

LOGISTICS PROCESS OPTIMIZATION THROUGH DIGITALIZATION USING PROCESS APPROACH

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Abstract: Companies must invest in quality - whether in the quality of services, products, processes, or the way of doing business. Hence the goal that all companies should strive for: to produce quality products or services, which enable the maximum fulfillment of customers' needs and requirements. The ability to achieve this, however, lies in the company's processes optimization. With process approach, control over processes is enabled and it can be used for their optimization. A case study of a selected boutique production company's processes was perpetrated. Based on existing process approach snapshot and review of current state of operations digitalization in the company, critical analysis was carried out. For the intention of improving business and competitiveness, we introduced an improved process approach based on ISO 9001:2015 standard. For the purposes of this paper, we will present the current state of one process and its proposed optimization through digitalization.

Keywords: logistics processes, process approach, operations planning, business optimization.

1. INTRODUCTION

Optimized supply chain is very important for smooth business operations, for meeting the requirements and exceeding expectations of the company's customers. If the company's supply chain is managed properly, it can lower costs and accelerate production cycle. However, in the event of inefficient supply chain management, the company may risk losing customers or customers number reduction and consequently losing its competitive advantage within the industry (Grimshaw, 2020).

The supply chain includes: "life cycle processes that include physical, informational, financial and knowledge flows designed to meet the end users' needs with the products and services of several related suppliers" (Ayers, 2001). According to this definition, the supply chain includes those processes that cover a wide range of activities, including the supply, production, transport and sale of physical products and services, whereas life cycle refers to both the market life cycle and the life cycle of use (Ayers, 2001).

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In connection with the supply chain, we must also mention logistics. There are many ways to define logistics, as Christopher (2005) provides a definition of the logistics basic concept: "Logistics is the process of strategically managing the procurement, movement and storage of materials, parts, and final inventory (and related information flows) through a company and its marketing channels in such a way that current and future profitability is maximized through efficient order fulfillment." Logistics is a planning orientation and framework that seeks to create a unified plan for the flow of products and information through business. Supply chain management is based on this framework and seeks to link and coordinate the other stakeholders' processes in the channel - customer suppliers and the company itself. Thus, for example, one of the supply chain management objectives could be to reduce or eliminate the buffer stocks that exist between companies in the chain by exchanging information on demand and current stock levels. (Christopher, 2005)

Due to the volume of work in companies, it is very important that we try to optimize internal processes as much as possible. Such optimization enables the company to produce products more efficiently, which will reach customers in a timely manner at lower costs. However, since logistics takes place everywhere, it is correct to present a few types of logistics, that are divided into five types by field (Logistics Glossary, b. d.):

- Procurement logistics, which manages raw materials and parts flow.
- Production logistics, which manages material flow within the company.
- Sales logistics, which manages products flow from manufacturer to customer.
- Recovery logistics, which manages customers return flow and waste returns.
- Recycling logistics, which manages recyclable materials flow.

Procurement logistics refers to the movement of goods when the raw materials and parts needed for production are supplied by suppliers. Many companies are actively involved in production, so that in appropriate times they procure the necessary materials in only the necessary quantities, because it is directly related to reducing the inventory costs. (Logistics Glossary, b. d.) As seen, the procurement function is a logistic function, which is immediately associated with supplies. In-depth studies reveal that its consequences are well beyond just supplies, and that the procurement logistics influences the whole logistic and supply chain. The procurement function can be defined "as the logistic function that handles the management of materials, equipment, spares, and services which must be received by the company, in the demanded conditions for the latter to perform its operations in an adequate manner, with the final objective of delivering the services required by its customers". (Hernández & García, 2006) Successful supply chain management and quality operations are thus essential for the competitiveness of any company, and the first step to achieve this is the effective management of the company's internal processes, especially procurement process.

A process can be defined as "a set of interconnected or interacting activities that convert inputs into outputs", with activities requiring the necessary resources allocation (ISO 9000:2008). The generic process consists of defined input requirements that amongst other include resources and raw materials. These are interconnected through various activities and control methods, which then provide the met output requirements or the process result (ISO 9000:2008). The outputs of one process are often the inputs of other processes and are interconnected throughout the system (ISO 9001:2015). Inputs and

intended outputs can be tangible (for example: materials or components) or intangible (for example: energy or information). As a result of the procedure, in addition to the intentional product, unintended consequences may occur (for example: waste or pollution). Each process has customers and other stakeholders (which can be internal or external to the company), with needs and expectations that, based on the latter, define the required process results. (ISO 9000:2008). Each process also has specific control and measurement control points (CP) that are necessary for management and vary according to the risks associated with the process (ISO 9001:2015).

The ISO 9001:2015 standard is based on seven quality management principles: customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making and relationship management. Based on the standard, a process approach can be defined as “the use of the system of processes in the company, together with the identification and interaction of these processes and their management to achieve the desired result” (ISO 9001:2015). The process approach helps the company plan its processes and their interaction. The ISO 9001:2015 standard encourages the adoption of process approach in developing, implementing, and improving the performance of the quality management system to increase customer satisfaction by meeting customer requirements. Understanding and managing interrelated and interconnected processes as a system contributes to the company’s success and efficiency in achieving the intended results. The approach helps with management of the processes’ interconnections and interdependencies in the system so that the overall effects of the company's operations can be improved.

The process approach includes systematic identification and management of processes and their interactions, which is why one of the process approach objectives is to help plan processes to achieve the intended results in accordance with the company’s quality policy and strategic direction. (ISO 9001:2015) The use of process approach in a quality management system thus allows: understanding of requirements and their consistent fulfillment, addressing processes in terms of added value, achieving successful process implementation, and improving processes based on data and information evaluation. Therefore, the company must establish, document, implement and maintain a quality management system and continuously improve its efficiency in accordance with the requirements of ISO 9001:2015. Thus, the company must (ISO 9000:2008):

- Identify the necessary processes and their use for quality management system.
- Determine the sequence and interaction of the processes.
- Determine the necessary criteria and methods to ensure the effectiveness of operation and control of the processes.
- Ensure resources and information availability to support process management.
- Monitor, measure (where appropriate) and analyze the processes.
- Implement the necessary measures to achieve results and improve the processes.

Based on the above, each company must determine the number and type of processes required to meet its business objectives. The number and type of processes vary from company to company, but typical processes can still be identified as: business management processes; resource management processes; realization processes; and measurement, analysis, and improvement processes (ISO 9000:2008). The procurement can be found in two of the typical division processes: resource management processes

and measurement, analysis, and improvement processes. The first include all the processes necessary to provide the resources needed to achieve the company's quality objectives and set results. And the latter include measurement, monitoring, auditing, performance analysis and improvement processes. Measurement processes are often documented as an integral part of process, resource, and implementation management.

Within the production company, as part of the types of logistics by fields, we know various business processes that may differ from company to company, but the basic business processes are in principle: procurement process, stock or inventory process, production process, sales and marketing process, the administration process and in general, and accounting and finance process. The procurement process is a business process related to the procurement of materials, raw materials, spare parts, goods, components, and other needs that are the foundation of the company's business. This process requires perfection, efficiency, and effectiveness in selecting all the listed elements. (KNIC, 2019) The process of stock or inventory control is a business process that regulates the entry and exit of elements such as materials, raw materials, semi-finished products, and the key is to control the flow of these elements (KNIC, 2019). Inventories are extremely important for enabling the continuous operation of all manufacturing companies. All companies operating through inventories have a large financial investment in the latter (Rusjan, 1999), as material costs can represent about from 20% to 60% of total production costs (Wilting & Hanemaaijer, 2014), thus each head of company or operations must devote a lot of time and attention to the procurement process. The good side of inventories is that they enable shortened products delivery times, reduction of congestion in the production process and risks reduction related to delays in delivery and incorrect forecast of demand. (Rusjan, 1999).

Procurement appears in various literature: as types of logistics by fields (procurement logistics), as typical processes (resource management processes) or as business processes within the production company (procurement process and stock or inventory process), which only confirms the importance of procurement. In each case, the interpretation of procurement is various and differ, but the essential components are the same everywhere, whether it is part of a process or a type.

2. METHODOLOGY

The research began with the current state of the studied boutique manufacturing company of plexiglass products. We divided the current state into a snapshot, which covers all company's fundamental processes; a critical analysis, which we performed based on the snapshot and an interview with an employee. The snapshot of the current state primarily enables obtaining an objective picture of company's operations, based on which we get to know the actual business situation, which enables the creation of optimal plan and structure and operations organization of the company. The snapshot thus includes:

- Identification of critical points, their causes, and consequences.
- Obtaining basic decision-making information.
- A quick search for potential solutions that can be implemented immediately.
- Elimination of redundant or unnecessary activities.

This paper studies only company's fundamental processes, thus it was limited to the internal company's processes. Researching external company's processes would require the cooperation of business partners, stakeholders, and customers, which represents a more complex acquisition and processing of data.

The snapshot is presented as flowchart, that shows the selected process execution using the flowchart widgets, which are graphic symbols. The latter are describing: the beginning or end; an activity, process, or sequence of activities; decision or CP; and direction of activities or processes implementation order. With the selected charting software, a custom legend was created to facilitate the flowcharts understanding, showing the used symbols and their meanings. The following symbols were used:

- An ellipse, indicating the process beginning and end.
- An arrow, indicating the entry or exit into or out of the activity or process.
- A rectangle, indicating the activity or process taking place.
- A rhombus, indicating the CP where decisions are made.

The existing procurement process flowchart is well understood and fairly simple – it covers all important activities and clearly indicates the interaction between them, which makes it well-designed. Critical analysis of the procurement process is presented on an overview basis of individual activities, employee's interviews, and cooperation with the CEO, which has been obtained during the snapshot performance. Critical analysis provides insight into individual internal procurement activities and reveals potential problems and obstacles within the process. The primary purpose of critical analysis is to determine how the procurement process can be optimized through digitalization.

An integral part of the company's existing process approach is the large number of simple as well as complex processes within which various activities take place. Thus, the current process approach has been divided into five fundamental processes. The first fundamental process of studied company, that crucially underpin the company's business, is procurement. The latter is a basic condition for starting a manufacturing company, as it includes activities such as inspection and inventory review, review of suppliers and selection of suitable partners, ordering new and necessary materials, checking the quantity and quality of supplied materials, and much more. Due to the importance of procurement, we decided to analyze the selected company's procurement process, which is the foundation of any production company. The remaining fundamental processes were demand and supply; custom product production; retail product production; product handover and sale. In the following chapter, an overview and a diagram of current procurement process will be presented with all its activities.

3. RESULTS AND ANALYSIS

As already mentioned, procurement is of key importance for manufacturing company's operation and is also the first process that begins to take place in this studied process approach. The following sub-chapter describes the current procurement process and its critical analysis. A renewed, improved procurement process is then presented as proposed solution of optimized process through digitalization.

3.1 Current procurement process and critical analysis

Figure 1 shows procurement process, which begins with an inspection of warehouse stock of materials, which requires a blank document with a table for the materials inventory, which was created by the CEO. An employee reviews and counts the material in stock and writes it in the table. The completed table represents the starting point for the necessary material orders, as it shows material shortage. The employee then hands over the completed table to the CEO, who reviews the suppliers' offers for the necessary materials, based on the table, and selects the appropriate one. The latter is sent the necessary material order, for which the order confirmation by supplier is needed. The waiting period for the ordered material delivery begins. When the supplier delivers the ordered material, an employee must first check the purchase order issued by the CEO. It states the material type, its quantity and price. This is followed by checking the material – whether the material type, quantity, quality, and price are correct. It has already happened that the supplier delivered the wrong material or that one ordered material type was not delivered. In this case, the reviewing employee must immediately notify the CEO and report the defect to the supplier. The material ordering activities are then repeated – if all the material has arrived and met the criteria (material type, quantity, quality, and price), the reviewing employee must sign the delivery note and accept the invoice from the supplier. The invoice is then submitted to the CEO, who forwards it to the accounting department for payment transfer. The material is then transferred to warehouse room, where it awaits production.

From the sole beginning, it was possible to observe the long-term and redundant activity, where employees inspect material warehouse stocks on hand. The employee needs a warehouse inventory table, which must be completed whilst inspecting the material stocks and upon completion delivered to the CEO. This activity is ineffective since a lot of valuable time could be used more optimally. Overall, the company takes the procurement process very seriously. They are aware that without good procurement they cannot maintain a competitive position in the market, so they spend a lot of time reviewing the supply market for plexiglass material. Although the company does business with a few regular suppliers, they are constantly reviewing other suppliers offers. In the past, one of the regular suppliers had higher prices of plexiglass material than the others – one might think it was because of better material quality. After the comparison, a conclusion was made that both suppliers have the same quality material, except that the permanent supplier raised prices due to the higher demand caused by the COVID-19 pandemic. Thus, the company changed one of its permanent suppliers, by which they reduced purchasing costs and maintained the same quality.

Delivered material on request is inspected every time it is received. If damaged panels of plexiglass material arrive, they will be rejected, and new ones are ordered immediately. In this case, the cost of damaged material is paid by the supplier, and the delivery time of new material is shorter since the error was made on the supplier's side. The same procedure occurs in the case of wrong material delivery or forgotten delivery of a specific material type. As described, an employee must sign the delivery note upon material receipt – if the material was not suitable, the delivery note is not signed. After material receipt, the latter is transported to the warehouse room of the company's premises, where the material stand is installed. The stand has sorted drawers for different plexiglass material types, which differ in thickness and color. The company does not own a large storage facility, which could be a big advantage.

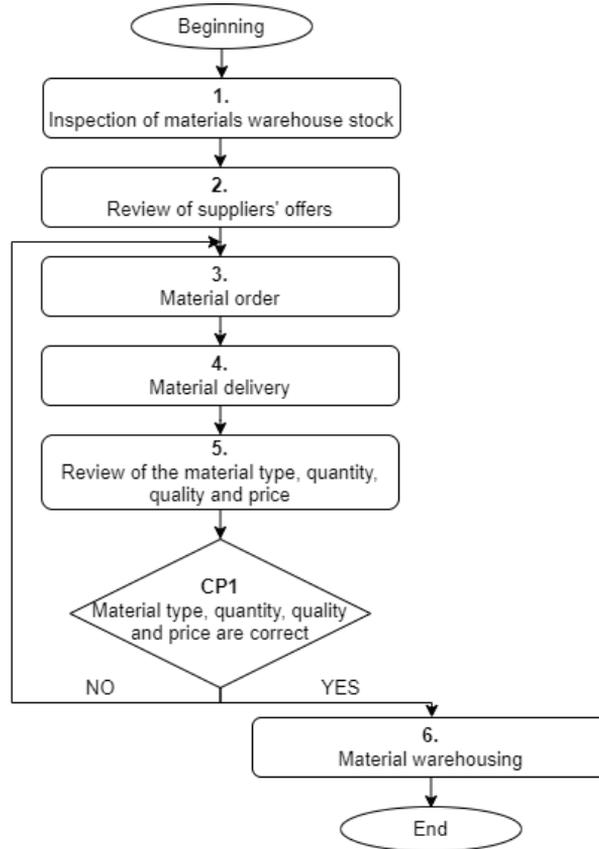


Figure 1. Current procurement process flowchart

3.2 Proposed solution of optimized procurement process through digitalization

An improved and optimized procurement process flowchart eliminates ineffective and redundant activities whilst including optimized activities, which would help whit efficiency of company's business. The procurement process may seem more complex and extensive, but it includes basic procedures to improve the process.

Proposed optimized procurement process is shown in Figure 2 and begins in the same way as the current process – with an overview of material stocks. For the first activity (inspection of materials warehouse stock), employees no longer need a document with inventory table, as the first improvement would be the implementation of material recording by a computer system. The procedure would take place when the material is taken directly from the warehouse and / or by issuing an invoice to the customer. As part of this improvement, the implementation of a computerized invoicing system is suggested, which would record the amount of plexiglass material used for a product. The amount of produced waste material would also be recorded in the program – this would not be visible on the customer's invoice. Currently, the company is issuing delivers notes upon products receipt by customers. Such recording would update the material stocks quantity on an ongoing basis, which eliminates the need to manually review materials stock, enables real-time data and employees time optimization.

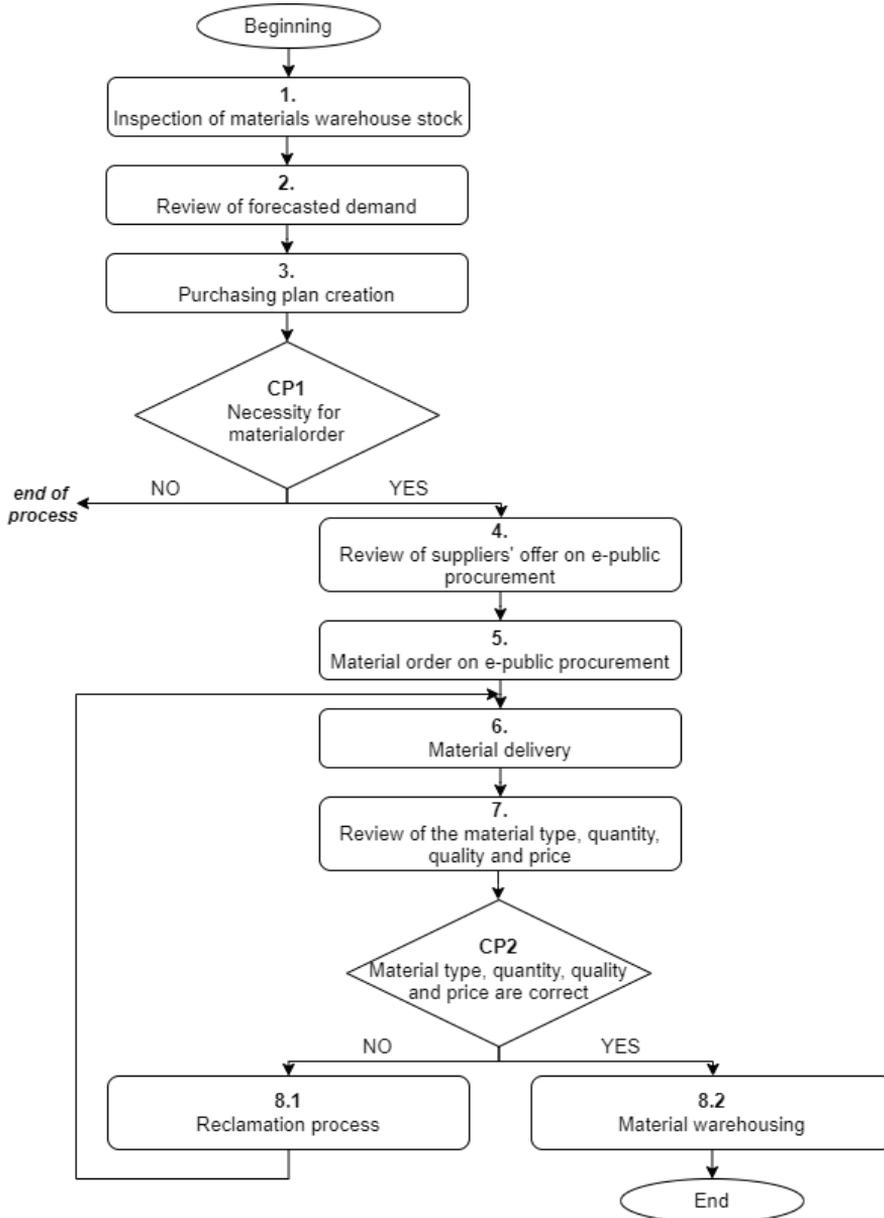


Figure 2. Proposed procurement process flowchart

Computerized invoicing system implementation would save space used to store delivery notes, annihilate search time for old invoices and stock inspection (since it would already be in the system). The system would also increase company's transparency and reduce environmental impact of paper consumption. For system's optimized use, it is recommended to purchase at least one tablet which would prevent running around the company's premises, as employees cannot carry around stationary computers. Thus, all

the necessary data would be at the grasp of hand and entered directly into the system through the tablet, which should support such a system.

Next proposed solution would be the implementation of the Kanban system, which manages lean Just-in-Time production. It was developed to improve production efficiency through the main advantage of the system – setting a permissible stock limit to avoid low or high stock levels (Wallace & Spearman, 2004). The CEO would specify and determine the allowed minimum and maximum materials stock limit as, for example, for transparent plexiglass material at 40% (this material type is used on daily basis), and for non-regular plexiglass material at 10%. When the stock of transparent plexiglass material would reach 40% or less, the system itself would report a shortage through the computer system. An upgrade would be for the system to communicate the material shortage directly to the supplier, which saves time in placing the order.

As third proposed improvement, but primarily necessary, demand forecasting was suggested. The demand forecast can be calculated based on past sales data. An example of such calculations model is ARIMA, which allows various settings based on the company's needs. The most up-to-date information for future demand can be obtained from large amounts of data. The more values entered, the more accurate the calculation will be – data for consecutive years, where monthly, weekly, or daily data are entered. Thus, the company would avoid in-bulk purchases and the material shortage challenges.

In case of non-implementation of material recording computer system, the materials stock reviewing and demand forecasting would be assigned to the CEO, who regulates the necessary materials purchase. Despite the non-implementation of the computer system, implementation of demand forecasting is strongly recommended. Obtained past sales data represent the foundation to prepare and create a purchasing plan, which is one of the most important parts of the company's business plan. The latter specifies the exact material requirement quantities, the calculation of orders number and their cost. At this point, the CEO decides whether a material order is necessary. If not, the procurement process ends here. In the case of an affirmative answer, a review of suppliers' offer on e-public procurement website follows. This activity is not imperative with every order, but it is recommended to execute it every few months, since it checks various suppliers offers, which change with time. The use of e-public procurement or e-purchasing is similar process to using consumer goods (Collins, 2012). It starts with browsing the suppliers' websites of the selected material. The comparison and purchase website can be visited to compare prices. The company's material requirements are specified to suppliers on the website, and the process ends with a transaction via electronic payment. This option provides the benefits for managers by helping them communicate with suppliers and potential suppliers, reducing the time of e-mails, costs of purchased goods, and the administrative costs associated with transactions. The process is faster and at the same time encourages better communication.

After the order is placed, the delivery waiting period begins. Upon delivery, the material is inspected as before (or with the help of material recording computer system). If the wrong materials have been delivered, the activity continues in the reclamation process – the CEO and the supplier are informed of the error and re-delivery is needed. If all the material is suitable, the delivery note is signed, the invoice is accepted, and the material is warehoused until use.

4. CONCLUSION

Up-to-date and detailed procurement planning enables inventory and procurement costs reduction with efficient production process. Thus, through optimized procurement planning, it is possible to coordinate purchasing activities with production. The main advantage of process approach, compared to others, is in the processes and activities' management and interactions control. For the most possible business optimization, it is necessary to harmonize all processes with the company's objectives, scope, complexity, and design them to add value. Using a process approach can improve a company's performance. Processes are managed as a system defined by a network of processes and their interactions, which creates a better understanding and transparency of the entire system, which allows its optimization and consequent increase in added value.

Every company has the need to be competitive in the business market, especially today, when facing the consequences of the COVID-19 pandemic. For this purpose, the current procurement process of the selected company was reviewed. Based on the latter, a proposed solution of optimized procurement process was made through digitalization. Despite the increased workload, the company has implemented demand forecasting this year, which allows yearly finance planning, that has been divided into materials, equipment, machinery, employees and other. Although the optimized procurement process has not been fully implemented, the partial implementation has made it possible to plan financial investments into new employment, purchase of a tablet and machinery.

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LOGISTICS 4.0 IN THE FUNCTION OF CIRCULAR ECONOMY IN THE AGRI-FOOD SECTOR

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Abstract: *By applying the solutions and technologies of Industry 4.0 in the field of logistics, the concept of Logistics 4.0 was developed. On the other hand Circular Economy (CE) is a model of production and consumption that ensures sustainable growth over time. The subject of this paper is to rank the main Logistics 4.0 based CE interest areas within the agri-food sector. The aim is to determine the areas which has the greatest potential for further development and should thus be in focus of the future planning. This is a multi-criteria decision making (MCDM) problem. For solving it a hybrid MCDM model combining the Analytical Hierarchy Proces (AHP) method for establishing the criteria weights, and the Comprehensive distance-Based RAnking (COBRA) method for the final ranking of the alternatives, is proposed. The results indicate that the most important CE interest areas are Reuse/Remanufacturing/Recycle, Supply Chain Management and Product Lifecycle Management.*

Keywords: *logistics, Industry 4.0, circular economy, agri-food, MCDM, AHP, COBRA.*

1. INTRODUCTION

In the broadest sense, logistics encompasses all systems and processes that enable the movement of material and non-material flows (Zečević, 2006). Processes that include the movement of these flows can be grouped from the aspect of direction and identified with the terms of forward logistics (flows from the place of origin to the place of consumption) and reverse logistics (flows from the place of consumption to the place of disposal, destruction, reuse, remanufacturing, recycling, etc.). However, both are covered by the term closed loop supply chain (CLSP) (Kumar & Kumar, 2013), which is often identified with the circular economy (CE) concept (Farooque et al., 2019).

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