness of information-sharing, the joint decision-making processes, and contracts (Arshinder & Deshmukh, 2008). From another point, the coordination mechanisms are divided into two groups. Soft tools contain some behavior science factors. Hard tools focus on the financial issues of coordination (Sing & Benyoucef, 2013; Szegedi, 2017). Figure 1 summarizes the theory of soft and hard tools.



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*Source: own construction (by Szegedi, 2017)*

The different perspectives of supply chain coordination have a common point: the base of a successful and efficient relationship is the cooperation. This paper is focused on the contracts, which could be the best way to coordinate the chain and make the relationships between the partners to be better and efficient.

### 3. Supply chain contracts

Within the supply chain, the level of dominance of the members is an important question, because it can influence the efficiency of their cooperation. This level of dominance also influences the decision-making mechanisms of the members. Two cases exist; the first is if the seller is the dominant one; in the second case, the buyer is the dominant member. If the seller is the dominant one, the conditions of the relationship are determined by the seller. The prices are defined to the buyer buy as much as the possible quantity of the products – this way, the seller can maximize its profit. But the buyer has a surplus from the products; it decreases the efficient operation of the buyer and also the whole chain. In the second case, if the buyer is the dominant member, the situation may be reversed; the buyer maximizes its profit to sell the products at lower prices, the seller realizes the increased needs, and more products will be manufactured by the seller. But this surplus will not be purchased and it stays with the seller. Consequences are the same – performance deteriorates of the members and of the chain could be realized, which causes the uncertainties of the supplies, demand, and is followed by the opposite strategies of the members, because they have conflicts of interest. Another issue is the companies' focus points – the primary goal is the maximization of their own profit and they do not want to balance the interests of their relationships. That is the reason why most of the companies have no willingness to share the information, to cooperate with each other within the chain. Though nowadays there is no real competition between the companies, rather the competition of supply chains is the typical trend. The name of this phenomenon is cooperation, when the companies have to cooperate under the competition (Bengtsson & Kock, 2014). The presented problems could be handled by the contracts.



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Contracts of the supply chain are not analyzed from the point of their legal nature, primarily. Contracts are rather frameworks of the partners' relationships. They can help to balance the different levels of members, make equity of their relationships, define rules to share benefits and costs (Sluis & Giovanni, 2008, Coltman et al., 2009). Therefore, contracts could be good tools to coordinate the chains and make the relationship of chain members better.

### 3.1. Introducing the typical supply chain contracts

Literature research could help to define the most interesting types of contracts of the researchers. I use a systematic review method, the PRISMA. PRISMA helps to filter the irrelevant issues from the point of supply chain coordination out.

In the first step, the keyword 'supply chain contracts' are searched. The next step is to search for the name of the contracts. To narrow the results, all articles that did not relate to supply chain management are excluded. Finally, with the help of abstracts, articles that show actual results on the topic of supply chain coordination remained on the list. Results of PRISMA are presented in Figure 2.

Figure 2: Results of literature research with the help of PRISMA

<u>STEPS</u>	<u>KEYWORDS</u>	<u>NUMBER OF HITS</u>
1	SUPPLY CHAIN CONTRACTS	67 599
2	- WHOLESALE PRICING - REVENUE-SHARING - QUANTITY DISCOUNT - QUANTITY FLEXIBLE - BUY-BACK	→ 6396 → 15028 → 5928 → 13178 → 11109
3	- WHOLESALE PRICING - REVENUE-SHARING - QUANTITY DISCOUNT - QUANTITY FLEXIBLE - BUY-BACK	→ 4521 → 9982 → 2056 → 13178 → 7123
4	- WHOLESALE PRICING - REVENUE-SHARING - QUANTITY DISCOUNT - QUANTITY FLEXIBLE - BUY-BACK	→ 122 → 341 → 98 → 302 → 565



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*Source: own construction (based on ScienceDirect database, 2021)*

The PRISMA helps to find the most frequently occurring contract types and helps to get information about the coordination characteristics of the different types, which predestines the goal of the next chapter that is focused on the paper's main issue. But first, the introduction of the frequent contract types is needed. In the following sections, the seller will be the wholesaler and the buyer will be the retailer.

### **3.1.1 Wholesale pricing contract**

This is a very traditional and simple type of supply chain contract. The wholesaler determines the wholesale prices, it has to be paid by the retailer for the products. The critical point is the determination of prices. If the members would like to maximize their profit at different prices the problem of double marginalization is realized. The focus of the maximization of individual profits impedes the existing of a satisfying level of cooperation. This can be prevented if there is a decision-maker, who organizes, coordinates the whole chain, and helps to determine the wholesale prices; it has to be equal with the cost of production. The term of this choice is the wholesaler has to be on break-even point; this is the only way to maximize the members' profits (Sluis & Giovanni, 2008).

### **3.1.2 Revenue-sharing contract**

A pre-determined ratio of the retailer's revenue will be divided between the supply chain members. Because of this ratio, wholesalers could determine lower prices, than for example in the wholesale pricing contract. The lower prices motivate the retailer to buy a higher quantity of the products (Rhee et al., 2014). It seems like this is a win-win situation for the chain members. The only problem could be the determination of the revenue-sharing ratio. If parties can agree on a fair ratio, which represents the position of the companies, the contract can be useful for the coordination issue (Molnár & Faludi, 2017).

### **3.1.3 Quantity discount contract**

Retailers are motivated to buy a higher quantity of products because the wholesalers offer better prices (discounts) for the orders with higher quantities. The advantages appear on both sides; retailers get better prices, wholesalers purchase higher quantities. Both parties can expect increasing profit (Choi et al., 2005). Problems can be the increasing quantities because parties can be overloaded, which can lead to increasing costs (Shin & Benton, 2007).

### **3.1.4 Quantity flexible contract**

It provides a certain degree of flexibility for both parties within an order period. Limits of lower and upper quantities of the order are set. The retailers can change their ordered quantity, but the original quantity will be delivered by the wholesalers. This type tries to balance the inequity, which caused by the dynamic changes of needs (Li et al., 2016).

### **3.1.5 Buy-back contract**

The buy-back contract protects the retailers against the surpluses of stock. The agreement of buy-back contract obliges the wholesalers to buy the retailers' unsold products back on the pre-determined buy-back price. The use of this type depends on the willingness to take risks.



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Because the buy-back prices result in less profit. On the side of wholesalers, the surplus of the stock is also a threatening issue (Sluis & Giovanni, 2016).

## 4. Determining the obstructive factors of supply chain coordination

With the help of the previous chapter, where the frequent types of contracts were introduced, we were able to get some insight into the problems inherent in coordination. But this is just one piece of a very big circle of problems.

Arshinder & Deshmukh (2008) used the Ishikawa-diagram to determine the various difficulties in the issue of supply chain coordination. The following list summarizes their major findings:

- organizational cultures of the supply chain members are different;
- production cycles of the members have a mismatch – including the production set up times;
- the optimal order quantities of members have a mismatch, which causes different and independent replenishment from each other, and delivery timing problems (especially in the frequency of delivery);
- incoherent conditions of cooperation, which causes the lack of information sharing;
- different level of members' dominance;
- different goals – no coherence between the individuals' goals
- obsolete or incompatible IT structure – from the sight of ensuring the information flow (Arshinder & Deshmukh, 2008).

Some of these factors need to be developed by the companies. In the era of industry 4.0, where every data is available on the internet-based platform, cloud-based systems are used, companies must have modern IT background.

Different organizational cultures are another basic problem. Some alliances, strategic alliances, fusions could help to solve this problem. But only just a little change of attitudes or some emphatical approach could improve to adapt to each other.

However, the other points of the list can be improved or eliminated by the use of contracts. The real question is which contract is suitable for the different problems? The next chapter introduces a decision-support model, which assigns different types of contracts to each problem.

## 5. How can the contracts help to eliminate the obstructive factors?

With the help of the PRISMA, the frequent supply chain contracts are defined, but the method has not only this result. Because of the final step of the PRISMA, the relevant results on the coordination characteristics of the contract have become known. With the help of Arshinder & Deshmukh's (2008) research, the basic problems of the supply chain coordination are also determined. From these two points of view, the problems and the characteristics of each contract could be compared and different contracts can be assigned to each problem.



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## 5.1.A decision-support model

To visualize the process, a decision table is used. This is the base of a decision-support model, which helps the companies to face the problems of their obstructive factors of coordination and choose from the contracts, as a potential solution for their problems (Table 1).

Table 1: Decision support model to assist in contract-choosing

<u>OBSTRUCTIVE FACTORS</u> \ <u>CONTRACTS</u>	WHOLESALE PRICE	REVENUE-SHARING	QUANTITY DISCOUNT	QUANTITY FLEXIBLE	BUY-BACK
<i>Different organizational culture</i>	*	*			
<i>Different organizational goals</i>	*	*			
<i>Different level of dominance</i>		*			
<i>Information-sharing problems</i>		*			*
<i>No cooperation</i>		*		*	
<i>No IT for information flow</i>		*		*	
<i>Mismatch: production cycles</i>				*	*
<i>Mismatch: ordered quantities</i>			*	*	*
<i>Mismatch: replenishment times</i>			*	*	
<i>Mismatch: delivery times</i>				*	

Source: own construction

The model could be the start of a complex decision situation. Because a contract-choosing mechanism always has more aspects. This model could handle the basic problems of relationships, which influences coordination. The literature review of contracts helps to get some good practice about the use of the different types. So the presented model is based on good practices and makes a connection to the determined obstructive factors of coordination.

The basis of the choices is an evaluation of the strength of obstructive factors. With the help of subjective points – which represent the strength of factors – given by the decision-makers, make an order. The next step is to check the decision table to find the strongest factor and the contract that could eliminate this factor. As a final step, the contract is chosen.

The wholesale pricing, the quantity discount, and the buy-back contracts can be used on a relatively small circle but in different types of problems. Thus, these types could be used in the case of companies, which operate in different spheres, industries. From the good practices, wholesale pricing contract's biggest problem is the decentralized setting, which means the members have no willingness to cooperate with each other. The only goal of the members is to maximize their own profit but in different ways, which causes the double marginalization. If the operation setting of the chain turns into centralization form, there is a leader, who supports the members to cooperate, and determines the prices, especially in the case of the wholesaler, the contract can be coordinate the chain. That means the different cultures and the goals derived from the different cultures could converge to each other. Quantity discount could handle the



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problems, which result from the mismatches of ordered quantities and replenishment times because it supports to be safety stocks. Buy-back contracts also solve the problem, which is derived from the mismatch of ordered quantities, but also give a solution for the different production cycles and the information-sharing problems. The disinformation of the demand changes could result in extra stock, but the retailer is protected from this surplus by the wholesaler.

The revenue-sharing contract and the quantity flexible contract are more widely applicable, they could eliminate more obstructive factors of the coordination. Revenue-sharing contracts decrease the differences of the partners, including the culture, the goals, increase the level of information-sharing, supports, and strengthens the cooperation. This contract pushes the members to make their chain centralized. The biggest motivation is the revenue-sharing rates, which encourage the members to determine lower prices, which helps to sell more products and realize higher profits. But the fluctuation, which is based on the quantities could be not handled by the revenue-sharing contract. For this problem, the quantity flexible contract is a good choice. The essence of this type is to give some freedom in the determination of the orders' quantities. With the help of this, quantity flexible contract could manage the mismatches due to quantity of the products – including the different production cycles, the different delivery- and replenishment times, or the different ordered quantities.

## 5.2 Limitations of the model

Contract-choosing situation is always a complex problem. The given model is able to help to define the basic problems of the members' relationship, that influence the efficiency of coordination. These problems are defined by the literature and some good practices. The model can be more relevant if it is supplemented by empirical research. The research should be focused on the determination of factors, which influence the relationships in practice. The research would also answer that the used contracts are consistent with the influencing factors. As a next step, some financial and legal aspects are also needed to be analyzed. Finally, the model has to be tested in the real corporate environment.

## 6 Summary

The coordination of supply chains is a very important problem of the 21<sup>st</sup> century. The paper recommends a potentially good solution for increasing the efficiency of supply chain coordination. A decision model is created, that is based on the most common problems, such as the mismatches of delivery times, replenishment times, the dynamically changing quantities of orders, or the different organizational cultures, goals, and the unsatisfying information flow, which is derived from the poor cooperation. To solve these different kinds of problems the contracts, one of the coordination tools is chosen.

Various contracts can offer many solutions for coordination problems. To choose the right one, it must know the attitudes of companies, the characteristics of their industries or sectors, and need to analyze the relationships of the partners. With the help of this research, information about the exact problem can be defined. This could be step zero of the problem-solving mechanism. The first step is the presented decision-support model. The advantages and



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disadvantages, the characteristics of the application of each contract are given; the decision-maker can evaluate its obstructive factors; the decision table helps to find the best contract, which fits its problem.

Further researches should be focused on the financial and legal natures of contracts, and the complex model should be tested in practice.

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