SUPPLY CHAIN STRATEGY ACCORDING TO THE INDUSTRY 4.0 CONCEPT

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Abstract

In recent years, the concept of Industry 4.0, called the fourth industrial revolution, has become increasingly popular. Application of automation, data exchange, cloud computing and the Internet of Things can transfer enterprises into a new reality and give an unprecedented greater opportunity to effectively compete with current market moguls and gain competitive advantage on the market. The following questions arise: How to successfully implement the concept of Industry 4.0? How to manage emerging, new supply chains to make their efficiency very high?

High volatility and unpredictability of the environment of modern enterprises causes the need for frequent changes of strategy in order to use the emerging market opportunities and avoid threats. As a result of the development and popularization of the Industry 4.0 concept, this trend is intensifying. For this reason, there is a need to create new solutions, methods and procedures to support the supply chain management in such a way that its efficiency is very high and dynamic, continuously growing.

The article proposes a new approach to supply chain management, the main objective of which is to support the process of implementing the Industry 4.0 concept. The application of the Balanced Scorecard method to the management and control of modern supply chains has been proposed. Thanks to the introduction of significant areas to the strategy map the proposed approach effectively supports the Industry 4.0 implementation eliminating some threats and allows to effectively manage the emerging modern supply chains based on building and control the implementation of a frequently updated strategy.

Keywords: Management of supply chain, Industry 4.0, Strategy of supply chain, Balanced Scorecard

1. INTRODUCTION

In recent years, the concept of Industry 4.0 has become increasingly popular. It introduces technical innovations and a new organization of the value chain, which changes the previous production in a revolutionary way. For this reason, it is called the fourth industrial revolution. Such solutions as: automation, data exchange, cloud computing, Internet of Things, etc. lead to create innovative production management systems based on on-line communication between elements of the production process and advanced analysis of large amounts of data, which results in much greater flexibility of production processes with low operating costs. They can transfer enterprises into a new reality and give unusually greater opportunity to effectively compete with current market leaders and gain a competitive advantage on the market. As a result of the implementation of the Industry 4.0 concept, supply chains are created with incomparably greater possibilities of quickly adapting to market needs. The implementation of the Industry 4.0 concept seems to be necessary as the new technologies, solutions and methods introduced transfer companies and supply chains to a different dimension of efficiency and flexibility while maintaining low costs. This results in a huge competitive advantage. The following questions arise: How to successfully implement the concept of the Industry 4.0? How to manage emerging, new supply chains to make their high efficiency and profitability?

High volatility and unpredictability of the environment of modern enterprises cause the need for frequent changes of strategy in order to use the emerging market opportunities and avoid threats. This trend is intensifying as a result of the development and popularization of the Industry 4.0 concept. For this reason, there is a need to create new solutions, methods and procedures to support the supply chain management in such a way that its efficiency is very high and dynamic, continuously growing.

The article proposes a new approach to supply chain management, the main objective of which is to support the process of implementing the Industry 4.0 concept. The application of the Balanced Scorecard method to the management and control of modern supply chains has been proposed. The presented approach effectively supports the Industry 4.0 implementation eliminating some threats and allows to effectively manage the emerging modern supply chains based on building and controlling the implementation of a frequently updated strategy. It is possible to introduce of significant areas to the strategy map.

2. SUPPLY CHAIN STRATEGIES

Customer needs cause strong pressure on wide range of high quality products, low prices, short delivery times, quick and high level of customer service, etc. For these reasons nowadays supply chains should be sustainable, long-term and customer-focused, in which a well-design and properly implemented strategy plays a significant role. This strategy should gain a competitive advantage [1].

According to the Porter's opinion the company can realize two main types of competitive advantage: low cost or differentiation. Additionally, there are three generic strategies for achieving excellence and market success: cost leadership, differentiation and focus. Enterprises that use cost leadership strategy strive to maintain the position of the lowest cost producer. They use economies of scale, proprietary technology or preferential access to raw material. In differentiation strategy products and services should be unique in its industry [2]. Differentiations means number of logistics constraints, several operational practices and also difference in technical capabilities.

One of the significant goals of a typical supply chain strategy is to ensure smooth flow at minimum cost [3], [4], [5]. Another sources underline that supply chain strategies determine material procurement, transportation of material, manufacture of product and distribution of product [6]. Generally, supply chain strategies can be divided on strategies based on material flow and strategies based on relationships between supplier and manufacturer. A material flow in a supply chain can depend on demand (product nature) or on supply (process). Material flow strategies are presented in **Table 1**, and relationship strategies are included in **Table 2**.

Table 1 Material flow strategies [3]

Strategies	**Applicability**
Agile	Highly innovative product with more uncertain demand and supply
Lean	Stable demand and functional products
Leagile	Products wih unpredictable demand and long lead times
Risk-hedging	Functional products and evolving processs

Table 2 Relationship strategies [3]

Type of relationship	**Applicability**
Partnership type supplier relationship	The product uncertainty is high and for lower volumes
Strategic alliances (complex innovations networks)	Complex technologies
Cooperation	Global reach achieving and time reducing to innovate complex technologies
Positive relationship	Technological uncertainty

Agility means the ability to match supply and demand in turbulent and unpredictable markets. It is strategy which is used for highly innovative products. The lean strategy is about an elimination of waste. This concept works well in conditions of relatively stable, predictable demand when variety is very low. Leagile strategy contains assumption of lean and agile strategy. It is used for unpredictable demand and long lead times. Risk

hedging strategy is applied for uncertain product when demand is less and uncertain supply process is high [3].

Summarizing, it should be noted that the strategy of supply chains has a significant role. Its strategic goals should be transferred to the strategy of individual elements of the supply chain, that is enterprises, setting mandatory directions for enterprises forming the supply chain and constituting superior priorities. In conclusion, there is a need to use methods that help quickly realize the often changing strategies in the supply chains. Therefore, the following questions arise: What changes do the enterprises which implement the Industry 4.0 concept require? Can the control of the introduction of this concept in the supply chains be controlled by strategy? What threats appear? How to avoid threats related to the implementation of the Industry 4.0 concept?

3. EFFICIENT BUILDING AND IMPLEMENTATION OF A COMPANY STRATEGY RELATED TO THE SUPPLY CHAIN STRATEGY USED THE BALANCED SCORECARD METHOD

Implementation of the Industry 4.0 concept is a huge challenge for companies which build supply chain and requires many different changes in the area of used technology, software and business management. It is necessary to prepare a well-design plan of implementation, which minimizes the risk of significant threats and weaknesses.

The preliminary research which was conducted on the basis of numerous observations in manufacturing enterprises of western Poland and the interview technique of industry experts carried out in years 2016-2017 showed four fundamental areas of changes [7]:

- technical infrastructure (demand for machinery and equipment);
- automation of device operation and communication between them;
- employee competences (the skills of employees needed to control an automated manufacturing system);
- collaboration with other companies which means building relationships and competencies together (in different way: collaboration networks, supply chains, etc).

Introducing such changes in the companies causes the risk of some main threats which are presented in **Table 3**, what underlined the aforementioned research. The significant strategic goals should be: maintaining liquidity, return on capital improvement, improvement of cost method and improvement in budgeting method.

Table 3 Main threats related to the implementation of the Industry 4.0 concept - area of management and finance (own study)

No	Reason	Main threat	Strategic goal area minimizing threat
1	High expenditures for machines, devices, technologies, software, communicators, sensors, etc.	The risk of losing liquidity	**Maintaining liquidity**
2	Fast technological progress	Fast economic consumption of fixed assets	**Quick return on capital**
3	High increase in indirect costs	The devaluation of traditional methods of accounting for costs that are too inaccurate and averaging many values without showing the real cost	**Improvement of costing method**
4	Frequent changed strategies	Budgeting is too static, too time-consuming to make changes	**Introduction planning cost methods including possibility of frequent changes in strategy**

For these reasons, it should be noted that there is a need to use methods that will help quickly relate the often changing strategies in the supply chains that implement the Industry 4.0 concept. The main goal of the research described in the article is to develop a solution that will also allow for the rapid introduction of the Industry 4.0 concept and will allow to control and reduce the risk of threats arising in connection with this implementation.

Therefore, in the article a new approach to supply chain management is proposed. Its main objective is to support the process of implementing the Industry 4.0 concept. The application of the Balanced Scorecard method (BSC) to the management and control of supply chain strategy is suggested. It is possible to introduce of significant areas of changes to the strategy map.

According to the BSC approach the strategy map consists of four basic perspectives: financial, customer, internal process and learning and growth. It allows a strategy realization to be monitored and controlled used a system of Key Performance Indicators (widely [8], [9]). The proposed approach consists in introducing certain permanent areas within which strategic goals are planned. This solution means that the strategy is guaranteed to include the objectives that reduce the risks that the implementation of the Industry 4.0 assumptions implies. Such an introducing of certain permanent strategic goals to the strategy map which helps to control implementation of the Industry 4.0 concept according management and finance area and avoids threats is presented in the **Figure 1**.

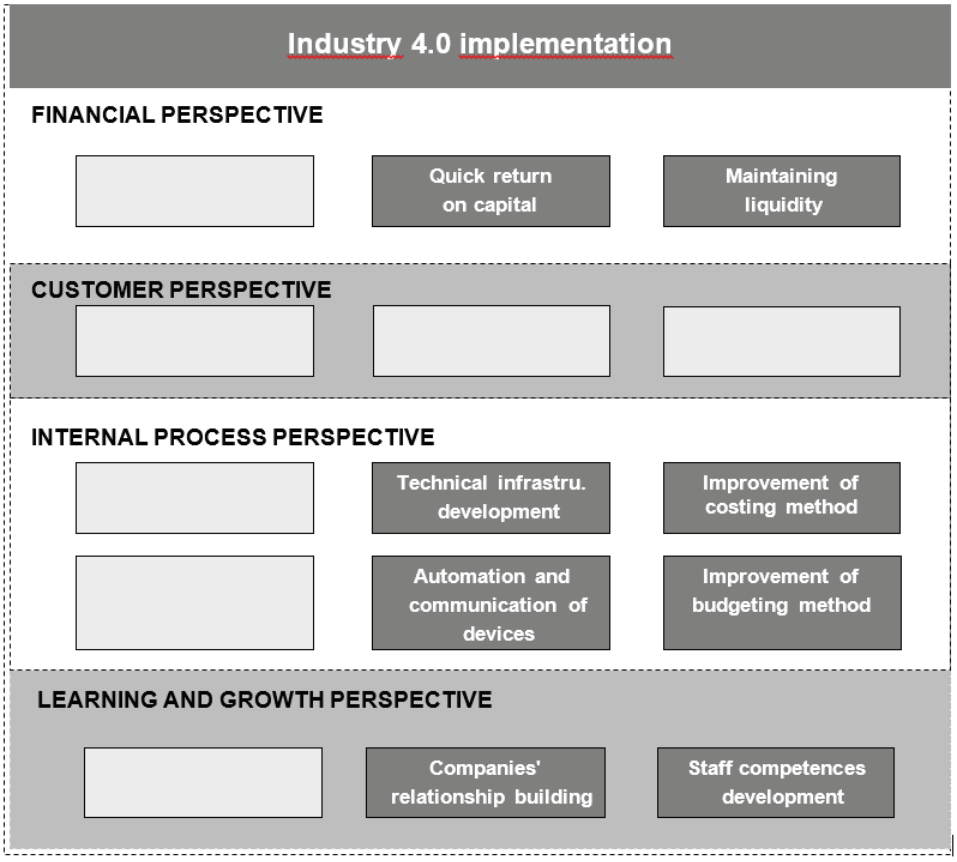

Figure 1 The strategy map - main goals according to the Industry 4.0 implementation (own study)

4. CONCLUSION

Implementation of the Industry 4.0 concept requires significant changes in the company. As the research has shown, these changes mainly concern the following areas: technical infrastructure, automation of device operation and communication between them, employee competences, and also collaboration with other

companies, especially in the group of small and medium. Introduction of such changes is connected with threats which according to the conducted research mainly include: a risk of losing liquidity, fast economic consumption of fixed assets, devaluation of traditional methods of accounting for costing that are too inaccurate and averaging many values without showing the real cost and budgeting is too static, too time-consuming to make quickly changes in strategy.

The method of building a strategy map for enterprises from the supply chain proposed in the paper, which implements the Industry 4.0 concept, is to primarily support the company in the quick and effective implementation of this concept, but also to help avoid the most important threats associated with such implementation. It is based on the Balanced Scorecard method and through the introduction of specified goals defined on the basis of research into the strategy map enables continuous monitoring and control of the implementation of these goals, and thus also the avoidance of the most important threats.

The presented approach effectively supports the Industry 4.0 implementation eliminating some threats and allows to effectively manage the emerging modern supply chains based on building and controlling the implementation of a frequently updated strategy.

In future research it is planned to extend the strategy map to the most frequently used tools such as RFID technology and many new innovative solutions [10], [11], [12].

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