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SUPPLY CHAIN PROJECT MANAGEMENT

VOLUME 1 SUPPLY CHAIN PROJECT MANAGEMENT CORE AND ENVIRONMENT



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INTRODUCTION

Nowadays the scope of supply chain activities is changing very dynamically. New challenges appear in companies during everyday business execution. In order to meet the goal of competitiveness, companies need to apply new tools and methods to improve their logistics processes. The implementation of effective supply chain management solutions requires not only strictly logistics-related competences, but also project management competences. The combination of the two types of competences mentioned above is required for supply chain project managers. People working in this position should not only be fluent in the world of logistics, but they should also know perfectly well and be able to apply the tools used in project management. The purpose of this book is to provide an overview of selected issues that a supply chain project manager may encounter in the course of their daily work.

The material prepared by the authors was collected and presented as a two-volume monograph entitled SUPPLY CHAIN PROJECT MANAGEMENT. Volume I, which, Dear Reader, you are currently holding in your hand, contains a total of six chapters referring to the following scope:

- Supply Chain Management,
- Strategic Management,
- Project Management,
- Logistics Management,
- Process Management,
- Human Resource Management.

The first chapter focuses on the basic issues of Supply Chain Management, including Sourcing and production planning, Inventory Management, Distribution and transportation management, Distribution Network Design, Supply Chain Integration and Global Supply Chain Standards. This last point is particularly relevant in the context of the flow of information in international supply chains. GS1 standards are in the world of logistics the same as the staff and notes in the world of music. Regardless of where the product is made, the use of identifying standards, e. g., barcodes, allows users to be fully informed about the product. It does not matter

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if the identifier is read in Poland, Spain or the United States. Standardization in this area serves as a universal language of logistics.

The second chapter discusses issues related to Strategic Management, with a special role of methods and tools of strategic analysis. Knowledge of issues in this area can be useful for the management of global projects.

The third chapter contains key issues related to project management. The reader will find here different approaches to the definition of the project, its stages and management methods used in this area. The authors' aim was not to provide ready-made recipes for the choice of one project management methodology, but to present equal approaches known from the subject literature. This chapter contains short characteristics of PRINCE2, PMBOK, SCRUM or Agile PM methods. An interesting issue discussed in this chapter is also the role of the project manager in supply chain management.

In chapter four, a brief description of the essence of logistics management was made by discussing the basic logistics processes. Nowadays, it is difficult to imagine an efficient company without the support of IT systems. And it is this aspect that one of the subsections is devoted to.

The essence of chapter five and six is to familiarize the reader with the logic and application of Business Process Management (chapter five), as well as with Human Resource Management (chapter six). These chapters present the methods of process management and the origin and key assumptions of the HRM term and contemporary trends in the area of Human Resource Management. Attention was also drawn to outsourcing of recruitment and training processes, as well as benefits obtainable thanks to efficient human resource management. Each supply project manager should be equipped with competences related to managing a team of people, because building an effective team of associates, as a project task, often determines the success of the project.

The authors would like to especially thank the reviewer prof. Marek Fertsch who provided his specialist experience and knowledge, as well as valuable comments, which helped create the final version of the present work.

We hope that this book will be a useful reference material to students and practitioners who are interested in the area of effective supply chain project management.

The Authors

1. SUPPLY CHAIN MANAGEMENT

1.1. Introduction to Supply Chain Management

Ever since companies started to see the benefits of working with commercial partners, the interest in the concept of supply chain management has been growing steadily. This is partly due to the desire to optimize supply chain performance in general. Other reasons include the technicization and technologization of life, along with globalization and glocalization of the economy, as well as the pursuit of maximum availability of products adapted to the rapidly changing requirements of receivers (customers / consumers)¹. Most of these factors are market-based and have a similar effect on the majority of supply chains, except at a different pace and scope. Therefore, maintaining the unambiguity of considerations, it is necessary to briefly clarify the concepts underlying the notion of supply chain management, i.e. management and supply chain, because both of these concepts in the area under consideration are complementary.

The term management has more than one meaning. Colloquially, management is most often interpreted as: exercising power and making decisions, managing people, allocating organizational resources or organizing the system². The definition provided by Amy Hissom well reflects the term of management. According to her, “management is the organizational process that includes strategic planning, setting objectives, managing resources, deploying the human and financial assets needed to achieve objectives, and measuring results. Management also includes recording and storing facts and information for later use or for others within the organization”³.

The term "supply chain" also attracts similar discussions related to the terminology. For example, in the literature on the subject, the supply chain is described in terms of: process, structure, network, concept and even philosophy. This multiplicity of definitions encapsulating

¹ Lummus R. R; Vokurka R. J., *Defining supply chain management: a historical perspective and practical guidelines*, Industrial Management & Data Systems, 1999, vol. 99 (1), pp.11-17. doi:10.1108/02635579910243851

² Sułkowski Ł., *Epistemologia i metodologia zarządzania (Epistemology and management methodology)*, Polskie Wydawnictwo Ekonomiczne, Warsaw 2012, p. 37.

³ Amy Hissom, *Management, Introduction to Management Technology*, 2009, as cited in: Stuhlman Management Consultants, *Knowledge Management Terms*, (2009-01-20), Retrieved 2019-07-23 from <http://www.amyhissom.com/MyWritings/Management.pdf>, p. 4.

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the essence of the supply chain is shown in the following comparison (Table 1.1), which indicates possible ways of interpreting this concept.

Table 1.1. Comparison of exemplary supply chain definitions

Author(s)	Supply chain definition	The way of the supply chain understanding
A. Agnetisa, N. G. Hallb and D. Pacciarellic	“represents all the stages at which value is added to a manufacturing product, including the supply of raw materials and intermediate components, finished goods manufacture, packaging, transportation, warehousing and logistics” ¹⁾	process
D. Chow and T. Heaver	“the group of manufacturers, suppliers, distributors, retailers and transportation, information and other logistics management service providers that are engaged in providing goods to consumers. A Supply Chain comprises both the external and internal associates for the corporate” ²⁾	structure
M. Christopher	“A network of connected and interdependent organisations mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users” ³⁾	network
A. J. Battaglia and G. Tyndall	“strategic concept of management sequence of events – from supplier to customer – which adds value to the products flowing through the supply chain” ⁴⁾	concept
M. C. Coopera and L.M. Ellrama	“integrating philosophy of management of the whole flow of goods from supplier to end customer” ⁵⁾	philosophy

Source: own study based on:

Agnetisa A., Hallb N. G., Pacciarellic D., *Supply chain scheduling: Sequence coordinatio*, Discrete Applied Mathematics, 2006, vol.154 (15), pp.2044-2063, DOI: 10.1016/j.dam.2005.04.019

Janvier-James A. M., *A New Introduction to Supply Chains and Supply Chain Management: Definitions and Theories Perspective*, International Business Research 2012, vol. 5 (1), doi:10.5539/ibr.v5n1p194; p. 195.

Christopher M, *Logistics & Supply Chain Management*, Pearson Education Limited, Harlow 2011, p. 4.

^{and 5)} Nowakowska A., *Efficiency of application of rfid in supply chain management*, <http://www.oeconomica.uab.ro/upload/lucrari/1020082/43.pdf>, p. 2.

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The definitions provided above can be considered as possibly the most synthetic overview of various interpretations regarding the issue of the supply chain. It is worth mentioning that in the literature there are numerous studies introducing the concept of the supply chain, but it is impossible to even briefly mention them here due to space limitations.

The authors cited in Table 1.1, and specifically the definitions proposed by them, were distinguished according to the principle of "definition fit per genus proximum et differentiam specificam", according to which the supply chain can be understood in terms of such categories as: process, structure, network, concept and even philosophy. At the same time, it should be emphasized that even though the interpretative concepts are differently distributed, this concept is not completely contradictory or fuzzy. The occurring generic differences do not exclude the existence of "terminological normative" of this concept, which was confirmed by its analysis in the form of "research reconnaissance" covering mainly Polish literature and the definitions from world literature cited in it.

The first terminological standard derived from the analysis of the supply chain definitions is related to the occurrence of the term 'flow' in almost all of the sources cited. At the same time, material flow (related to product movement) and information flow (related to information exchange) are emphasized more often, while the flow of financial resources (representing the monetary dimension of material flows and information exchange accompanying them) occurs less frequently.

Most authors who provide definition of the supply chain term also focus on increasing (adding) value at every stage of product flow, from the supplier to the final recipient. The supply chain is treated as a value stream, which is clearly directed to the final recipient, and is considered in the context of the value provided to it by all links in a given chain.

The authors also pay attention to cooperation between individual links in the supply chain and integration between them, i.e. generally the relations between suppliers and recipients. These relationships are important because they enable the release of synergistic effects that constitute part of the supply chain concept.

Therefore, using the records of set theory, it can be assumed that the supply chain is a set of elements and relations in the meaning of supplier-recipient relationships, and not relations in the sense of mathematical ordering, which can be written as:

$$SC = (E, R, P) \tag{1.1}$$

- with the additional meaning that R (mathematical symbol of conclusion),
- E^2 (if only binary relations or R [conclusion] are considered),
- 2^E (if also relationships between many entities at once are considered).

where: SC (supply chain); E (set of elements); R (set of relations); P (supply chain purpose).

Depending on the complexity of flows, supply chains can be described using linear and supply network approach. In linear approach, the organizational basis for shaping the supply chain is created by suppliers and customers between whom there are bilateral and sequential logistic connections of one-to-one nature. This type of flow is graphically shown in Figure 1.1. (point 1).

As the number of supply chain links increase in different flow phases, bilateral cooperation is more and more often replaced by network cooperation, which creates various forms of flow networks. In the network approach, the organizational basis for shaping the supply chain is created by suppliers and customers between whom, in a given flow phase (supply, production or distribution), there is a link participating simultaneously in the flow of two or more streams. In Figure 1.1. (point 2) an exemplary structure of the supply chain in the network approach is presented, consisting of a set of links: supplier's suppliers (SS_n), suppliers (S_n), producers (M_n), distributors (D_n), retailers (R_n) and final recipients, i.e. consumers (C_n).

A more complex approach to logistic flows creates a supply network that arises as a result of merging, permeating, and even overlapping of individual links in the supply chain, These links include: suppliers, recipients, cooperators and competitors. Suppliers and recipients can be thought of as cooperating links which in relation to one another create vertical relationships. Competing entities create horizontal relationships. With such a mix of flows, it can be posited that within the supply network there are not only logistic connections, but also other activities, including marketing (product promotion, customer service, research and development). In this context, supply chain management refers to the process of how products are designed, procured, produced and distributed from raw materials to the customer. It is a process in which co-functional teams from different forms of flow are created, coordinated in such a way so as to effectively fulfill demand while minimizing costs and maximizing profits⁴.

⁴ Smock D., *Supply chain management: What is it?*, Purchasing, 132 (13), pp. 45-49.

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Although the supply chain management term was coined in the literature over 30 years ago, S. LeMay et.al. claim that in the literature on the subject they do not find a common, nominal, actual or formal supply chain management definition. Therefore, in their research they collected current definitions of supply chain management from various sources, developed standards for their assessment and, using the developed standards, proposed a definition that should be considered. Assuming that supply chain management (henceforth, SCM) “is the design and coordination of a network through which organizations and individuals get, use, deliver, and dispose of material goods; acquire and distribute services; and make their offerings available to markets, customers, and clients”⁵. This, points to the shift of supply chain management boundaries.

The rest of this section refers to the definition of supply chain management developed by The Global Supply Chain Forum (GSCF) members. According to them, supply chain management can be defined as the integration of key business processes from end user through suppliers that enables providing products, services, and information that add value for customers and other stakeholders⁶

In Figure 1.1. selected items were presented:

- goals of supply chain management,
- key areas of supply chain management,
- graphic approaches to the supply chain.

Key areas of supply chain management are described in sub-chapter 1.2.

⁵ LeMay S., Helms M., M, Kimball B., McMahon D., *Supply chain management: the elusive concept and definition, International Journal of Logistics Management*, vol. 28 (4)/2017, p. 1446.

⁶ Lambert D. M, Cooper M. C., *Issues in Supply Chain Management, Industrial Marketing Management*, vol. 29 (1)/2000, p. 66.

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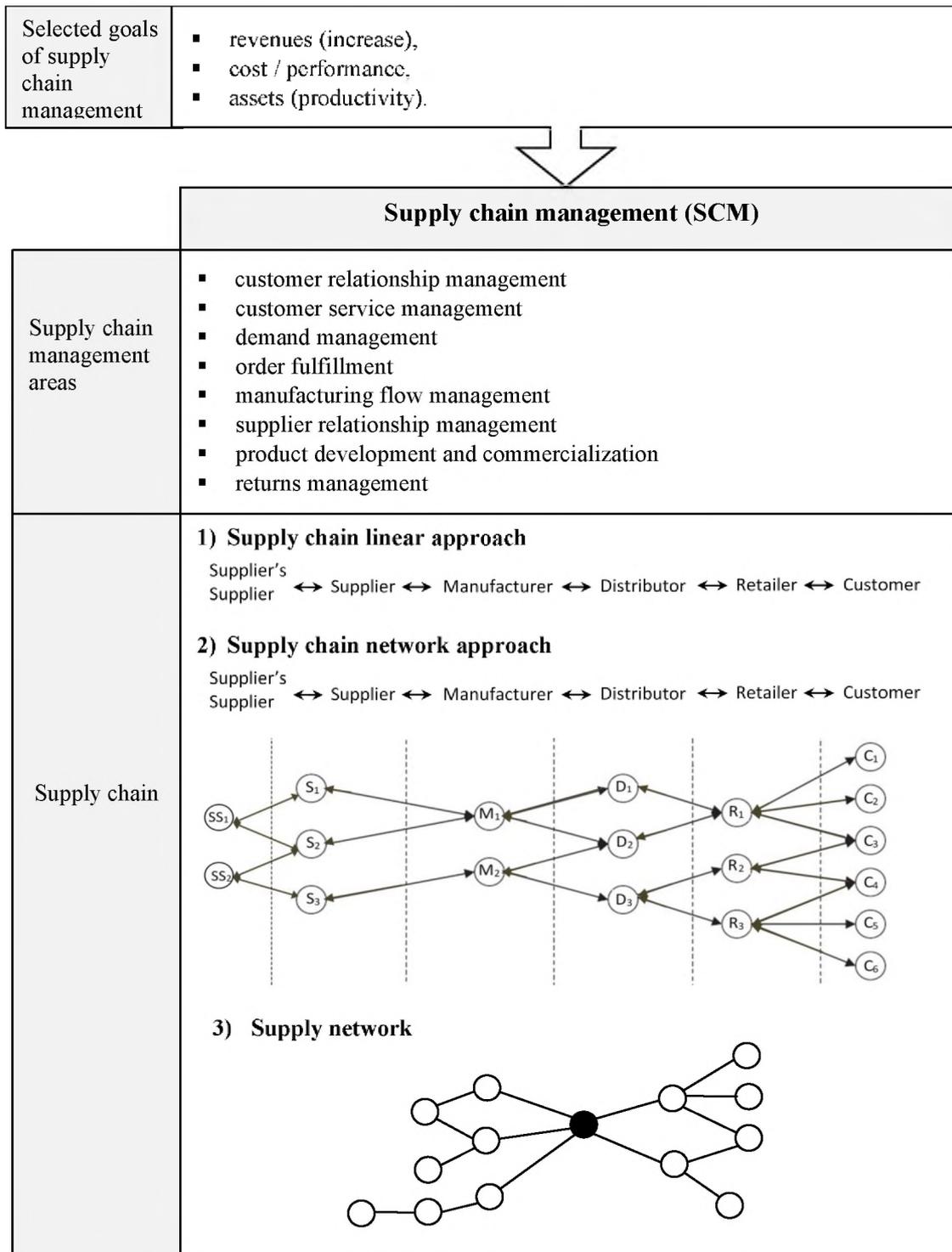


Figure 1.1. Supply chain management

Source: own study based on Chu-hua Kueia, Christian N. Madua and Chinho Linb, Developing global supply chain quality management systems, International Journal of Production Research vol. 49 (15)/2011, p. 4458; Christopher M, Logistics & Supply Chain Management, Pearson Education Limited, Harlow 2011, p. 3.; Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p.13-36.

The above considerations lead to the conclusion that supply chain management is the management of all activities in this process, the implementation of which usually initiates further activities creating added value for the client and other interested parties. Understanding and linking between different approaches to the supply chain seems to be necessary so that the concept of supply chain management can develop and be useful, both in theoretical and practical terms⁷.

1.2. Processes and operations that constitute the supply chain management core

Business and logistics processes have different proceeding - depending on tasks and specifications, resources, technicalization and technologization of customer requirements. Similarly, logistic systems that operate by implementing specific processes. However, not all processes implemented within a given logistics system are logistics processes. Therefore, before describing the basic business processes that constitute the supply chain management core, it is crucial to consider the basic logistics activities that may include⁸:

- customer service,
- demand forecasting,
- information flow,
- transport,
- storage,
- inventory control,
- manipulation activities,
- orders processing orders,
- parts supplying,
- packaging,
- returns handling,
- waste management.

At the same time, it should be noted that the above-mentioned logistics activities are associated with the spatial-temporal and quantitative-qualitative transformations of physical

⁷ Ellram L. M., Cooper M. C., *Supply chain management: it's all about the journey, not the destination*, Journal of Supply Chain Management; vol. 50 (1)/2014, p. 17.

⁸ Sadowska B., *Rachunek kosztów logistycznych w przedsiębiorstwie (Logistics costs in the enterprise)*, CeDeWu, Warszawa 2017, p. 119.

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material as well as information flows. In addition, these activities can be implemented by the enterprise itself or on the basis of outsourcing, i.e. the transfer of their implementation to other external entities⁹.

M. A. García-Vidales, et al. by analyzing large companies from the automotive industry located in the city of Aguascalientes Mexico, considered ways of implementing the following logistics activities¹⁰:

- receiving and processing orders,
- storage,
- purchasing,
- distribution,
- inventory control,
- picking - just in time,
- transport.

This shows that the content of logistics tasks related to purchasing are most often provided by the enterprises themselves, while receiving and processing orders, storage, distribution and transport are most often transferred to other entities on the outsourcing principle. On the basis of the research conducted by them, it should be noted that only a part of the surveyed enterprises referred in their responses to inventory control (8 out of 19 enterprises), which suggests, as researchers indicate, that these enterprises do not have inventories. In addition, the researchers also posit that the companies researched have a negative correlation between downtime and the number of logistics activities performed by the companies themselves and / or outsourcing companies, concluding that this ultimately translates into better supply chain performance¹¹.

Based on previous considerations and publications of "Issues in Supply Chain Management"¹² and "The Supply Chain Management Processes"¹³ below have been signaled

⁹ Mol M. J., *Outsourcing: Design, Process and Performance*, Cambridge University Press, 2007.

¹⁰ García-Vidales M. A., Campos-García R. M., González-Gómez O., García-Vidales M. Y., The influence of logistics activities on the performance of supply chain: Case of automotive sector in Aguascalientes, Mexico, *African Journal of Business Management*, vol. 6 (32)/2012, p. 9232.

¹¹ García-Vidales M. A., Campos-García R. M., González-Gómez O., García-Vidales M. Y., The influence of logistics activities on the performance of supply chain: Case of automotive sector in Aguascalientes, Mexico.

¹² Lambert D. M, Cooper M. C., *Issues in Supply Chain Management*, *Industrial Marketing Management*, vol. 29 (1)/2000.

¹³ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, *The Supply Chain Management Processes*, *The International Journal of Logistics Management* vol.12 (2)/ 2001.

only key areas of supply chain management, which are included in Figure 1.1., The key areas are the core of supply chain management. The reader can also choose to supplement their knowledge by using the indicated literature. However, with a view to achieving a comprehensive image of SCM, each of the processes have been described in detail at the strategic and operational level, and divided into subprocesses and activities.

The customer relationship management process - focuses on building and maintaining relationships with customers. It is related to customer segmentation and adapting the offer / contracts to their needs. At the strategic level its following components can be specified – subprocesses included in the discussed macro-process¹⁴:

- 1) Review corporate and marketing strategy – team for the process of customer relationship management (process team) analyzes corporate and marketing strategies and identifies key customer segments.
- 2) Customer categorization – the process team is developing customer categorization criteria.
- 3) Contract adaptation – the process team prepares standard contracts for individual customer groups. It should be noted that in this subprocess, the process team works with other teams to develop optimal contract performance solutions that can be offered to clients.
- 4) Metrics and indicators - the process team develops metrics and indicators for assessing the company's relationship with customers. In this subprocess, the team works with other project teams.
- 5) Common benefits - the process team develops guidelines for sharing benefits with customers.

At the operational level, you can specify subprocesses that are a development and specification of the described subprocesses at the strategic level.

The customer service management process - involves the movement of goods from the moment of acceptance of the order to the moment of delivery of the goods to the recipient along with informing him in real time about the availability of the product, date of shipment

¹⁴ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p.15-17.

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and the status of the order. At the strategic level its following components can be specified - subprocesses included in the discussed macro-process¹⁵:

- 1) Customer service strategy – the customer service management process team (process team) develops a customer service strategy in cooperation with the customer relationship management team.
- 2) Response procedures – the process team develops procedures for responding to events with customer service. In this subprocess, the team works with other project teams.
- 3) Infrastructure – the process team develops the infrastructure necessary to implement procedures for responding to customer service related incidents.
- 4) Metrics and indicators – the process team develops customer service metrics and indicators. In this subprocess, the team works with a customer relationship management team.

The demand management process - is related to synchronizing the needs of customers with supply, production and distribution capabilities as well as developing contingency plans in case of disrupting the balance of supply and demand events. At the strategic level its following components can be specified - subprocesses included in the discussed macro-process¹⁶:

- 1) Forecasting methods – the demand management process team (process team) defines forecasting methods, their levels, time frames and data sources.
- 2) Information flow plan – in this subprocess, the team works with other project teams on whose information the forecasting process is based and with which it communicates.
- 3) Synchronization procedures – the process team develops synchronization procedures required to match the demand forecast with the organization's capabilities.
- 4) Contingency management system – the process team develops guidelines in case of events that could disturb the balance of supply and demand. In this subprocess, the team works with other process teams, such as customer relationship management,

¹⁵ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p.17-18.

¹⁶ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p.18-20.

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customer service management, manufacturing flow management or supplier relationship management.

- 5) Metrics and indicators – the process team develops metrics and indicators for assessing process performance. In this subprocess, the team works with a customer relationship management team.

The order fulfillment process - containing all the steps necessary to satisfy the recipient at the lowest cost of the order processing. At the strategic level its following components can be specified - subprocesses included in the discussed macro-process¹⁷:

- 1) Review marketing strategy, supply chain structure and customer service goals – the order processing process team (process team) analyzes the role of customer service in marketing strategy, in the supply chain structure and for customer service purposes. In this subprocess, the team works with a customer relationship management team.
- 2) Order fulfillment – the process team defines the requirements of the orders. In this subprocess, the team works with a customer relationship management team and with manufacturing flow management.
- 3) Logistics network – the process team assesses the logistics network. In this subprocess, the team works with other process teams.
- 4) Plan for order fulfillment – the process team defines the order fulfillment plan.
- 5) Metrics and indicators – the process team develops metrics and indicators for assessing order performance. In this subprocess, the team works with a customer relationship management team.

The manufacturing flow management process - is associated with all activities related to the production and flexibility of production needed to serve customers. At the strategic level its following components can be specified - subprocesses included in the discussed macro-process¹⁸:

¹⁷ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p.20-22.

¹⁸ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p.22-24.

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- 1) Review manufacturing, sourcing, marketing and logistics strategies the production flow management process team (process team) analyzes production, supply, marketing and logistics strategies.
- 2) Production flexibility – the process team determines the flexibility of production
- 3) Push / pull boundaries – the process team sets push / pull boundaries to help identify warehouse points along the supply chain. In this subprocess, the team works with the order fulfillment process team, supplier relationship management and product development and commercialization.
- 4) Production restrictions and requirements – the process team defines production requirements and restrictions. In this subprocess, the team works with the supply relationship management team.
- 5) Manufacturing capabilities – the process team determines the production capacity. In this subprocess, the team works with other process teams.
- 6) Metrics and indicators – the process team develops metrics and indicators for assessing production efficiency. In this subprocess, the team works with a customer relationship management team.

The supplier relationship management process - focuses on building and maintaining relationships with suppliers as well as managing contracts with suppliers. At the strategic level its following components can be specified - subprocesses included in the discussed macro-process¹⁹:

- 1) Review corporate, manufacturing and sourcing strategies – team for the process of supplier relationship management (process team) analyzes corporate, production and supply strategies, and identifies key components of products and / or services.
- 2) Supplier categorization – the process team develops criteria for categorizing suppliers.
- 3) Contracts adaptations – the process team prepares standard contracts for individual groups of suppliers. It should be noted that in this subprocess, the process team cooperates with other teams to develop optimal solutions for the implementation of contracts / deliveries.

¹⁹ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p. 24-26.

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- 4) Metrics and indicators – the process team develops measures and indicators for assessing the relationship of the company with suppliers. In this subprocess, the team works with other project teams.
- 5) Common benefits – the process team develops guidelines for sharing benefits with suppliers, e.g., improving the delivery process.

The product development and commercialization process - includes all activities related to the development and introduction of new products to the market, taking into account cooperation between suppliers and customers. At the strategic level its following components can be specified - subprocesses included in the discussed macro-process²⁰:

- 1) Review sourcing, manufacturing and marketing strategies – the product development and commercialization team (process team) analyzes acquisition, production and marketing strategies, and determines their impact on product development.
- 2) The process of generating ideas – the process team determines the process of generating ideas and analysis. In this subprocess, the team works with a customer relationship management team.
- 3) Problems and limitations – the process team develops the problem and restrictions associated with product implementation.
- 4) Metrics and indicators – the process team develops measures and indicators for product development and commercialization assessment. In this subprocess, the team works with a customer relationship management team.

The returns management process - containing all activities related to handling returns. At the strategic level its following components can be specified - subprocesses included in the discussed macro-process²¹:

- 1) Analysis - the team for the return management process (process team) examines the guidelines regarding environmental and legal compliance.
- 2) Rules – the process team develops guidelines for returns management. In this subprocess, the team works with other teams.

²⁰ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p.26-28.

²¹ Croxton K. L., García-Dastugue S. J., Lambert D. M and Rogers D. S, The Supply Chain Management Processes, The International Journal of Logistics Management vol.12 (2)/ 2001, p. 28-30.

- 3) Metrics and indicators – the process team develops indicators and indicators for assessing returns. In this subprocess, the team works with a customer relationship management team.

In order to determine the level of effectiveness and efficiency of individual logistics activities and processes, it should be noted that even the simplest logistics activities and processes should be monitored, among other things, using appropriately selected indicators and measures²². Furthermore, importance in this respect can also be attributed to the architecture used for mapping, modeling and simulation of logistics processes and systems, which also serve to effectively manage logistics and supply chains²³.

1.3. The role of standards in supply chain management

Supply chain participants use different processes and systems. Therefore, sharing simple information about the flow of products between trading partners (suppliers, manufacturers, logistics operators, transport companies, wholesalers, retailers, consumers) requires the use of common identification and communication standards to avoid incompatibilities when integrating enterprises in the supply chain.

In order to avoid such a situation and its consequences, the GS1 System (Global System the First), i.e. global system, global standards and global solution, enables effective supply chain management by uniquely identifying participants and facilities, such as trade units, resources, logistic units, physical locations (for example: warehouses, production plants) or places for storing raw materials / semi-finished products / finished products (for example: shelves). This includes the ability to track (reconstruct the history of) the flow of goods in supply chains along with the registration of parameters identifying these goods and all locations covered by the given flow²⁴.

The list of global GS1 identifiers and their application is presented in Table 1.2.

²² Benotmane Z., Belalem G., Neki A., *A Cost Measurement System of Logistics Process*, International Journal of Information Engineering and Electronic Business, 2018, vol.11 (5), DOI: 10.5815/ijeeb.2018.05.04, p. 25.

²³ Mańkowski C., *Architectures of logistics processes and systems*, Research Journal of the University of Gdańsk. Transport Economics and Logistics, vol. 68 Modeling of Logistic Processes and Systems, 2017.

²⁴ GS1 PL, <https://www.gs1pl.org/standardy-i-rozwiazania/traceability-recall>

Table 1.2. Global Identifiers of GS1 System

ID Key		Used to identify
GTIN	Global Trade Item Number	products and services
GLN	Global Location Number	parties and locations
SSCC	Serial Shipping Container Code	logistics units
GRAI	Global Returnable Asset Identifier	returnable assets
GIAI	Global Individual Asset Identifier	assets
GSRN	Global Service Relation Number	service provider and recipient relationships
GDTI	Global Document Type Identifier	documents
GINC	Global Identification Number for Consignment	consignments
GSIN	Global Shipment Identification Number	shipments
GCN	Global Coupon Number	coupons
GMN	Global Model Number	product model
CPID	Component/Part Identifier	components and parts

Source: own study based on <https://www.gs1.org/standards/id-keys> (09.06.2019).

Most GS1 identifiers consist of²⁵:

- prefix,
- company number,
- numerical or alphabetical designation,
- check digit.

The prefix is assigned by the national organization of the GS1, it symbolizes the country administering the given identification number. The company number is assigned to the company or organization by the national organization of the GS1 system. In contrast, the company number with the GS1 prefix forms the "GS1 company prefix" - enabling the creation and use of identifiers within the GS1. Numerical or alphabetical markings are assigned in accordance with the rules of a given type of identifier, the structure of which

²⁵ Halas E. (ed.), Kody kreskowe i inne globalne standardy w biznesie (Barcodes and other global standards in business), Instytut Logistyki i Magazynowania, Poznań 2012, p. 29-32.

allows it. The check digit is usually the last digit of the numeric part of the identifier and is used to correctly read the code²⁶

The following part of the current section provides examples of applications of GS1 identifiers on the example of a linear supply chain of juice in a bottle.

Orchard → manufacturer → transport and logistics → wholesaler and distributor →
retail distribution center → retail store → consumer

<p>GROWER</p>  <p>RETAILER</p>	Grower	GLN
	Raw materials	GTIN
	Transport	GIAI
	Producer	GLN
	Raw materials	GTIN
	Transport	GIAI
	Manufacturer	GLN
	Item	GTIN
	Case	SSCC
	Pallet	SSCC
	Transport	GIAI
	Store	GLN
	Transport	GIAI
	Pallet	SSCC
	Case	SSCC
	Item	GTIN
Retailer	GLN	

Figure 1.2. An example of link identification and flow of goods in the supply chain using GS1 standards

Source: own study based on Giulia Bruno, Politecnico di Torino, A virtual supply chain architecture to grant product transparency in agribusiness, in: Information Resources Management Association USA (ed.), Supply Chain and Logistics Management: Concepts, Methodologies, Tools, and Applications, IGI Global, USA, p.

94.

²⁶ Halas E. (ed.), Kody kreskowe i inne globalne standardy w biznesie (Barcodes and other global standards in business), Instytut Logistyki i Magazynowania, Poznań 2012, p. 29-32.

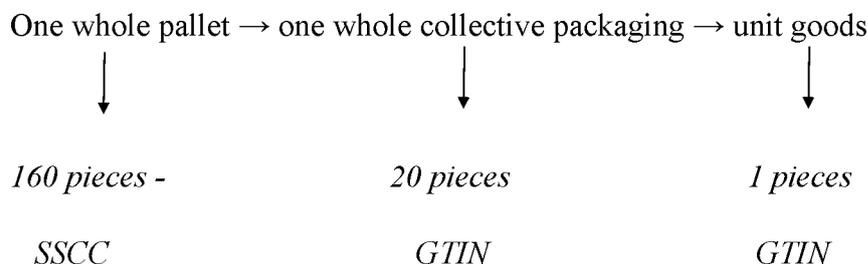
Identification of business partners (links in the supply chain) is carried out thanks to the GLN (Global Location Number) identifier, which is used to identify parties and locations. It can be used to identify enterprises or / and identify each place in an enterprise (for example: warehouses, production plants) or storage places for raw materials / semi-finished / finished products (for example: racks, shelves).

Identification of raw materials / semi-finished products / finished products is carried out thanks to the GTIN (Global Trade Item Number) identifier, which provides unambiguous identification of any trade unit (defined as a product - from raw material to consumer product, or a service that can be valued, ordered or invoiced) between participants in the supply chain at any point. There are four types of GTIN symbolism²⁷:

- GTIN-8,
- GTIN-12,
- GTIN-13,
- GTIN-14.

GTIN-8 is used for small-sized products, GTIN-12 is mainly used in the USA and Canada, GTIN-13 is most often represented in the EAN-13 code, while GTIN-14 can be used for commercial units as non-retail bulk packaging. It should be also emphasized that GTIN is a number, i.e. digits, and EAN - a graphic reflection of the sequence of digits located under the bar code that is used for scanning and exactly in it the GTIN number is encrypted²⁸. In addition, it should be noted that GTINs are also used to identify crates in which products (raw materials / semi-finished products / finished products) may be located, while pallets are identified by means of the Serial Logistic Unit Number (SSCC)²⁹.

Packaging hierarchy



²⁷ GS1 AISBL, Global Trade Item Number (GTIN), 2015,

https://www.gs1.org/docs/idkeys/GS1_GTIN_Executive_Summary.pdf

²⁸ Hałas E. (ed.), Kody kreskowe i inne globalne standardy w biznesie (Barcodes and other global standards in business), Instytut Logistyki i Magazynowania, Poznań 2012, p. 32-33.

²⁹ GS1, <http://discover.gs1.org/cpg/grower/>

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Logistics units are identified by the SSCC (Serial Shipping Container Code) identifier, i.e. any combination of commercial items packed together (for example: in a box, on a pallet, in a package) for storage and / or transport needs³⁰.

“The Global Trade Item Number (GTIN) and Serial Logistics Unit Number (SSCC) are used to identify and track products as they travel from the manufacturer to stores and packaging, to shipping”³¹.

Resources are identified thanks to the GIAI (Global Individual Asset Identifier) and GRAI (Global Returnable Asset Identifier) identifiers. The GRAI identifier is used to identify reusable resources (for example: pallets, boxes, barrels) that are used and then returned³². The GIAI identifier is used to identify individual resources - assets that require unambiguous identification for their management purposes (for example: vehicles, computers, desks, machines)³³.

Deliveries and shipments are identified by the GINC (Global Identification Number for Consignment) and GSIN (Global Shipment Identification Number). The GINC identifier is used to identify the shipment and allows freight forwarders and carriers to track transported logistics units³⁴. The GSIN identifier is used to identify the shipment consisting of one or more logistic units intended for transport³⁵.

The Global Service Relation Number (GSRN) is used to identify / register services (for example, service provider and recipient relationships)³⁶.

The Global Document Type Identifier (GDTI) is used for document identification, tracking and electronic archiving³⁷.

The Global Coupon Number (GCN) identifier is used to identify electronic tickets, coupons that can be exchanged for financial discounts or for points when making a purchase³⁸.

³⁰ GS1 AISBL, Serial shipping container code (SSCC), 2015,
https://www.gs1.org/docs/idkeys/GS1_SSCC_Executive_Summary.pdf

³¹ GS1, <http://discover.gs1.org/cpg/grower/>

³² GS1 AISBL, *Global Returnable Asset Identifier (GRAI)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_GRAI_Executive_Summary.pdf

³³ GS1 AISBL, *Global Individual Asset Identifier (GIAI)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_GIAI_Executive_Summary.pdf

³⁴ GS1 AISBL, *Global Identification Number for consignment (GINC)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_GINC_Executive_Summary.pdf

³⁵ GS1 AISBL, *Global Shipment Identification Number (GSIN)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_GSIN_Executive_Summary.pdf

³⁶ GS1 AISBL, *Global Service Relation Number (GSRN)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_GSRN_Executive_Summary.pdf

³⁷ GS1 AISBL, *Global Document Type Identifier (GDTI)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_GDTI_Executive_Summary.pdf

³⁸ GS1 AISBL, *Global coupon Number (GCN)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_GCN_Executive_Summary.pdf

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The Global Model Number (GMN) identifier makes it possible to uniquely identify a product model throughout its entire life cycle, from design, through production, supply, use, maintenance, to disposal³⁹.

The Component / Part Identifier (CPID) is used to identify subassemblies and components that are part of the final product. CPID is mainly used in the automotive industry⁴⁰.

The use of GS1 System identifiers is the answer of enterprises to contemporary market challenges: consumers, society and also competition. However, it should be added that the decision to use them in the organization's activities results more from the conviction of their positive impact in improving the flow of goods and information, extending the supply chain, as well as from the possibility of rapid response in the event of the need to withdraw harmful / defective goods from the market. It is an investment that pays off in the long run for every supply chain participant.

³⁹ GS1 AISBL, *Global Model Number (GMN)*, 2019,
https://www.gs1.org/sites/default/files/docs/idkeys/gs1_gmn_executive_summary.pdf

⁴⁰ GS1 AISBL, *Component / Part Identifier (CPID)*, 2015,
https://www.gs1.org/docs/idkeys/GS1_CPID_Executive_Summary.pdf

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https://www.gs1.org/docs/idkeys/GS1_GIAI_Executive_Summary.pdf
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https://www.gs1.org/docs/idkeys/GS1_GCN_Executive_Summary.pdf
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https://www.gs1.org/sites/default/files/docs/idkeys/gs1_gmn_executive_summary.pdf
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2. STRATEGIC MANAGEMENT

2.1. Introduction to Strategic Management

Business management determines the general direction of development, and thus the adoption of a certain operational concept. Such a concept is reflected in the strategy, which is the company's endeavor to achieve selected objectives on the basis of knowledge of its resources and analysis of environmental conditions and competition⁴¹.

Strategic management can be defined as an information and decision-making process, within which decisions are made with a long time horizon and at the same time with a wide material horizon⁴². On the basis of these assumptions, one can distinguish strategic management from tactical and operational (Table 2.1). In this context, time horizon is understood as an estimated length of time or the time perspective of the decision. Material horizon, on the other hand, refers to the comprehensive depiction of the organization to which the decision applies.

Table 2.1. Levels of management

Management level		Time horizon of the decision	Material horizon of the decision
Upper management	Strategic management	> 3 years	The entire organization, part, or the whole sector
Middle management	Tactical management	(1; 3) years	Establishment, division and organizational service
Lower management	Operational management	< 1 year	Department, branch, line, production cell, work station

Source: Kalkowska J., Pawłowski E., Trzcielińska J., Trzcieliński S., Włodarkiewicz-Klimek H., *Zarządzanie strategiczne. Metody analizy strategicznej z przykładami*, Wydawnictwo: Politechnika Poznańska, Poznań 2010, p. 8.

⁴¹Mruk H., Pilarczyk B., Szulce H., *Marketing uwarunkowania i instrumenty*, Wydawnictwo: Akademia Ekonomiczna w Poznaniu, Poznań 2007, p. 248.

⁴² Abosede A.J., Obasan K.A., Alese O.J., *Strategic Management and Small and Medium Enterprises (SMEs) Development: A Review of Literature*, International Review of Management and Business Research, vol. 5, issue 1/2016, pp. 315-335.

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The indicated aspect of the long time horizon and the broad material scope of strategic management finds expression, among others, in the following definitions ⁴³:

1. Strategic management is a continuous, iterative process aimed at adapting the entire organization to the environment in which it is located ⁴⁴.
2. Strategic management is a specific concept of company management directed towards the future, based on the analysis of future operating conditions, the resulting visions of the organization and the resulting consistent missions, goals and systems of activities (strategies)⁴⁵.
3. Strategic management is a process of defining and redefining strategies in response to or in anticipation of changes in the environment. Sometimes this process can even trigger changes. Also associated with it, is the process of implementation in which the resources and skills of the organization are disposed in such a way so as to execute the adopted long-term development goals, and also to secure the organization's existence in potential discontinuity situations⁴⁶.

The above-mentioned definitions also emphasize the impact of the environment on a company, and therefore the need to adapt company's potential to changes occurring in different segments of the environment. However, in the subject literature the approaches towards interpreting strategic management seem to mainly accentuate the phases that make up this process:

1. Strategic management is a process consisting of the following interrelated activities:
 - a) shaping the business concept and formulation of the organization's vision of development, and as a result determining the sense of its existence, long-term direction and mission, b) deriving specific goals from the mission, c) development of a strategy aimed at achieving goals, d) implementation and execution of the strategy in an effective and economic manner, e) evaluation of activities, review of the situation and undertaking corrective actions of the mission, goals, strategy and

⁴³ Kalkowska J., Pawłowski E., Trzcielińska J., Trzcieliński S., Włodarkiewicz-Klimek H., *Zarządzanie...* *op.cit.*, pp. 8-10.

⁴⁴ Certo S.C., Peter J.P., *Random House*, New York 1988, p. 5.

⁴⁵ Pierścionek Z., *Strategie konkurencji i rozwoju przedsiębiorstwa*, Wydawnictwo PWN, Warszawa 2003, p. 14.

⁴⁶ Krupski R., *Zarządzanie strategiczne. Koncepcje - metody*, Wydawnictwo: Akademia Ekonomiczna we Wrocławiu, Wrocław 2007, p. 97.

ways of its implementation. It should take into account the accumulated experience, changing conditions, new ideas and new opportunities⁴⁷.

2. Strategic management is a process involving three interrelated activities: strategic analysis, strategy formulation and strategy implementation⁴⁸.
3. Strategic management consists of three stages: analysis, planning and management, understood as the stage of implementation of the developed strategy⁴⁹.

With reference to aspects related to the company's logistics, and in the wider context the flow throughout the entire supply chain, their role in management, including the strategic one, is steadily growing⁵⁰. In particular, it is related to the elements of company's success, such as resources, capabilities and competences⁵¹. This success potential is, above all, the basis for the company to achieve the expected market and economic effects – to which logistics can significantly contribute. Consequently, these effects are indicators of the company's success, as well as the foundation enabling the creation of its long-term competitive advantage - which already constitutes a result of a properly implemented strategy.

The concept of logistics, which is based on the so-called flow orientation is often perceived as a systemic determinant of the company's efficiency and success, as well as a determinant creating a competitive advantage of the company⁵². Accurate logistics decisions with a strategic dimension contribute to ensuring the success of the organization and the entire supply chain.

By utilizing a properly selected set of techniques and methods supporting logistic decisions, one can make the supply chain successful. These decisions should also refer to the development of strategies and tools for their implementation⁵³. A properly constructed and executed strategy eliminates, to some extent, threats and risks of failure to perform tasks

⁴⁷ Thompson A., Strickland A., *Strategic Management. Concepts and Cases*, Publishing House: IRWIN, Burr Ridge 1993, p. 3.

⁴⁸ Dess G., Miller A., *Strategic Management*, Publishing House: McGraw-Hill New York 1993, p. 9.

⁴⁹ Gierszewska G., Romanowska M., *Analiza strategiczna przedsiębiorstwa*, Wydawnictwo: PWE, Warszawa 1997, p. 13.

⁵⁰ Ghemawat P., *Competition and business strategy in historical perspective*, *Business history review*, 76(01)/2002, pp. 37-74

⁵¹ Foss K., Harmsen H., *Studies of Key Factors of Product-Development Success. A Resource-Based Critique and Reinterpretation* [w:] Foss N.J., Knudsen Ch. (eds.), *Towards a Competence Theory of the Firm*, Publishing House: Routledge, London 1996, pp. 1-12.

⁵² Blaik P., *Logistyka. Koncepcja zintegrowanego zarządzania*, Wydawnictwo PWE, Warszawa 2017.

⁵³ Tell J., *Managerial strategies in small, fast-growing manufacturing firms*, *Journal of Management Development*, vol. 31(7)/2010, pp. 700-710.

or processes, and at the same time ensures the efficiency and effectiveness of strategy implementation.

2.2. Stages and levels of Strategic Management

There is no consensus in the relevant subject literature as to the moment of carrying out strategic analysis. In principle, it should be performed during the phase in which organization strategy is being developed. Nonetheless, many authors place strategic analysis as the first phase of this process⁵⁴. Kałkowska J., et al., postulate the view that although the development of the company's mission and goals requires strategic analysis, it is carried out primarily to derive the company's strategy from it⁵⁵.

On this basis, it can be assumed that strategic management is a process that includes activities aimed at developing: mission, goals and strategies, followed by strategy implementation and monitoring, and when it is necessary also enables taking regulatory actions at earlier stages (Figure. 2.1).

⁵⁴ Humble J.W., *Zarządzanie przez określanie celów*, Wydawnictwo: PWE, Warszawa 1975, p. 33; Certo S.C., Peter J.P., *Random...* op. cit., pp. 28-52; Johnson G., Scholes K., *Exploring Corporate Strategy*, Publishing House: Prentice Hall, New York 1993; Kraus S., Kauranen I., *Strategic management and entrepreneurship: Friends or foes?* *International Journal of Business Science and Applied Management*, vol. 4(1)/2009.

⁵⁵ Thompson A., Strickland A., *Strategic...* op. cit., p. 6.

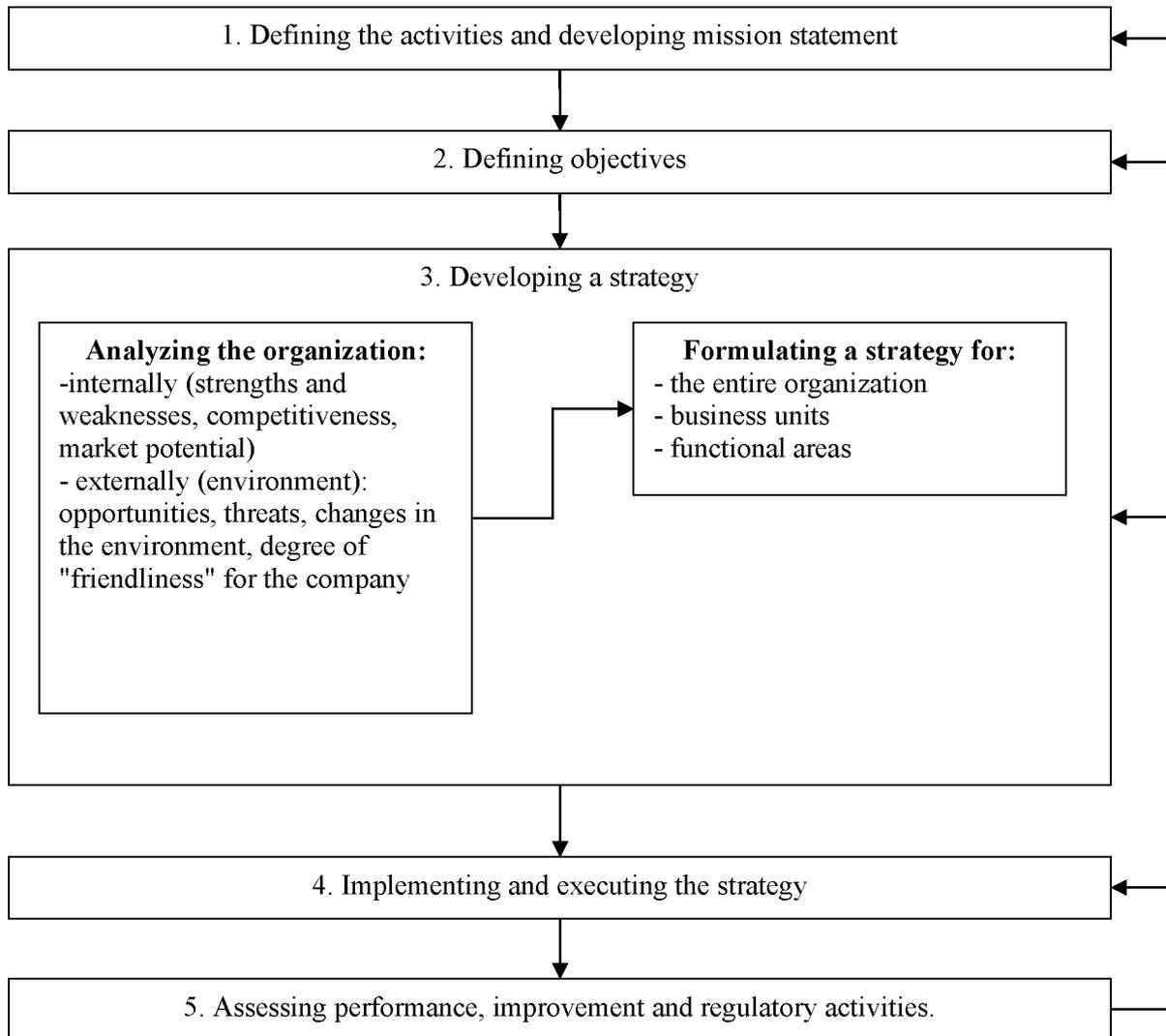


Figure 2.1. Phases of the strategic management process in the supply chain

Source: opracowanie własne na podstawie: Kałkowska J., Pawłowski E., Trzcielińska J., Trzcieliński S., Włodarkiewicz-Klimek H., Zarządzanie... op. cit., p. 10; Thompson A., Strickland A., Strategic... op. cit., pp. 4, 43, 57.

The individual stages of the strategic management process (Figure 2.1) are described below.

1. The mission of the company

The company's scope of activity is determined by its specialization. In accordance with it, it should shape its resources and market. Due to this, specialization should not be defined too broadly as it contributes to wasting resources. Similarly, it should not be specified too narrowly because it increases the probability of missing opportunities. The organization's specialization is shaped according to the vision of the top management, reflecting its intentions and aspirations as to the company's future in the long term. The

vision is treated as a kind of dream of the top management regarding what they would like the company to be like. Therefore, verbalization of the vision leads to the formulation of the mission⁵⁶.

2. Company goals

Goals constitute future desired state of affairs or processes. Due to the time horizon, they can be long-term, medium-term and short-term. The former are formulated primarily for the needs of strategic management. The goals of the entire enterprise are decomposed for the purposes of its organizational units of successively lower levels of complexity. On this basis, it is possible to distinguish between strategic, tactical and operational goals.

However, from the point of view of strategic management, it is useful to divide these objectives into market and financial goals. The first group is related to strengthening the position of the company. They concern the competitive position of the organization and determine such values as "... a faster growth of the company than the industry average, increase in market share, achieving a higher level of quality of products and services than competitors, achieving lower total costs than competitors, strengthening the reputation of the company and its position on international markets, gaining leadership in technological progress,..."⁵⁷. On the other hand, the financial objectives "... usually relate to measurable volumes such as revenue growth, return on investment and cash flow"⁵⁸.

The essential function of the objectives is that they operate the company's missions and, as such, they should make it possible to check whether the company is moving in the direction specified in the mission statement. That is why they should be precisely defined, understandable for the members of the organization and measurable.

3. Strategy

Strategy in a broad sense can be understood as the organization's activities aimed at achieving specific goals⁵⁹. Strategy can also be understood as directional actions and approaches formulated by the management in order for the organization to achieve success⁶⁰. In addition, it should be noted that a well-formulated strategy helps to select and organize the organization's resources into a unique and valuable composition that takes into account

⁵⁶ Kalkowska J., Pawlowski E., Trzcielińska J., Trzcieliński S., Włodarkiewicz-Klimek H., *Zarządzanie... op. cit.*, p. 10; Dess G., Miller A., *Strategic op. cit.*, p. 25.

⁵⁷ Thompson A., Strickland A., *Strategic... op. cit.*, p. 5.

⁵⁸ *Ibidem*, p. 5.

⁵⁹ Certo S.C., Peter J.P., *Random... op. cit.*, p. 13.

⁶⁰ Thompson A., Strickland A., *Strategic... op. cit.*, p. 2.

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the competences and deficiencies of the company as well as the expected changes in the environment and the situation-based actions of intelligent opponents.

The individual levels of management correspond to the scope of strategy and decision areas (Table 2.2).

Table 2.2. Levels of strategy formulation and corresponding decision areas

Strategy level	Person responsible	Strategy decision area
Organization's strategy	President of the board, CEO; decisions are usually adopted or accepted by the management board or the supervisory board	<ul style="list-style-type: none"> - Creating effective business units (acquisitions, strengthening the existing units, withdrawal from inefficient operations). - Obtaining a competitive advantage by using a synergistic effect from the cooperation of business units. - Formulating investment priorities and directing resources to business units with the greatest opportunities. - Review, assessment and coordination of strategic plans proposed by business unit managers.
Business units strategies	Plant director, business unit manager; decisions are usually approved or accepted by the president of the board or the board of the company / corporation.	<ul style="list-style-type: none"> - Formulating intentions to achieve competitive advantage and effective competition. - Formulating actions that are a reaction to changes in the environment. - Integrating strategic intentions of key departments and organizational services. - Taking actions to achieve the objectives of the organization.
Functional strategies	Managers of departments and organizational services (decisions are usually accepted by the head of the company or business unit).	<ul style="list-style-type: none"> - Undertaking activities conducive to business unit strategies and achieving the goals of organizational divisions and services.

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		- Assessing and integrating strategic intentions proposed by lower level managers.
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Source: Kalkowska J., Pawłowski E., Trzcielińska J., Trzcieliński S., Włodarkiewicz-Klimek H.,
Zarządzanie strategiczne. Metody analizy strategicznej z przykładami, Wydawnictwo: Politechnika
Poznańska, Poznań 2010, p. 14.

Strategy defines the direction and scope of the organization's activities over the long term, ensures gaining an advantage by adjusting resources in a changing environment in such a way so as to meet market needs and expectations of the stakeholders⁶¹.

4. Strategy implementation and execution

Strategy is of fundamental importance for the future of the company. Its change occurs either as a result of unsatisfactory current situation of the company, or in connection with the expected vital changes in internal and external conditions that may cause future deterioration of its currently good situation.

Consequently, it needs to be highlighted that strategy implementation is related to crucial changes in the company. Generally, the employees of the organization are concerned about the changing situation as it can violate their personal stability. Therefore, strategy implementation is a difficult process which frequently meets with resistance from employees and their teams. In order to mitigate this resistance, employees should become the subject of these changes (*empowerment*), and be involved in the process of both preparing the strategy and designing the changes necessary to implement it.

A characteristic feature of strategy is causing changes in organizational structures in all their dimensions: specialization, configuration, centralization, standardization and formalization. These changes should in each case be purposeful and rational, and therefore carefully considered. However, even then their implementation may, at some point, cause a decrease in the efficiency of the organization. Therefore, consistency is needed, especially for the top management of the organization, in maintaining changes, so that they lead to at least partial achievement of the set goal⁶².

⁶¹ Kalkowska J., Pawłowski E., Trzcielińska J., Trzcieliński S., Włodarkiewicz-Klimek H., *Zarządzanie... op. cit.*, p. 16.

⁶² *Ibidem* p. 18-19.

5. Business evaluation, improvement and regulatory activities

Strategy includes activities which a company undertakes in order to achieve an objective. These activities, and also the objectives, are decomposed to the tactical level (functional strategies). A method of such a decomposition, and at the same time, a tool for monitoring the implementation of the strategy is a strategic scorecard. Objectives and measures covered by the strategic scorecard are analyzed from four different angles related to: finances, customers, internal processes, and development.

The objectives, as well as the measures contained in the strategic scorecard, make it possible to assess the company's progress in implementing the adopted strategy, in addition to achieving strategic goals and fulfilling its mission. If the situation in this respect is unsatisfactory, or significant changes have taken place in the environment or inside the company that do not fit into the prospective scenarios of the organization, then regulatory and remedial actions should be taken. These corrective measures are taken in order to modify functional strategies, business unit strategies, corporate strategies, at least some strategic goals or, as a last resort, the mission of the company.

2.3. Strategic Analysis Methods

With a view to determining the directions of strategic planning in the supply chain, it is proposed to adopt a model of strategic management process in which the following components can be distinguished⁶³:

- strategic planning including strategic analysis and strategy design,
- strategy implementation consisting of initiating the strategy and its further development and evaluation,
- strategic control system consisting of strategic controlling and operational controlling.

The development of the company's strategy requires carrying out a strategic analysis of significant factors related to its environment and interior. The existing and potential set of factors present in the environment creates situations that may favor or hinder the achievement of the company's long-term intentions (objectives). Strategic analysis provides many methods to study, evaluate and predict the future states of these factors. In addition,

⁶³Pająk W., *Strategie zarządzania w sieci dostaw*, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie, nr 856/2010, p.58.

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methods of strategic analysis also include a broad set of sector and portfolio analysis for companies and their environment. The most important include⁶⁴:

- scenario analysis,
- stakeholder analysis,
- structural analysis of the sector,
- value chain model,
- strategic balance of the company,
- matrix of functions and resources,
- portfolio methods, i.e.:
 - BCG matrix,
 - McKinsey matrix,
 - ADL matrix,
 - SWOT analysis model.

Another classification distinguishes between methods for macro-environment analysis, methods for analyzing competitive environment, methods for analyzing the strategic potential of an enterprise and integrated methods for strategic analysis (Table 2.3).

Table 2.3. Methods included in the scope of strategic analysis

Category	Description
Macro-environment analysis method	<ul style="list-style-type: none"> - scenario methods consist in determining and forecasting events that may take place and their impact on the company's prosperous performance, - trend extrapolation forecasts, a method suitable for carrying out surveys in enterprises characterized by low growth dynamics, and located in a stable environment, it is not possible in this case to determine the exact time at which this method is up-to-date, - the Delphi method (expert evaluation), based on a qualitative evaluation of facts, expert evaluations are used to forecast the future - strategic gap analysis, one of the statistical methods in which trends are determined, using this method one can analyze the increase in sales of the surveyed company against the background of sales of the whole sector

⁶⁴Malara Z., *Przedsiębiorstwo w globalnej gospodarce. Wyzwania współczesności*, Wydawnictwo: PWN, Warszawa 2006, p. 11.

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<p>Competitive environment analysis method</p>	<ul style="list-style-type: none"> -Porter's Five Forces analysis, identification of the bargaining power of suppliers, bargaining power of buyers, intensity of competitiveness in the industry, threat of new entries, danger associated with the emergence of substitutes, - experience curve helps in determining the relationship between the production volume and the unit cost of the product, - point assessment of the attractiveness of the sector, allows assessing the attractiveness of the sector based on specific criteria, compares it to other sectors in order to determine the appropriate strategy, - a map of strategic groups enables to develop a map of enterprises that operate in the same industry to compare undertaken actions, - benchmarking, i.e. searching for best practices and implementing them into the company's strategic operation, - strategic segmentation analysis, the purpose of which is to separate the areas of company's activity in order to perform their comparative analysis, helpful in choosing the strategy of company's activities
<p>Company's strategic potential analysis method</p>	<ul style="list-style-type: none"> - resource analysis, testing the company's potential by collecting and describing the resources owned by the organization to determine their functionality, - analysis of key success factors, development of a list of factors, according to specific criteria, significantly affecting the company development and the possibility of maintaining competitive advantage, - the value chain model is an analysis of management processes as well as activities in a certain sector of the organization, identification of strengths and weaknesses of the company, - product, technology, and company life cycle, enables indicating product, technology and company development stages, - portfolio methods, allow assessment of the structures existing in the entity, as well as formulation of changes in the way of management, the main portfolio methods include: BCG matrix (Boston Consulting Group), ADL matrix (AD Little), McKinsey Matrix (GE - General Electric Corporation) and CW Hofer Matrix. - strategic balance
<p>Integrated strategic analysis method</p>	<ul style="list-style-type: none"> - SWOT analysis, consists in assessing and determining the strategic position of a company, based on the analysis of macro-environment and micro-environment, in order to select the appropriate strategy. - ASTRA analysis, is a method of strategic planning which creates possibilities of rational selection of strategies from the available alternatives, - SPACE analysis (<i>Strategic Position and Action Evaluation</i>), its purpose is to identify the company's development opportunities by analyzing its current activities as well as its position on the competitive market

Source: Tyrańska M., Walas-Trębacz J., *Wykorzystanie metod analizy strategicznej w przedsiębiorstwie*, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2010, p. 76-85

Due to the fact that the organization can make events happen, and therefore shape favorable conditions in its environment as well as prevent and mitigate adverse situations, this environment can be divided into further (macro-environment) and closer (competitive) environment. Macro-environment affects the industries and economic sectors as well as companies belonging to them, while a single company, especially a small or medium-sized one, has little potential to change it. In relation to the competitive environment, depending on the location of the organization and its potential, i.e. broadly understood resources, it has more or less opportunities to influence individual segments of this environment or to defend against the threats arising from them.

2.4. Logistics and Supply Chain Strategy

Supply chains place new demands on companies regarding strategies and the way they are formulated. In this case, strategic management does not exclusively concern individual companies but rather the entire supply network. This means that in order to guarantee its proper functioning, one needs to analyze the essence and role of the process of strategic management in a different way⁶⁵.

Supply chain can be defined as a set of activities performed one after another by various organizations from the moment that value creation process begins, until it reaches the end user⁶⁶. Supply chain can also be described by specifying a product, customer, markets in the geographic sense and/or distribution channels.

Additionally, in broader terms, cooperation can occur in various functions performed by companies forming the supply chain. This cooperation includes supply and distribution, but may also apply to marketing, research and development or production. In case of partners jointly managing real and information flow (logistics), the entire supply chain is already in existence.

The supply chain is a network of organizations involved, through links with suppliers and recipients, in various processes and activities that create value in the form of products and services delivered to final consumers⁶⁷. In turn, supply chain management involves the integration of key business processes from initial suppliers to end users who provide

⁶⁵ Bolsoford P., Rosenbaum R., *Supply Chain Excellence*, American Management Association, Publishing House, New York 2003, p. 40.

⁶⁶ Simchi-Levi D., Kamiński P., Simchi-Levi E., *Designing and Managing the Supply Chain. Concepts, Strategies, and Case Studies*, Publishing House: McGraw-Hill / Irwin, Boston 2000, p. 243–244.

⁶⁷ Christopher M., *Logistics & Supply Chain Management*, Pearson Education Limited, Harlow 2011, p. 13

products, services and information, and add value to customers and other supply chain stakeholders⁶⁸. The strategic approach to supply chain management is a critical challenge from the point of view of survival in contemporary, increasingly global business⁶⁹.

There is no shortage of strategy definitions in the literature for individual enterprises, while analyzing strategies and competitiveness factors at chain level supply is definitely poorer. In the context of strategy, three levels of aggregation are most often distinguished⁷⁰:

- functional level,
- company level,
- level of corporation.

At the first of the distinguished levels, functional strategies related to specific management areas are discussed. We can distinguish marketing, financial, operational activities, e.g. logistics, etc. At the enterprise level, specific markets and products of a business unit are determined, this level requires the integration of a functional area with a view to a separate range of products or services for a specific group of customers. However, the corporate level covers more than one area of activity. At this level, corporations and industries are decided⁷¹. However, from the supply chain perspective it is necessary to supplement the levels indicated fourth aggregation, going beyond a single organization, called the network level or multi-organizational⁷².

It includes enterprises connected in groups of two or more partners. Such groups usually have only a few members, as is the case with strategic alliances, joint ventures, or partnerships that create added value. However, they can be networks consisting of dozens or even hundreds of organizations. Depending on the situation, the entire corporation or only a part of it may join the cooperation with other companies. This level is very important for analyzing supply chain strategies, as strategy matching at each level will address different aspects. In the case of network-level strategies, one should not only "set the enterprise relative to the environment, but also set the enterprise networks relative to the extensive

⁶⁸ Lambert D.M., *The Supply Chain Management and Logistics Controversy* [w:] Brewer A.M., Button K.J., Hensher D.A., *Handbook of Logistics and Supply Chain Management*, Elsevier Science, Oxford 2001, p. 100.

⁶⁹ Rutkowski K., Ocicka B., *Awans Polski do światowej ligi zarządzania łańcuchami dostaw XXI w. – nieziszczalne marzenie czy realna przyszłość?* [w:] Brdulak H., Duliniec E., Gołębiowski T., *Funkcjonowanie łańcuchów dostaw: aspekty logistyczne, przykłady branżowe*, OW SGH, Warszawa 2011, p. 307.

⁷⁰ Konecka S., *Typologia strategii łańcuchów dostaw*, *Logistyka*, vol. 5/2011, p. 1093-1094.

⁷¹ Konecka S., *Typologia strategii łańcuchów dostaw*, *Logistyka*, vol. 5/2011, p. 1093-1094.

⁷² Witt B. de, Meyer R., *Synteza strategii*, PWE, Warszawa 2007.

environment"⁷³. In relation to supply chain strategy, it is also worth quoting T. Hines's views, he distinguishes⁷⁴:

- corporate strategy,
- business strategy (adequately to the strategy at the level of the strategic business unit in B. Witt's approach),
- operational strategy,
- competitive strategy.

T. Hines also emphasizes that between supply chain strategy and competitive strategies individual enterprises must have a strategic fit. strategies supply chains are run under the umbrella of business strategies and competitive strategies are market focused. This is in line with the view of C. Bozarth and R.B. Handfield, according to which supply chain strategies⁷⁵:

- translate the business strategy into activities in the sphere of supply chains,
- enable delivery of value to target customers and markets,
- enable the development of key competences in the sphere of supply chains.

Thus, the supply chain strategy is influenced by the same factors that need to be taken into account when analyzing the company's strategy - primarily demand, supply and competition in the industry. The nature of demand and product characteristics are of great importance here. They are most common criteria taken into account when dividing supply chain strategies. However, the supply chain strategy must not overlook the success factors in the industry, structure corporations, especially aspects of inter-organizational relations, the distribution of bargaining forces and the resulting leadership position towards the leader in the supply chain, and even the supply chain cycle itself (these elements are called non-standard competitiveness factors)⁷⁶.

So far, considerations on the supply chain strategy are illustrated in Figure 2.2. Included on the distinguished levels of strategy analysis, in relation to level IV (networks) are indicated non-standard competitiveness factors.

⁷³ Witt B. de, Meyer R., *Synteza strategii*, PWE, Warszawa 2007.

⁷⁴ Hines T., 2004, *Supply Chain Strategies: Customer Driven and Customer Focused*, Butterworth-Heinemann.

⁷⁵ Bozarth C., Handfield R.B., *Wprowadzenie do zarządzania operacjami i łańcuchem dostaw*, Helion, Gliwice 2007.

⁷⁶ Konecka S., *Typologia strategii łańcuchów dostaw*, Logistyka, vol. 5/2011, p. 1093-1094.

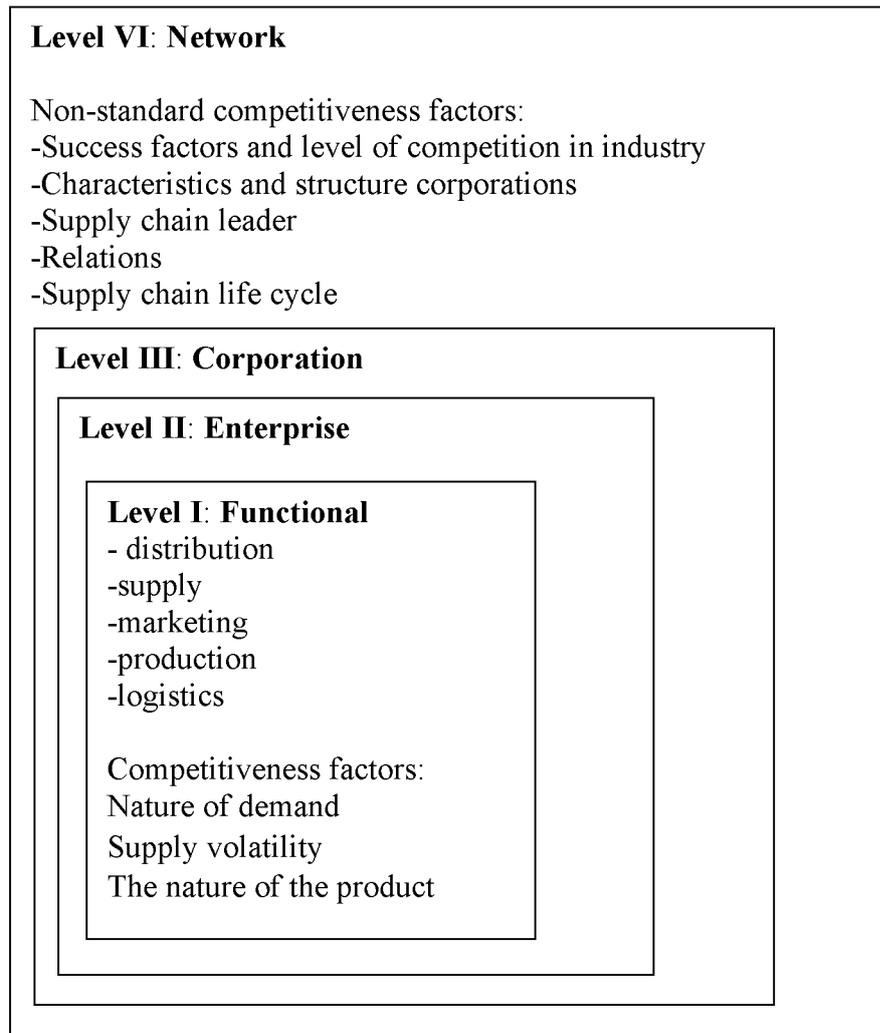


Figure 2.2. Analytical diagram of supply chain strategy factors

Source: own work based on: Konecka S., *Typologia strategii łańcuchów dostaw*, Logistyka, vol. 5/2011, p. 1094.

Five phases can be distinguished in the context of the supply chain life cycle: identification of business opportunity, selection of business partner, formation of the supply chain, operation of the supply chain, and reconfiguration of the supply chain. This is a repetitive cycle. For every new business opportunity or product line these phases spring into action, thus creating a living and dynamic supply chain. In short, a supply chain life can be separated into three stages: formation, operation and extinction. Each step is critical to the next step, even extinction is critical to the next formation and the overall success for the supply chain and the overall continuity of the business. With steadily shortened product life cycles, increasing market volatility, and currently, swift changes in the global economy, a

successful supply chain is a supply chain that is able to respond both dynamically and appropriately to the constantly changing challenges it is facing⁷⁷.

An enterprise that designs link structure and creates a strategy for value creation by links is referred to as a chain or supply chain leader. In international supply chains, this role is often played by a company competing in the global market, which has taken over strategic leadership in a business network co-created with partners such as key suppliers, key customers and other network members. Other stakeholder groups also exert influence on the network's operations, e.g. competitors, non-business entities or government institutions⁷⁸. The importance of a leader is increasing in the global reality of competition between supply chains⁷⁹.

The supply chain leader is developing cooperation relationships with network participants as well as with its stakeholders, leading to vertical integration of connections. He coordinates and manages relationships so that all partners implement a joint strategy building the competitive advantage of networks over competing systems. On the one hand, it cooperates with suppliers, ensuring long-term orders stimulating the development of their potential, including as a result of knowledge transfer, best practices and management systems. On the other hand, together with partners, it creates value for both business and individual clients⁸⁰.

In addition, the leader undertakes cooperation with non-business entities, e.g. universities, research institutes or government institutions, primarily to strengthen human capital and increase access to knowledge and intellectual value. The development of cooperation takes place through scientific research initiatives and projects with the participation of partners. It is also worth noting that the leader can enter into cooperation agreements with competitors. They favor, among others joint venture relationships in the pursuit of advanced research and development of new materials or products, investments in

⁷⁷ Solvang W.D., *A new supply chain perspective: The supply chain life cycle*, <http://www.husdal.com/2008/10/09/a-new-supply-chain-perspective-the-supply-chain-life-cycle/> (16.12.2019).

⁷⁸ Rugman A., D'Cruz J., *The Theory of the Flagship Firm*, *European Management Journal*, Vol. 15/1997, s. 403.

⁷⁹ O'Brien P.L. (2015), *Supply Chain Leaders of the Future*, Russell Reynolds Associates, <http://www.russellreynolds.com/content/supply-chain-leaders-future> (16.12. 2019).

⁸⁰ Ocicka B., *Współczesne strategie zarządzania międzynarodowymi łańcuchami dostaw*, *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, nr 283/2016, s. 63-64.

the sphere of research and development or joint submission of tenders for large-scale projects⁸¹.

The two most popular types of supply chain strategies (cited especially in Polish literature) are lean and agile. The division into these two types of supply chains is most often due to demand - its nature and products - their nature. Functional products (predictable demand) and innovative products (unpredictable demand) - each of these product categories requires a different supply chain structure, which is why determining the characteristics of the demand for products is often the first step towards developing an effective strategy for building and managing the supply chain. Products with constant predictable demand, mass, available at many different retail outlets, satisfying basic, time-constant needs are functional products. The effect of stable demand is high competition and hence low profit margins. In contrast, innovative products can provide companies with greater profits. However, they are characterized by a short life cycle, large diversity and innovative character, which makes it difficult to forecast demand⁸².

In addition, when choosing a supply chain strategy, it should be stated which function: physical function or reacting to the market mediation function, i.e. flexibility, dominates the supply chain. The physical performance function consists in processing raw materials into parts, components, finished products as well as their storage and transport. In addition, we can distinguish the type of agile supply chains on the basis of their belonging to innovative products (with unpredictable demand and short life cycles). The main goal of supply chain management is then to tailor products to individual demand, which can be achieved by planning processes in line with demand, custom assembly, mass customization or deferment strategy⁸³.

The indicated division of supply chains was limited to the criterion of demand and the resulting policy: production to stock, production or assembly to order. Information on other important elements such as strategy or information sharing is closely related to the demand management policy. This division also indicates which parts of the supply chain processes should be standardized and which should be individualized⁸⁴.

⁸¹ Ocicka B., *Współczesne strategie zarządzania międzynarodowymi łańcuchami dostaw*, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach, nr 283/2016, s. 63-64.

⁸² Konecka S., *Typologia strategii łańcuchów dostaw*, Logistyka, vol. 5/2011, p. 1095-1098.

⁸³ Konecka S., *Typologia strategii łańcuchów dostaw*, Logistyka, vol. 5/2011, p. 1095-1098.

⁸⁴ Konecka S., *Typologia strategii łańcuchów dostaw*, Logistyka, vol. 5/2011, p. 1095-1098.

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M. Christopher, H. Peck and D. Towill divide into lean and agile supply chains on the basis of demand characteristics and supply characteristics reduced to the length of the total delivery time. A pure lean supply chain strategy should be used if demand is predictable and the total delivery time is long, whereas when the total delivery time is short the best strategy is the lean chain associated with the principle of continuous replenishment. However, when the demand is unpredictable and the total delivery time is short, then the agility strategy should be used taking into account its most obvious form - Quick Response. The indicated authors also mention the third type of supply chain - hybrid, because it combines the features of lean and agile in literal translation can be called "lean-agile" supply chain ("leagile"). It is suitable for situations where demand is difficult to predict and total delivery time is long. Then conditions arise to apply the principle of deferral⁸⁵.

H.L. Lee also drew attention to issues of the nature of supply in the division of supply chains into different types and, similarly to Fisher, he characterized the demand side by "functional products" (low demand uncertainty) and "innovative products" (high demand uncertainty). He described the supply side of the supply chain as: stable processes (here the supply uncertainty is low) and evolutionary processes (here the supply uncertainty is high). By combining the listed opportunity, Lee has distinguished four types of supply chains and their main strategic aspects⁸⁶:

- efficient - in this case, when developing a strategy, focus on economies of scale, eliminate non-value-making activities, and develop optimization tools,
- risk-hedging - here it is best to collect and share resources in the supply chain so as to reduce and share risk,
- responsive - here the strategy is characterized by mass individualization and custom production,
- agile - in terms of strategies, a combination of security strengths and reactive supply chains should be considered, their configuration should be subordinated to the following goal: to be reactive and flexible for the needs of customers, and at the same time protect against the risk of disruption or shortage by sharing stocks or other resources.

⁸⁵ Christopher M., Peck H., Towill D., *A taxonomy for selecting global supply chain strategies*, The International Journal of Logistics Management, nr 2/2006, PP. 277-287.

⁸⁶ Lee H.L., *Aligning Supply Chain Strategies with Product Uncertainties*, California Management Review, nr 44 (3)/2002, pp. 105-119.

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In connection with the consideration of supply chain strategies in the context of uncertainty and risk, supply chain strategies using risk management have also appeared in the literature. There is talk of supply chain risk management and in this context vulnerable or fragile supply chains.

D. Corsten and Chr. Gabriel, like most authors, have chosen slender and agile chains. The division was made on the basis of product structure - assembly and chemical-biological products as well as uncertainty of demand - dynamic and stable demand. Based on these two elements, two other types of supply chain strategies were identified: connected and speed. For products suitable for physical assembly and characterized by stable demand, it is proposed to use slender chains and agile chains for unstable demand⁸⁷.

Another approach was presented by T. Klas, the main advantage of this approach is that it integrates most of the aspects taken into account in other approaches. The main criteria taken into account are strategic goals on the one hand and mechanisms for coordinating the flow of information goods on the other. The strategic goals are costs and flexibility. Whereas the coordination mechanisms were first divided into forecast-based mechanisms and mechanisms based on actual demand, then they were divided into the push and pull system⁸⁸.

⁸⁷ Corsten, D., Gabriel Chr., *Supply Chain Management erfolgreich umsetzen. Grundlagen, Realisierung und Fallstudien*, Springer Verlag, Berlin 2009.

⁸⁸ Klaas T., *Logistik-Organisation. A Configurational Approach to Logistics-Oriented Organizational Design*, Deutscher Universitäts-Verlag 2002.

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3. PROJECT MANAGEMENT

3.1. Definition of the project and project management

Project management is an indispensable element of enterprises associated in the currently functioning supply chains, supporting their development. The management of logistics projects, which are a set of activities carried out by a logistics company to achieve the assumed goal set by the supply chain management, enables the improvement of many processes implemented as part of cooperation between enterprises, improving their functioning and ensuring uninterrupted flow of material and information streams, thanks to which it is possible to customize the products and services to the changing, increasingly demanding needs of customers. Changing markets of recipients somewhat initiate changes in the area of supply chain management, leading to a greater extent meeting the requirements of final recipients. Traditionally managed processes implemented by integrated enterprises under a common network may not fulfill customer requirements and also cause loss of market position in the absence of changes in management processes. That is why the important role of project management in logistics companies is more and more often noticeable. Implementation-oriented enterprises seek to treat changes that must be implemented in supply chains as individual projects, whose timely and effective implementation results in the possibility of further innovation. The adjustment of processes performed within the supply chain is conducive to the increase of the company's competitiveness on the market and effectively affects the increase of customer satisfaction. Project management is therefore an indispensable element of supply chain management by providing the opportunity to implement changes and modify processes controlled in an appropriate manner by the responsible person in the form of project manager⁸⁹.

The significant role of project management in the development of contemporary supply chains has prompted authors to focus on the issues of project management as part of this book.

The correct understanding of project management requires providing the definition of the concept and all terms related to it. The project is a set of activities, which timely completion determines the implementation of the entire project. The project is considered

⁸⁹ Pisz I., Controlling of logistics projects in Total Logistic Management no. 4, 2011, pp. 107-123.

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completed when all the activities that make up the project are completed. The projects are unique, individual activities that can be repeated or resemble operations performed in other projects. However, it is rare to implement two identical projects, because each of them can be characterized by certain individual conditions resulting largely from financial constraints or customer requirements⁹⁰.

Therefore, the project is a set of activities carried out under a predetermined schedule to meet customer requirements regarding its effects or financial results. Projects always require specifying the scope, budget and schedule as key elements in its effective implementation. The scope of the project refers to the requirements as to the quantity and quality of work to be performed. The budget can be understood as the expenditure allocated to the implementation of the project, both in monetary and temporal terms. The schedule not only specifies the duration of the entire project, but also identifies the operations required to complete the project along with an indication of their cycles and order of implementation. Each time the project must include the following elements:

- the objective and all activities to be carried out under the project,
- the start and end date of the project, together with an indication of the start and end dates of all activities included in it,
- budget amount,
- human and nonhuman resources required for the implementation of the entire enterprise, which includes money, equipment, tools, etc.⁹¹.

It should be noted, however, that the three components of the project indicated above are conditioned by an appropriate level of quality that needs to be guaranteed by project team⁹².

⁹⁰ Nagarajan K., *Project Management*, New Age International, New Delhi, 2004, p. 1.

⁹¹ Kerzner H., *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, John Wiley & Sons, New York 2009, p. 2.

⁹² Oberlender G. D., *Project Management For Engineering And Construction*, McGraw-Hill, Boston 2003, pp. 4-5.

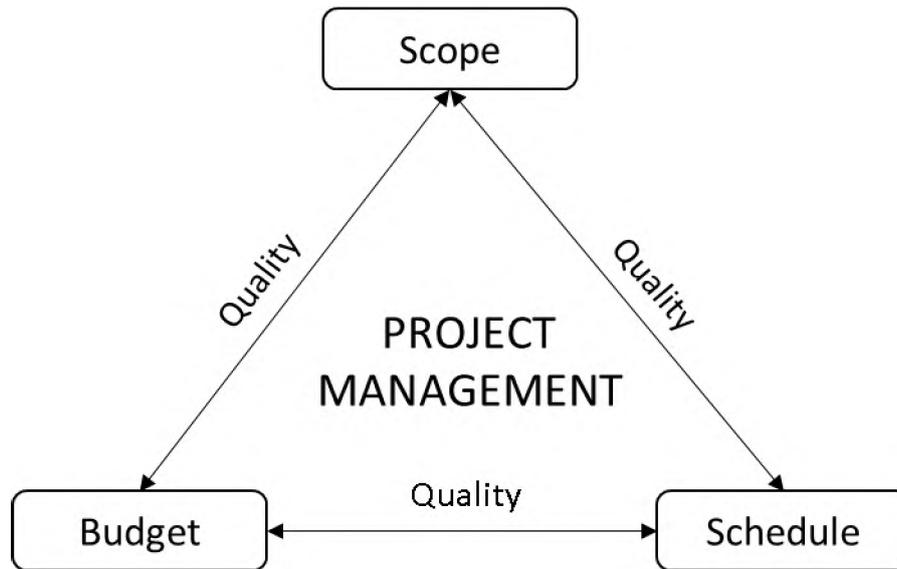


Figure 3.1. Three dimensions of the project according to its quality level.

Source: Oberlender G. D., *Project Management For Engineering And Construction*, McGraw-Hill, Boston 2003, pp. 4-5.

According to ISO 9000:2001, quality is called “the degree to which a set of inherent characteristics fulfils requirements”⁹³. So this is the degree to which specific product or service features meet the expectations of customers and process contractors. On the other hand, in the context of project management, quality refers to three out of five process groups identified below as part of the project life cycle. The first group of activities is quality planning in the project planning phase, which assumes the definition of quality standards for participants and beneficiaries of the project, and criteria used to measure quality in the project. Another group of operations requiring quality indication is the implementation of the project, which includes performance of quality assurance processes focusing mainly on providing appropriate tools and certificates guaranteeing quality management in accordance with generally binding quality standards. In the next phase, at the control stage, the quality of project management refers to the processes of performing of quality control, including measuring and verifying that the implemented project fulfills the standards indicated in the quality planning phase⁹⁴.

⁹³ Nokes S., Kelly S., *The Definitive Guide to Project Management: The Fast Track to Getting the Job Done on Time and on Budget*, Pearson Education, Harlow 2007, p. 206.

⁹⁴ Nokes S., Kelly S., *The Definitive Guide to Project Management: The Fast Track to Getting the Job Done on Time and on Budget*, Pearson Education, Harlow 2007, p. 205.

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In the literature on the subject, there is also a definition of a project referring to project objectives called SMART and formed as an acronym from the following words:

- **Specific** – the project's purposes should be specified and clearly defined so as not to mislead the user,
- **Measurable** – project purposes must be measurable, because only then can they be reliably controlled and verified,
- **Aligned** – the purposes must coincide with the organizational assumptions of the enterprise, its strategy and, above all, the clients' requirements,
- **Realistic** – purposes must be realistically achievable by the enterprise or project team,
- **Timed** – the purposes should relate to the time allocated to the project in real terms; the duration of individual activities should be estimated and the feasibility of the purposes should be verified in a given time⁹⁵.

The projects relate to various areas of the enterprise's activity, however, they are largely implemented as part of increasing the company's revenues or implementing processes of change in the functioning of entire companies or individual departments. This requires guaranteeing the necessary financial outlays and incurring significant costs by the enterprise⁹⁶.

Projects are primarily characterized by the need to achieve their purposes by integrating both tools and methodology or the involvement of project team members. It is the last factor that largely determines the effectiveness of project processes carried out due to the importance of exchanging information needed to implement individual activities between employees of the company responsible for various areas of the project being implemented. In addition to communication, which also contributes to strengthening the bond between team members, it is also necessary to involve other resources, which include, first of all, risk management, demand management, scheduling or control techniques as well as information systems. The key role in the project is performed by the manager, whose main tasks are to ensure the smooth flow of individual processes, as well as the allocation of tasks to employees and resources due to their predispositions and skills, thus ensuring a high degree of utilization of

⁹⁵ Badiru A. B., Triple C Model of Project Management: Communication, Cooperation, and Coordination, CRC Press, Boca Raton 2008, p. 51-52.

⁹⁶ Lester A., Project Management Planning and Control, Butterworth-Heinemann, Oxford 2017, p. 1.

the potential of both human and intangible resources. The project manager's role is also to monitor the project budget. Projects are usually goal-oriented⁹⁷.

Speaking of projects, it is also necessary to identify typical projects that are implemented by project units. Project types with a brief description are presented in Table 3.1.

Table 3.1. Types of projects

Project type	Characteristics
Hardware projects	A project is usually concerned with creating a “physical” product. Activities carried out under this type of project relate primarily to the implementation of buildings, e.g. storage spaces or redesigning products that are part of other products. In this case, the costs of implementing tangible elements far outweigh the costs of management.
Paper/soft projects	These projects usually refer to non-physical products related primarily to the creation of a management system or organization of processes in an enterprise. Sometimes individual models of solutions used in the management of hardware projects are also used in paper project management processes, however, a significant difference in costs is noticeable due to the complexity of the created products.
Temporary/short term projects	Projects specific in terms of the involvement of employees responsible for the project, who largely carry out individual activities as part of employee responsibilities. Projects of this type are used e.g. in the implementation of new order processing solutions or the installation of machinery or production equipment. These

⁹⁷ Harrison F. L., Lock D., *Advanced Project Management: A Structured Approach*, Gower Publishing, Ltd., Aldershot 2004, p. 6.

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	<p>projects are characterized by the use of much cheaper tools and management techniques.</p>
<p>Open projects</p>	<p>These projects are usually difficult to classify as projects subject to management processes. This is sometimes due to lack of start or end dates or the indication of clearly defined objectives due to the nature of the processes concerned. They are mainly used to conduct continuous market research, search for new markets, improve the productivity or efficiency of production, transport, storage processes, etc. Due to their characteristics, the application of techniques and principles of project management is difficult.</p>

Source: based on Woodward J. F., Construction Project Management: Getting it Right First Time, Thomas Telford, London 1997, pp. 7-9.

When talking about projects in the context of change management, special attention should be given to the project life cycle, which is a set of individual project phases, whose characteristics and duration vary depending on the type of project or the industry they concern. The most common model illustrating project phases is the four-phase project lifecycle shown in Figure 3.2.

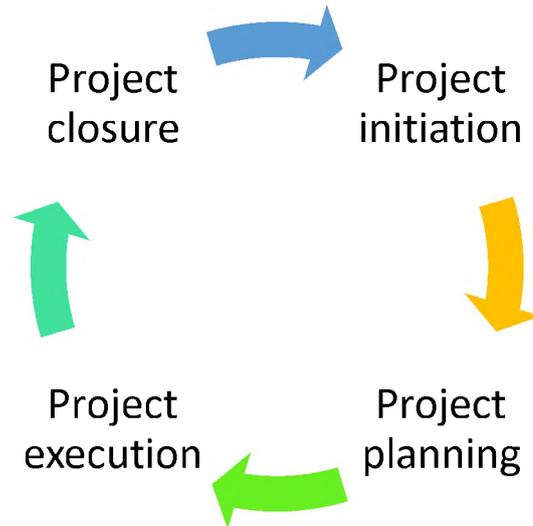


Figure 3.2. Project life cycle

Source: own work based on Panneerselvam R, Senthilkumar P., Project Management, PHI Learning Pvt. Ltd., New Delhi 2009, p. 10.

It should be noted that each project is fully adapted to the needs of the recipient and the objectives that are defined in it, and each phase contains a series of activities carried out in a specific order, which allows the implementation of the assumptions adopted at the beginning.

In addition, the project often illustrated in Figure 3.2 is enriched with a monitoring and control phase verifying the correctness of activities carried out under the project. The project life cycle illustrating the additional phase is shown in Figure 3.3.

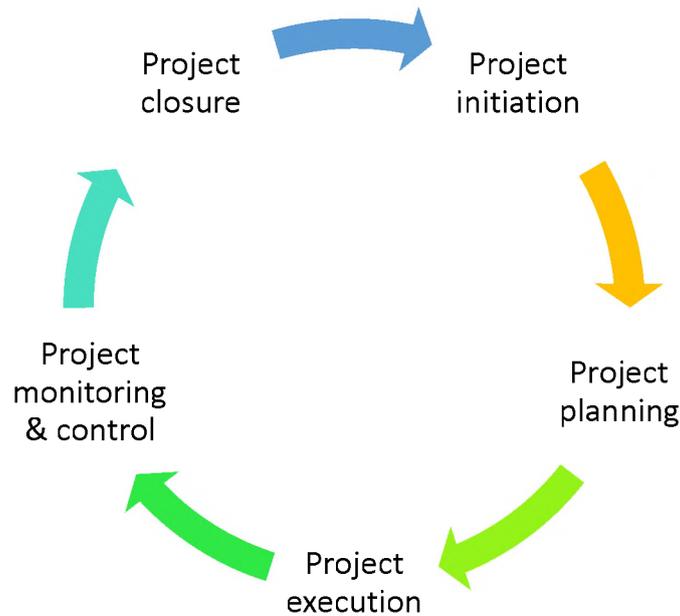


Figure 3.3. Extended project life cycle

Source: Magalhaes Pessoa C. R., Bigao Silva F., Erichsen Nassif M., *The Relationships between Project Management and Knowledge Management: Where We Can Find Project Knowledge Management in the Project Management Process* in Jamil G. L., *Handbook of Research on Effective Project Management through the Integration of Knowledge and Innovation*, IGI Global, Pennsylvania 2015, p. 135.

Project initiation involves setting project purposes, both main and ancillary, project scope and products that are at result of full project implementation. As part of this phase, it is also necessary to verify the feasibility of the project and to approve it allowing for the transition to the next phase. **Project planning** is the phase of detailing the project. It assumes the definition of individual activities to be carried out under this phase. The project planning stage assumes the division of individual tasks between teams formed for the purpose of project together with the definition of the tasks and responsibilities of each employee group. Therefore, project planning assumes the definition of all tasks to be carried out under the project together with schedules and costs of project activities and resources at the company's disposal. In addition, milestones that constitute restrictions that may delay the implementation of individual stages and, consequently, the entire project should also be identified here. **Project execution** is the phase for which the project manager is responsible in particular, controlling the implementation of individual activities in accordance with the previously created plan and schedule. In addition, the task of the manager in this phase is to

assign individual tasks to employees with appropriate qualifications to ensure the effective implementation of the tasks entrusted. Appropriate distribution of operations ensures the implementation of high-quality processes enabling the production of products according to the parameters specified in the initial phase and guaranteeing effective processing of input sources into the planned output elements. In addition, this stage requires managers to conduct progress reports in order to verify the correct implementation of individual activities relative to the activities planned in the first phase. **Project monitoring and control** assumes verification of processes carried out by individual project teams or employees. The task of the project manager at this stage is to measure and evaluate expenses incurred for individual project activities in terms of their correct implementation in the previously assumed time. Verification of individual stages carried out in the project primarily allows for proper risk assessment and identification of bottlenecks that may hinder the timely implementation of the project. **Project closure** assumes complete transfer of the final effects (products, process outputs) and full project documentation to the client and informing all interested parties, including shareholders or employees, about the project closing. At this stage, it is also necessary to free all resources used in the project to involve them in subsequent change management processes⁹⁸. In addition, three project constraints including scope, time and costs, should be also identified at this stage⁹⁹.

There are many project definitions depending on the authors and perspective we use to describe it. PMBoK® defines it as “*temporary* endeavour undertaken to create a unique product, service, or result”¹⁰⁰ whereas PRINCE2 textbook rather says, that it is a “temporary organization created for the purpose of delivering one or more business products according to an agreed business case”¹⁰¹. Whatever we would like to take as the definition, the truth is, that we separate projects from operational activity because of the main purpose – treating some initiative as the project and managing it according to project management rules increases the probability of its successful completion¹⁰².

⁹⁸ Narang R., Software Engineering—Principles and Practices, McGraw-Hill Education, New Delhi 2015.
Sudhakar G. P., Elements of Software Project Management, PHI Learning Pvt. Ltd., New Delhi 2010, p. 5-7.

⁹⁹ Sudhakar G. P., Elements of Software Project Management, PHI Learning Pvt. Ltd., New Delhi 2010, p. 7.

¹⁰⁰ Bassi A., Project Management Body of Knowledge in the Context of PMI and ISO, Knowledge and Project Management, Springer, Cham 2017, pp. 53-67.

¹⁰¹ Hinde D., PRINCE2 Study Guide: 2017 Update, John Wiley & Sons, Hoboken 2018.

¹⁰² Joslin R., Müller R., Relationships between a project management methodology and project success in different project governance contexts, International Journal of Project Management 33.6 (2015): pp. 1377-1392.

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We may therefore propose a new definition, based on the principle of risk reduction that should be known to every manager: “project is any initiative that will benefit from implementing project management rules to it”. If a company executive does not recognise project management rules as beneficial for his initiative - no project definition will help.

Without delving into methodological details, one may agree, that every initiative should have beginning and the end, which translates into at least two project stages. First stage is project set-up, which extracts initiative from operational work and should answer main questions making the initiative justified:

- What are expected benefits of the project?
- What is the aim of the project?
- What products or assets should be made as result of the projects?
- What resources (budget, team, etc.) are needed to do this?
- What are the key risks that may prevent the project from succeeding and should be managed?
- What is the expected project timeline or at least deadline if exists?
- Who is dedicated to manage the project?

All known methodologies address above question in some project initial documentation needed to start the project in a controlled way.

One may also agree, that before one finishes the project, answers to the following questions should be known:

- Has the project achieved its purposes and brought all the expected results?
- Has the project used resources within the agreed limit?
- Has the project brought the expected benefits or will they still be expected in the future thanks to the project?

All these questions should be answered at the last stage of the project, which gives the organization the possibility of a controlled completion of the project.

It also seems obvious that during the project, required work should be planned and then carried out. However, here we can find the biggest differences in the approach to project management between different standards and methodologies of project management¹⁰³.

According to the definition, project management is “the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and

¹⁰³ McCormick M., Waterfall vs. Agile methodology." MPCS, N/A 2012.

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expectations from a project”¹⁰⁴ In other words, project management is “the planning, monitoring and control of all aspects of a project and the motivation of all those involved in it, in order to achieve the project objectives within agreed criteria of time, cost and performance”¹⁰⁵. Project management can also be thought of as such activities as planning, enforcement and control over activities carried out in the enterprise or the entire supply chain that guarantee the achievement of all the objectives assumed in the project at the assumed cost, time, with the use of appropriate resources, the use of which will ensure achievement of the performance level indicated in the pre-design phase, and most importantly, guaranteeing customer satisfaction¹⁰⁶.

The main purpose of project management is to ensure the implementation of individual activities included in it, in order to timely achieve project assumptions despite random events that may delay the completion date¹⁰⁷.

The uniqueness of project management is characterized by a high degree of separation from company management. First of all, it should be pointed out here that project management refers to the management of change introduced as part of implemented projects, while company management focuses mainly on managing processes implemented in the company for a long time, and thus on their proper enforcement¹⁰⁸.

In addition, the benefits of using project management in industrial and service activities should be highlighted here. The most important advantages include:

- the ability to immediately indicate the feasibility of the project and set limits on the creation of plans,
- recognition of employees' skills and the properties of processes that are the basis for the implementation of subsequent projects,
- improvement of management procedures and implementation of individual managerial processes,
- early detection of problems,
- the option to resign from continuous progress reporting¹⁰⁹.

¹⁰⁴ Forbes D. E., *Project Management Information Systems*, Transportation Research Board, Atlanta 2000, p. 5.

¹⁰⁵ Lester A., *Project Management Planning and Control*, Butterworth-Heinemann, Oxford 2017, p. 5.

¹⁰⁶ Kerzner H., *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, John Wiley & Sons, New York 2009, p. 3.

¹⁰⁷ Harrison F. L., Lock D., *Advanced Project Management: A Structured Approach*, Gower Publishing, Ltd., Aldershot 2004, p. 3.

¹⁰⁸ Lester A., *Project Management Planning and Control*, Butterworth-Heinemann, Oxford 2017, p. 1.

¹⁰⁹ Kerzner H., *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, John Wiley & Sons, New York 2009, pp. 3-4.

It should also be mentioned that both proper planning and implementation through the implementation of projects as well as the appropriate selection of employees involved in the project and the allocation of tasks adequate to their skills seem to be crucial for the effective implementation of processes. While the issues of planning, implementation and control are strictly technical activities, the selection of employees should be based on their predispositions and skills, both hard and soft. Sometimes soft skills of the employees have a much greater impact on the effectiveness of processes implemented as part of the project, because elements such as communication, continuous exchange of information, team management or the ability to work in a group determine the effectiveness of implementing individual processes¹¹⁰.

3.2. Project manager duties

As described in Section 3.1, the effectiveness of project management processes depends primarily on proper implementation of individual phases of the project life cycle, as well as the selection of appropriate tools and methodologies used by employees with appropriate predispositions and qualifications. Project Manager is responsible for assigning tasks on the basis of skills and knowledge of how to manage changes implemented in the enterprise process environment. Project Manager is a person designated by the company responsible for implementing the project to ensure that the objectives set out in it are fulfilled. The role of a project manager can be entrusted to both an employee employed in the company and a person specially selected for these purposes who meets the requirements as to their skills and predispositions. The tasks carried out by a project manager relate primarily to the enforcement of activities and operations to ensure that the objectives and assumptions of the project are met. project manager is responsible for planning activities, allocating appropriate resources, optimal in terms of the ability to perform individual observations, ensuring the implementation of individual stages of the project by delegating resources, as well as managing risk. Risk management is performed in such a way so as to ensure that its occurrence does not cause a reduction in the quality of implemented processes, and above all does not affect the delay in implementing the entire project¹¹¹.

¹¹⁰ Lester A., Project Management Planning and Control, Butterworth-Heinemann, Oxford 2017, p. 6.

¹¹¹ Newton R., The Project Manager: Mastering the Art of Delivery, Pearson Education, Harlow 2005, p. 12-13.

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Taking into account all of the above, we may discuss the role of Project Manager and his responsibilities. Following¹¹², we may conclude, that he is personally responsible for:

- Setting-up the project, by finding responses for the questions mentioned in the section 3.1 and obtaining decisions to start the project.
- Conducting requested analyses and preparing project plan in the areas of project management knowledge mentioned in the section 3.3,
- Obtaining acceptance for project plan and managing daily project work during implementation phase,
- Confirming that project achieved its objectives and closing the project, as it was mentioned in section 3.1.

Furthermore, it is expected that Project Manager prepares and then updates on a regular basis (as long as it is requested by organization) the following managerial products:

- Project Charter or Project Brief, as the first project document requested to start the project
- Project Business Case, confirming that project has business justification
- List of Project Expected Deliverables, which defines project scope
- Project Schedule and Phase Detailed Schedules (or Time-box Plans in Agile projects)
- Procurement Plan, defining all requested procurements in the project
- Project Budget or Project CashFlow, defining project expenditures
- Project Resource Plan, which defines resources needed to conduct implementation phase
- Risk List and approach to Risk Management during the project
- Quality Plans, requested to confirm that quality of the deliverables will be achieved
- Communication Plan, that helps avoiding typical project risks coming from communication problems
- Change Management Plan, to ensure that project will be under control even when experiencing changes
- List of project stakeholders and plans for their engagement

¹¹² Bassi A., Project Management Body of Knowledge in the Context of PMI and ISO, Knowledge and Project Management, Springer, Cham 2017, pp. 53-67.
Hinde D., PRINCE2 Study Guide: 2017 Update, John Wiley & Sons, Hoboken 2018.

Since – as it was mentioned in section 3.4 - international projects are especially fragile in the communication and cultural area, it should be expected that International Logistic Project Managers have high communication, as well as cultural and change management skills. Therefore in such project much higher concentration on following management areas is expected:

- Stakeholder engagement strategies,
- Team building activities,
- Negotiations and conflict management,
- Communication plans,
- Communication and collaboration tools for virtual teams,
- Distributed decision making process,
- Coaching and training plans for future users of project deliverables,
- Resistance management.

Most of the activities from the areas above depend on project manager's knowledge, as well his or her mind-set and soft skills. This is impossible to be defined by a set of sequential steps described in the procedure. Therefore, as one of the most important factors determining project success, one should carefully consider selection of a project manager rather than introducing a detailed company's project management procedure.

3.3. Classical versus agile approach

In the classical approach (sometimes called “waterfall approach”) works should be planned and then carried out. This is where the next project phases take their name from: Planning and Implementation. This approach works best for non-innovative projects, where it is possible to well define expected project outcomes, project environment is stable and the main challenge is to do the work known in advance¹¹³.

The traditional approach to project management focuses primarily on the implementation of the project based on the life cycle that was presented and defined at the beginning of this chapter. Therefore, classic project management is carried out in five stages,

¹¹³ Spalek S., Traditional vs. Modern Project Management Methods. Theory and Practice. Smart and Efficient Economy: Preparation for the Future Innovative Economy, 21st International Scientific Conference, 2016.

among which there are: starting work on the project, project planning, implementation, control and monitoring of the project as well as the project closing phase.

In this approach we expect that main planning work to be done right after project set-up, which makes project more predictable and simplifies measure of the project work progress during the implementation phase. However, in VUCA worlds this approach is becoming more and more impossible to apply¹¹⁴.

Before commencing the actual work, the project plan should be approved, which is an agreement to its implementation. Thanks to the above approach, during the implementation phase most of the project manager's work is to manage deviations from the originally accepted plan.

In agile approach no one expects the work plan to be known in advance¹¹⁵. This approach has obvious advantages for innovative projects or for projects implemented in unpredictable, rapidly changing environments. In contrast to the classical approach, agile methodologies propose to produce products in cycles, consisting of continuous planning and implementation of work, striving for the final solution by the method of small increments.

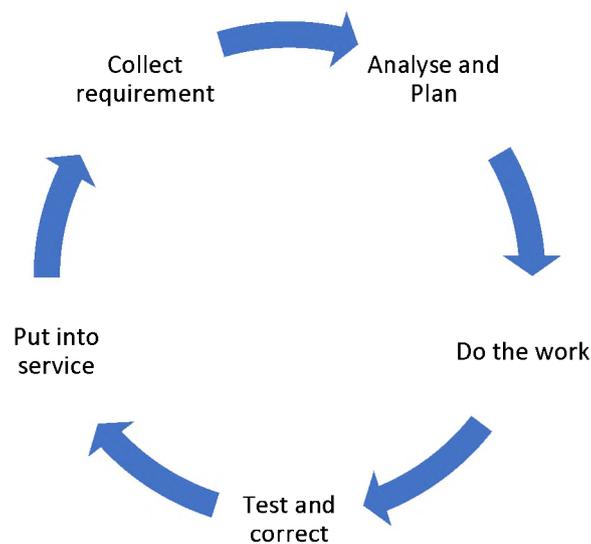


Figure 3.4. Agile project cycle

Source: Camilleri E., *Project success: critical factors and behaviours*, Routledge, London 2016.

¹¹⁴ Svejvig P., Andersen P., Rethinking project management: A structured literature review with a critical look at the brave new world. *International Journal of Project Management* 33.2/2015, pp. 278-290.

¹¹⁵ Rasnacis A., Berzisa S., Method for adaptation and implementation of agile project management methodology. *Procedia Computer Science* 104/2017, pp. 43-50.

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It is noteworthy that agile methodologies put great emphasis on teamwork, knowledge, collaboration, communication and human factor. This is in line with critical success factors for successful projects resulting from many scientific research in project management subject¹¹⁶.

In agile projects, instead of managers and workers there is rather expected work organization based on self-managed and empowered, well-communicated and built teams, where classical team manager works in the role of servant leader. Such approach becomes crucial especially in the context of multicultural, international projects which have a high risk associated with teamwork.

Comparing the traditional and agile approach to project management, it should be noted that the classic approach refers to the achievement of objectives in accordance with a strictly defined order, thus, referring to the plan established in consultation with the client and specialists in specific fields. Clear and transparent framework and requirements for the project mean that its course, assuming that it is carried out in accordance with predetermined stages, will bring the expected results. Therefore, it is characterized by a high degree of certainty, however, at the same time, by the low flexibility in introducing changes during its implementation, which should be considered its weakness. In the case of the agile approach, which is based on the principles of agile management, the purpose is to eliminate all those activities that are ineffective for the client from the point of view of process implementation, i.e. they do not guarantee added value. Therefore, one should focus only on processes valuable from the point of view of the recipient, which at the same time will guarantee the effective implementation of individual elements of the project. In addition, it should be pointed out that agile project management is an approach mainly used in variable design environments where the ability to predict market scenarios is limited. Therefore such a project is required to make changes almost in real time ensuring thereby timely implementation of the process¹¹⁷. Table 3.2 shows differences between the traditional and agile approaches in detail.

¹¹⁶ Camilleri E., *Project success: critical factors and behaviours*, Routledge, London 2016.

Janssen M., Van Der Voort H., Fleur van Veenstra A., *Failure of large transformation projects from the viewpoint of complex adaptive systems: Management principles for dealing with project dynamics*, *Information Systems Frontiers* 17.1/2015, pp. 15-29.

¹¹⁷ Meredith J. R., Mantel S. J., Shafer S. M., *Project Management: A Managerial Approach*, John Wiley & Sons, Hoboken 2017, p. 209-211.

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Table 3.2. Comparison of Agile and Traditional Project Management Approach

DIMENSION	AGILE PROJECT MANAGEMENT	TRADITIONAL WATERFALL APPROACH
Planning	Short-term plans that are adjusted as project progresses	Attempts to stick to long-term plans made in advance
Client involvement	Throughout the project	Beginning and end of project
Project execution	Broken down into incremental stages called iterations or sprints	Work completed based on a comprehensive and highly structured plan
Communication	Open, frequent (daily) communication among stakeholders encouraged	Mainly for project control
Feedback on results	At the end of each iteration	At the end of the project
Work structure	Integrated cross-functional team	Team members tend to work independently and rely on project manager to coordinate tasks
Project leadership	Self-managed teams with project manager as facilitator of the process	Project manager allocates work to team members and controls the process
Team member feedback	Open communication encouraged by all team members	Feedback typically provided confidentially by project manager
Process ownership	Team	Project manager
Experimentation	Encouraged to identify ways to best meet customer requirements	Discouraged in order to meet project deadline and stay on budget
Scope	Flexible	Rigid
Change	Welcome and expected part of project	Resisted and often requires formal change order request
Priorities	Customer is top priority followed by team and then scope	Schedule is top priority followed by scope and then team
Measures of success	Agile Triangle: value (extrinsic quality), quality (intrinsic quality), constraints (cost, schedule, and scope)	Iron Triangle: cost, schedule and scope

Source: Meredith J. R., Mantel S. J., Shafer S. M., Project Management: A Managerial Approach, John Wiley & Sons, Hoboken 2017, p. 210.

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When comparing traditional and agile approaches to project management, reference should also be made to methodologies and standards of project management most commonly used by project managers. The most commonly used project management standards used as part of the traditional approach include PMI (PMBOK) and PRINCE2, while the SCRUM standard is most often used as part of the agile approach.

PMBOK standard (Project Management Body of Knowledge) defined by the American Organization Project Management Institute, is one of the most commonly used standards in project management. It defines both processes, tools and techniques that should be implemented on the way to effectively achieve project objectives¹¹⁸. This standard is updated on an ongoing basis by the Project Management Institute, thus remaining competitive on the market of project management standards. Furthermore, “PMBOK defines the project management as five basic process groups and nine knowledge areas that are elements of almost all projects. Applicable to projects, programs, portfolios, and operations, these concepts have become a framework for effectively launching and executing IT-related and other projects”¹¹⁹.

The PMBOK standard assumes the implementation of five stages indicated in the project life cycle, which include: **project initiating**, mostly includes purposes and budget defining, **planning**, providing the initial and ending date of the whole project and every activity, allocating resources to each task, **executing**, performing the processes which had been planned at the previous stage using allocated resources (staff, tools etc.), **controlling**, monitoring if the key processes and objectives were reached during the project execution, **closing**, summarizing the project and its results in a report and providing effects to the customer¹²⁰.

According to PMBOK, a developed project plan should address following project knowledge areas¹²¹:

- Scope management – ensure the project work includes all elements required to complete the work scope,
- Schedule management – ensure the project work will be completed in a timely way
- Cost management – address project finances,

¹¹⁸ Project Management Institute, PMBOK® Guide – Fourth Edition, Project Management Institute Inc., Pennsylvania 2013, p. 13.

¹¹⁹ Moeller, R. R., Executive’s Guide to IT Governance, Wiley, Hoboken 2013, p. 278.

¹²⁰ Moeller, R. R., Executive’s Guide to IT Governance, Wiley, Hoboken 2013, p. 278.

¹²¹ Kerzner H., Project Management: A Systems Approach to Planning, Scheduling, and Controlling, John Wiley & Sons, New York 2009.

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- Quality management - ensure that project output is delivered with requested quality
- Resource management – secure, manage and monitor use of resources,
- Communications management – ensure communications on the project are planned and carried out appropriately,
- Risk management – identify, analyze and manage project risk,
- Procurement management – carry out purchasing and contracting,
- Stakeholder management – identify and engage project stakeholders,
- Integration management – coordinate activities across all knowledge areas.

According to other methodologies¹²² one could also add the following areas that should be planned:

- Benefit management – ensures that project benefits are under control,
- Requirements management – ensures that all requirements are collected and addressed,
- Project governance – ensures that work execution and decision making process meets the specifics of the project.

The PRINCE2 (Projects In Controlled Environments) standard is frequently used as an alternative to the PMBOK standard, which require a higher degree of command and orientation in project management controlled by senior management rather than only by a project team set up for this purpose¹²³. The PRINCE2 standard assumptions are also based on the project life cycle, however, it defines eight main groups of processes implemented as part of the project and 45 groups of subprocesses. The major groups include:

- Starting up a Project,
- Initiating a Project,
- Planning a Project,
- Managing Project Delivery,
- Controlling a Stage,
- Managing Stage Boundries,
- Directing a Project,

¹²² Joslin R., Müller R., Relationships between a project management methodology and project success in different project governance contexts, *International Journal of Project Management* 33.6/2015.

¹²³ Moeller, R. R., *Executive's Guide to IT Governance*, Wiley, Hoboken 2013, p. 280.

- Closing a Project¹²⁴.

Project management based on the PRINCE2 standard is shown in Figure 3.5.

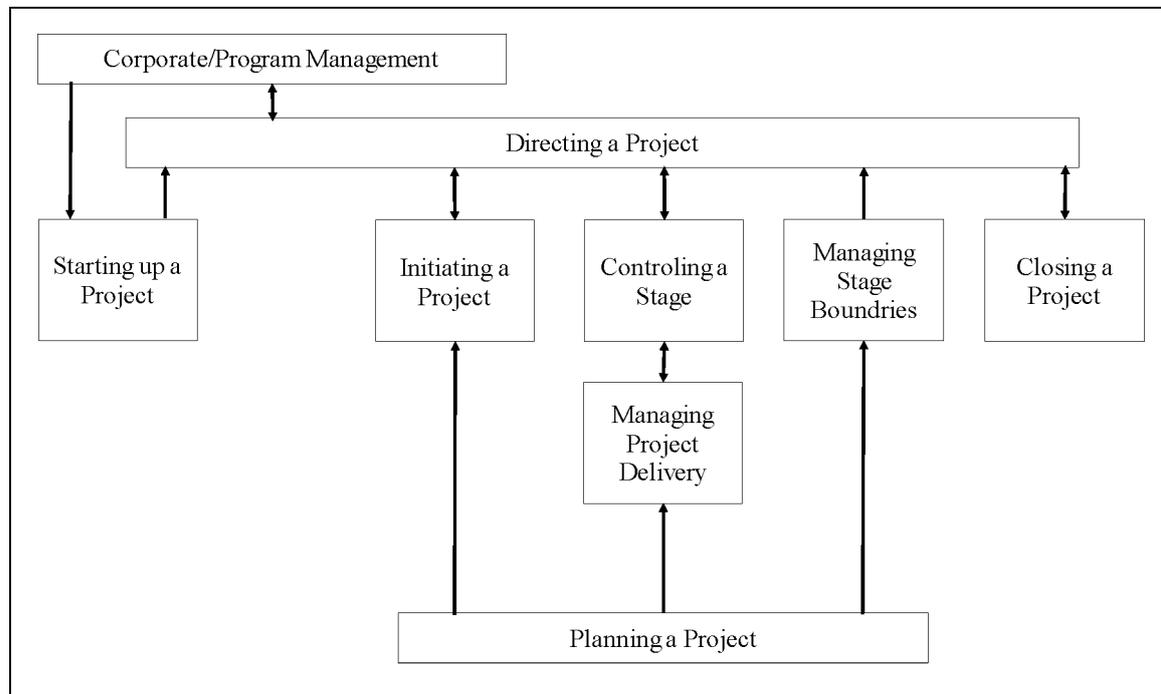


Figure 3.5. Project Management Process Using PRINCE2

Source: Moeller, R. R., *Executive's Guide to IT Governance*, Wiley, Hoboken 2013, p. 282.

In addition, as part of applying the PRINCE2 standard, it is possible to use various techniques, leaving to the user the choice of the model, however, the most commonly used methods are:

- Product-based planning,
- Change control,
- Quality review.

Product-based planning begins the management process, allowing the use of the standard planning process framework for other types of projects. This technique involves

¹²⁴ Silvius G., *Sustainability in Project Management Processes* in Silvius G., Tharp J., *Sustainability Integration for Effective Project Management*, IGI Global, Pennsylvania 2013, p. 63.

indicating product requirements, stages of its implementation, as well as its content. The scope of work associated with the implementation of the project allows for the indication of quality standards and ways of controlling them. Specific standards and requirements for project results also require the use of appropriate techniques and models of change management, whose effective use will allow project objectives to be achieved¹²⁵.

The last methodology described is SCRUM, which is used in agile project management. The advantage of this technique is the possibility of utilizing it in the project at every stage of the project.

The structure of SCRUM is shown in Figure 3.6.

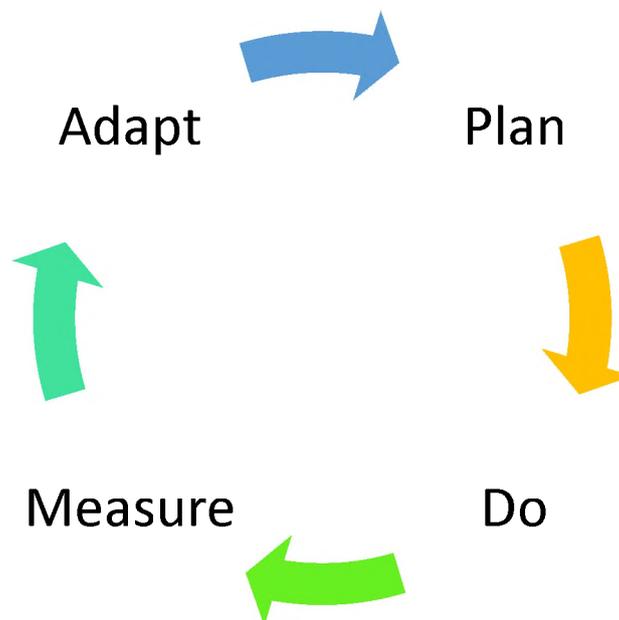


Figure 3.6. The Scrum framework

Source: Cole R., Scotcher E., *Brilliant Agile Project Management*, Pearson, Harlow 2015, p. 88.

As part of the planning process, it is necessary to carry out operations related to updating the backlog and conducting a sprint planning meeting, in which it is necessary to identify current problems and plan actions to compensate for them and prevent their occurrence. The implementation of processes as part of agile project management assumes daily work based

¹²⁵ Great Britain. Office of Government Commerce, *Managing Successful Projects with PRINCE2*, The Stationery Office, London 2002, p. 17-18.

on plans declared in the previous phase. At the measurement stage, it is necessary to verify work progress and possible use of additional resources required for the timely implementation of the project. In the adapt phase, it is necessary to implement the project and verify the applied actions in order to develop more effective methods by both employees as well as the project manager¹²⁶.

The main rule of the SCRUM standard is frequent repetition of activities illustrated in Figure 3.6, which guarantees not only leveling of errors appearing in the project implementation processes, but also adjusting the project to the needs of the recipient during its implementation, which translates into much more accurate adaptation to the consumer's requirements¹²⁷. SCRUM, combining the principles of both lean and agile management, is not in itself a management tool, but it only sets the framework that should be used when implementing projects. This standard adapts very quickly to the environment, which allows for much faster decision making and reacting to emerging issues¹²⁸.

3.4. Introduction to International Project Management

When defining international project management, it is necessary to indicate the importance of an international project constituting a multicultural undertaking related to the implementation of objectives and principles, under which integrated project teams from different countries, characterized by many cultural premises, apply processes jointly. This, in turn, results in the development of a common product or service¹²⁹. While international projects do not differ from traditional projects in terms of the phases or techniques described at the beginning of this chapter, one of the biggest differences between traditional projects and international projects is the level of complexity of international projects that far exceeds the scope of projects focusing on implementation in one country. It should be noted here that the use of ready-made tools developed for the needs of national projects may be inefficient due to the fact that the scope of their activities is too small and the skills of individual employees responsible for the implementation of individual processes are insufficient¹³⁰.

¹²⁶ Cole R., Scotcher E., *Brilliant Agile Project Management*, Pearson, Harlow 2015, p. 88

¹²⁷ Pries K. H., Quigley J. M., *Scrum Project Management*, CRC Press, Boca Raton 2011, p. 15.

¹²⁸ Cole R., Scotcher E., *Brilliant Agile Project Management*, Pearson, Harlow 2015, p. 89.

¹²⁹ Köster K., *International Project Management*, SAGE, London 2009, p. 12.

¹³⁰ Lientz B., Rea K., *International Project Management*, Academic Press, London 2003, p. 3-4.

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In order to verify the differences between standard and international projects, it is necessary to briefly characterize international projects, as presented in Table 3.3.

Table 3.3. Characteristics of international projects

Characteristics of international project	Description
Complexity	The complexity of international projects relates directly to the geographical location of shareholders and project participants, their cultural differences, difference of interests, a very large number of processes carried out both as part of a single enterprise and between cooperating links in the supply chain. A high level of complexity also hinders communication in the project.
Risk	International projects are characterized by a high degree of risk resulting primarily from the high degree of project complexity. Both the complexity, as well as huge financial outlays that usually accompany international projects, increasing their rank, are burdened with a high degree of uncertainty as to the timely implementation of certain stages of the project or their financing.
Uniqueness	The uniqueness of the project is primarily due to the implementation of the project in many countries with different economic systems. Their uniqueness also results from the definition of purposes as well as the activity and number of enterprises involved in the implementation of the project.
Diversity	The greatest diversity here concerns the level of education, national culture and professions performed by individual units.
Dynamics	Due to the greater complexity and scope of the international project, one should take into

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	account a higher probability of unforeseen situations that may significantly affect the degree of implementation of individual activities and, consequently, the entire system.
Limited Resources	The greater the scope of the project, the greater the number of appropriate resources that should be implemented in the project. This is associated with an increase in expenditure, consumption of material and human resources. Sometimes the selection of resources is conditioned by additional restrictions, in particular the level of language proficiency.

Source: Köster K., International Project Management, SAGE, London 2009, p. 16-19.

The most important differences between standard and international projects, which are due to several characteristic dimensions describing the projects, are given in Table 3.4.

Table 3.4. Comparison Summary of Standard and International Projects

Attribute	Standard Projects	International Projects
Organizations	Single	Multiple organizations and departments, each with their own self-interest
Systems and technology	Homogeneous	Multiple systems that require local knowledge and support

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Society	Single and common culture	Multiple, varied cultures
Company culture	Single	Variations in each area due to local factors and history of the firm in each location
Organization	Can be focused on the project	Many other competing demands for resources
Self-interest	More easily understood	More complex to understand
Regulations	Understood and known	Harder to understand; more subject to interpretation

Source: Lientz B., Rea K., *International Project Management*, Academic Press, London 2003, p. 10

When it comes to cooperation across borders and cultures, one should expect many new risks which may cause a project to fail. Divergent business and political goals of organizations participating in the project, as well as different levels of their maturity in project management constitute an additional problem. It becomes necessary to develop a common platform and standards for planning, control, reporting and even such mundane matters as various templates used in the project documentation. According to Zein¹³¹ such project environment, in addition to high project management skills, also requires tremendous sensitivity to cultural differences and understanding various styles of behavior, thinking, and acting in particular cultures.

¹³¹ Zein O., *Culture and project management: managing diversity in multicultural projects*. Routledge, London 2016.

Huang J., The challenge of multicultural management in global projects, *Procedia-Social and Behavioral Sciences* 226/2016, pp. 75-81.

Browne W. et al., Two Key Success Factors for Global Project Team Leadership: Communications and Human Resource Management, *Journal of Information Technology & Economic Development* 7.2/2016.

For such demanding environment there is a need to dive into the psychological aspects of project management¹³² and use tools and techniques far beyond standard project management methodologies. Most of such projects are indeed programs¹³³ requiring many new competences from those responsible for management. It also seems obvious now that in such large, multicultural projects we have to combine psychological aspects related to change management with project management skills¹³⁴ across organizations and borders.

From project failure cases¹³⁵ we may see that most of the problems, even in local projects, are related to the human factor, communication, conflicts, collaboration and other areas called *soft skills*. These skills are currently recognized as part of the project manager competency model and their meaning for projects was acknowledged years ago. But does it mean that companies teach project managers how to communicate or collaborate? It appears to be an obligatory task for every enterprise, at least before large international projects.

It is easy to understand why so many international projects fail to bring expected benefits or do not follow the original plans. And at the same time, it is hard to understand why so many logistics companies, despite the awareness of an increasingly dynamic environment, do not develop their project organizations and strive for project management maturity¹³⁶.

Management Of International Logistics Projects

Logistics is just one of many industries that has to adapt to the VUCA world . Volatility, uncertainty, ambiguity, and complexity will be the most important words in the upcoming decades, forcing managers to implement changes as the response to the rapidly changing environment.

The best method to prepare an organization for changes is to adopt project management rules as an organized, methodical way of implementing changes. In the following parts of this

¹³² De Mascia S., Project psychology: using psychological models and techniques to create a successful project, Routledge, London 2016.

¹³³ Levin G., LeRoy Ward J., Program management complexity: A competency model. Auerbach Publications, 2016.

¹³⁴ Hornstein H. A., The integration of project management and organizational change management is now a necessity, International Journal of Project Management 33.2/2015, pp. 291-298.

¹³⁵ Camilleri E., Project success: critical factors and behaviours, Routledge, London 2016.

Anthopoulos L. et al., "Why e-government projects fail? An analysis of the Healthcare. gov website, Government Information Quarterly 33.1/2016, pp. 161-173.

Alami A., Why do information technology projects fail?, Procedia Computer Science 100/2016, pp. 62-71.

Vahrenkamp R., Logistic Consulting Berlin, 25 Years City Logistic: Why failed the urban consolidation centres?, European Transport/Transporti Europei 60.4/2016, p. 6.

¹³⁶ Ogonowski P., Madziński M., Project management maturity in companies operating on Polish logistics market, LogForum 15.2/2019.

section the authors will attempt to briefly describe the idea of project management in the logistic industry.

Projects In Logistics Companies

Projects are not a new idea. We have been implementing projects since ancient times. However in the last sixty years we have made great progress in the scientific description of what a project is and how it should be conducted. However, there are great differences among industries and companies in the level of project management rules adaptation¹³⁷. The logistics industry is rather process oriented¹³⁸, since supply chains are built around repetitive business activity. Therefore, for most logistics companies, project management will be some additional activity, perceived as something that is not the main part of the core business. Something that really forces logistics companies to implement project management rules is the need to implement new organization, new technology, new service or any other “new thing”. VUCA world seems to provide a good description of the set of reasons why, suddenly, a process-oriented company has to do something really new.

Organizations, like humans, learn from mistakes¹³⁹ so we may expect that a true need for project management rules in a logistics company will come after some important project failures. An alternative solution may be the recruitment of an experienced executive, who had already seen such failures in a previous company, and does not want to see a similar situation in the present one. Whatever the reason, one of the first things that such a company will need to do, will probably be deciding which of its activity should be understood as project and conducted according to project management rules.

International Logistics Projects – Management Maturity Issue

Combining everything that has been described so far, we get a picture of the complexity of the issue of international logistics projects and it seems to be a matter of management maturity of the company. A well organized company has to be able to perform systemic implementation of changes, especially in the world that brings more and more challenges every day. One may even put forward the theory that an efficient implementation

¹³⁷ de Carvalho M. M., Alves Patah L., de Souza Bido D., Project management and its effects on project success: Cross-country and cross-industry comparisons, *International Journal of Project Management* 33.7/2015, pp. 1509-1522.

Pennypacker J. S., Grant K. P., Project management maturity: An industry benchmark, *Project Management Journal* 34.1/2003, pp. 4-11.

¹³⁸ Marchesini M. M. P., Chicarelli Alcântara R. L., Logistics activities in supply chain business process: A conceptual framework to guide their implementation, *The International Journal of Logistics Management* 27.1/2016, pp. 6-30.

¹³⁹ Serrat O., *Building a learning organization*, Knowledge solutions, Springer, Singapore 2017, pp. 57-67.

of the project organization can constitute a significant competitive advantage over other companies on the logistics market¹⁴⁰.

Let us at the end summarize challenges standing behind logistics market. Anticipating deep and complex changes in the logistics industry, some authors even define idea of Logistics 4.0¹⁴¹. In the next years one may expect tremendous number of projects influenced by the existence of such trends like: the Internet of things, high need for transparency, electric vehicles, autonomous vehicles, integrity control in the supply chain, drones, smart city logistics, and many, many others.

Project management in global, turbulent market is slowly becoming a “must-have” competency¹⁴². Some studies even show¹⁴³ that project management should be perceived as the enabling and most important way for successful company strategy implementation. In the light of present scientific knowledge it is hard to believe that an organization that wants to adapt to rapidly changing business reality can do it without the help of methodical project management and continuous improvement of its maturity in this area.

3.5. Other elements of project organization

Aside from the rules of project management and the skills of the employees in the field of project management, it is also advisable to mention two crucial elements of project organization needed to achieve high maturity in the area of project management. These are: project management office (PMO) and project management software.

PMO is an organizational unit responsible for the implementation and supervision of the project organization performance¹⁴⁴. Its daily tasks include, among others:

- ensuring the operation of project management rules across the organization,

¹⁴⁰ Jugdev K., Thomas J., 2002 Student Paper Award Winner: Project Management Maturity Models: The Silver Bullets of Competitive Advantage?, *Project management journal* 33.4/2002, pp. 4-14.

¹⁴¹ Barreto L., Amaral A., Pereira T., Industry 4.0 implications in logistics: an overview, *Procedia Manufacturing* 13/2017, pp. 1245-1252.

¹⁴² Schelini Spinelli A. L. et al., Project management as a competitive advantage for the internationalization of Brazilian companies, *Internext* 12.3/2017, p. 1.

Kerzner H., *Project management best practices: Achieving global excellence*, John Wiley & Sons, Hoboken 2018.

Kim S-C, Jae-Sung L., Kyu-II S., The impact of project management assets on the VRIO characteristics of PM process for competitive advantage, *International Journal of Productivity and Quality Management* 15.2/2015, pp. 153-168.

¹⁴³ Schelini Spinelli A. L. et al., Project management as a competitive advantage for the internationalization of Brazilian companies, *Internext* 12.3/2017, p. 1.

¹⁴⁴ Kaul, P., Joslin R., *Understanding PMO Success*, 2018.

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- optimizing project portfolio,
- being responsible for business benefits of projects,
- ensuring organizational learning from project lessons and mistakes,
- reporting periodically to project management,
- making recommendations for project managers in the area of project management standards and best practices,
- selecting and optimizing project management methodologies,
- ensuring the availability of tools, document templates, and expert knowledge required in projects,
- supporting project managers in the following areas: organization of meetings, projectors, meeting notes, library of project documentation, etc.

The above list does not exhaust PMO's responsibilities. Recent research in this area¹⁴⁵ indicates the growing role of PMO in an increasingly dynamic project environment, where PMO takes over many tasks by actively supporting the process of managing the portfolio of projects, education and even supporting innovation processes in the organization, which are generators of ideas for new projects.

The last factor to consider is project management software. There is a lot of ways how project management software tools may impact daily project management work¹⁴⁶, ranging from simple support in the schedule, by establishing tasks to extended functions supporting project resource management, project portfolio, investment management and even the innovation process.

Unfortunately, there is no uniform standard of files or documentation templates for project management, which obviously causes problems with cooperation in the case of projects implemented by many organizations using different software. However, research in this area¹⁴⁷ clearly shows a positive correlation between the use of project management software and the effectiveness of project managers and other people involved in project implementation.

¹⁴⁵ Aubry M., Project management office transformations: Direct and moderating effects that enhance performance and maturity, *Project Management Journal* 46.5/201, pp. 19-45.

¹⁴⁶ Liberatore M. J., Pollack-Johnson B., Factors influencing the usage and selection of project management software, *IEEE transactions on Engineering Management* 50.2/2003, pp. 164-174.

¹⁴⁷ Ali B., Saeed A., Anbari F. T., Money W. H., Impact of organizational and project factors on acceptance and usage of project management software and perceived project success, *Project Management Journal* 39.2/2008, pp. 5-33.

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- [56] Svejvig P., Andersen P., Rethinking project management: A structured literature review with a critical look at the brave new world. *International Journal of Project Management* 33.2/2015.
- [57] Vahrenkamp R., Logistic Consulting Berlin, 25 Years City Logistic: Why failed the urban consolidation centres?, *European Transport\Transporti Europei* 60.4/2016.
- [58] Woodward J. F., Construction Project Management: Getting it Right First Time, Thomas Telford, London 1997.
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4. LOGISTICS MANAGEMENT

4.1. Logistics processes, systems and subsystems

4.1.1. Supply subsystem

Logistics is very often defined as concept composed of seven conditions which need to be fulfilled in order to ensure effective customer service (known as 7R's of logistics), which are:

- **Right product.**
- **Right place,**
- **Right time,**
- **Right quantity,**
- **Right condition,**
- **Right customer,**
- **Right price¹⁴⁸.**

Logistics can also be defined as a “(...) movement of goods from customer's order to their final consumption or use by the customer. It involves planning, implementing and controlling the efficient, cost-effective flow of materials or services (and related information) from the point of origin to the point of consumption by the customer.”¹⁴⁹ Logistics relies on effective planning, organization and implementation of the processes of moving goods from the source of origin to the place of final consumption, including all processes that add value to the products or services provided.

Logistics system is described as “(...) all the functional activities determining the flow of materials and information, but also the infrastructures, means, equipment and resources that are indispensable to the execution of these activities.”¹⁵⁰ Logistics system “(...) controls and enables the realization of “flow” of materials, information and finance.”¹⁵¹ The logistics system covers both different facilities of an enterprise, between which transport processes

¹⁴⁸ Swamidass P.M. (ed), *Encyclopedia of Production and Manufacturing Management*, Springer, Boston 2000, p. 684.

¹⁴⁹ Voortman C., *Global Logistics Management*, Juta and Company Ltd, Cape Town 2004, p. 13.

¹⁵⁰ Ghiani G., Laporte G., Musmanno R., *Introduction to Logistics Systems Management* 2nd edition, Wiley, Chichester 2004, p. 2.

¹⁵¹ Malindžák D. et al., *Design of Logistic Systems (Theory and Applications)*, Open Science Publishers, New York 2015, p. 11.

are carried out as well as suppliers and recipients of the transported products or services. Its main goal is to integrate all processes in such a way so as to deliver products or services to them in the shortest possible time and at the lowest price and still be able to make profit¹⁵².

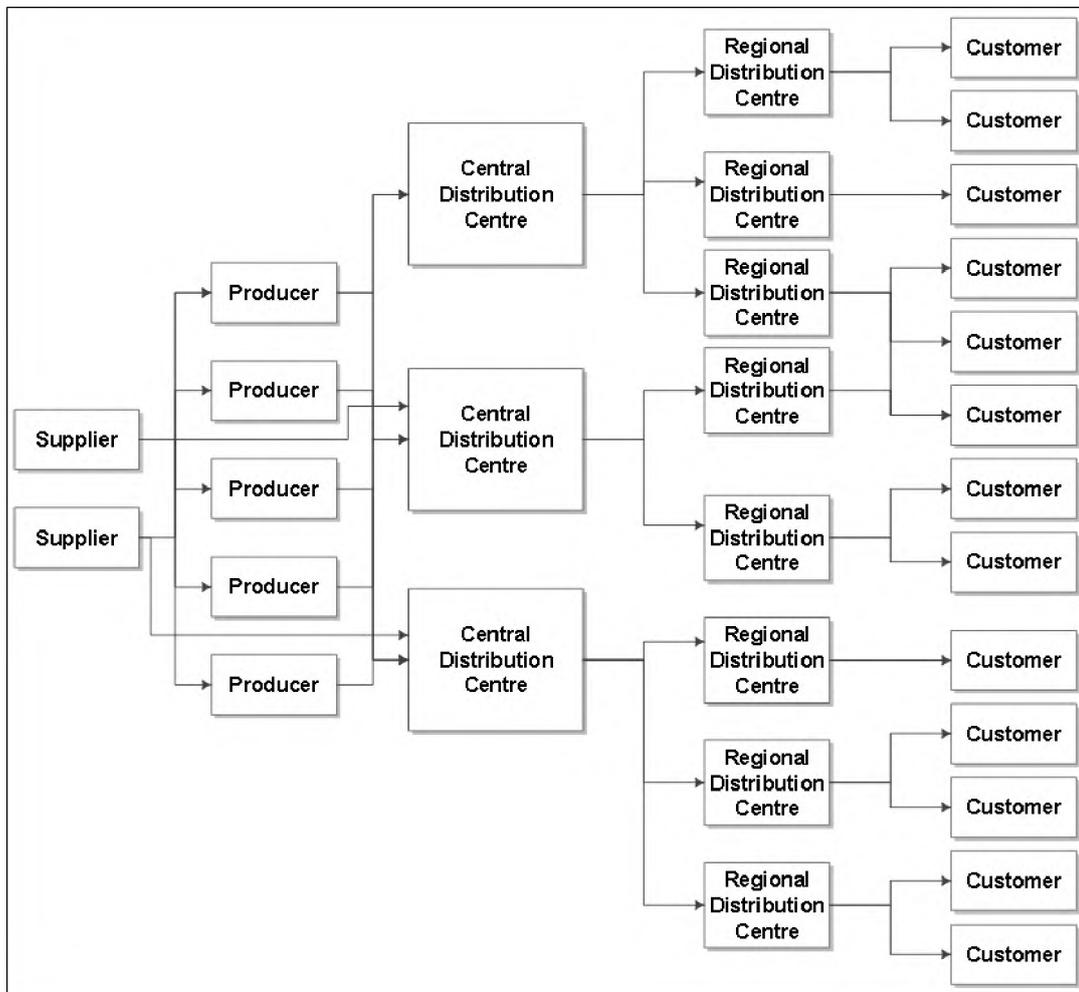


Figure 4.1. Exemplary logistics system

Source: Ghiani G., Laporte G., Musmanno R., Introduction to Logistics Systems Management 2nd edition, Wiley, Chichester 2004, p. 2.

According Owens and Warner two types of logistics systems can be distinguished ¹⁵³:

- push system – is assumed that all processes fulfilled within this system are performed on the basis of previously prepared schedules and implemented regardless of whether

¹⁵² Owens R. C., Warner J. T., Concepts of Logistics System Design, DELIVER, Boston 2003, p. 3.

¹⁵³ Owens R. C., Warner J. T., Concepts of Logistics System Design, DELIVER, Boston 2003, p. 5.

there is a need for a given process at the exact time. The push system is demand-driven¹⁵⁴. It is also known as MTS system (make-to-stock), in which all decisions regarding the fulfillment of processes are made on the basis of forecasts and pre-determined plans¹⁵⁵.

- pull system – it indicates that all processes fulfilled within the system are carried out on the basis of orders, and the last link in the chain or the last work station in the production system initiates the process of the preceding cell or position. The system is based on the assumption of the Just in Time concept¹⁵⁶. The pull system is consumption-controlled. It is also referred to as MTO (make-to-order), in which the process is initiated by the order from the customer or the next link in the supply chain¹⁵⁷.

In addition, the notion of a logistics system also includes the concept of MTA (make-to-assemble). In this case, with a view to obtaining accessibility, semi-finished goods are manufactured in accordance with push strategy, while their final assembly is carried out on the basis of pull strategy¹⁵⁸.

This chapter also provides a brief outline of the characteristics of logistics subsystems including: procurement subsystem, production subsystem, distribution subsystem, as well as reverse logistics¹⁵⁹.

The **purchasing subsystem** function is aimed at managing the company's purchasing processes that ensures, above all, the availability of all activities required for the production or distribution processes. In the logistics phase division, the purchasing subsystem will be considered as **purchasing logistics**, sometimes also called **procurement logistics**¹⁶⁰.

¹⁵⁴ Harrison A., van Hoek R., Logistics Management and Strategy. Competing through the supply chain 3rd edition, Pearson, Harlow 2008, p. 184.

¹⁵⁵ Ghiani G., Laporte G., Musmanno R., Introduction to Logistics Systems Planning and Control, Wiley, Chichester 2004, p. 4.

¹⁵⁶ Malindžák D. et al., Design of Logistic Systems (Theory and Applications), Open Science Publishers, New York 2015, p. 34.

¹⁵⁷ Ghiani G., Laporte G., Musmanno R., Introduction to Logistics Systems Planning and Control, Wiley, Chichester 2004, p. 4.

¹⁵⁸ Ghiani G., Laporte G., Musmanno R., Introduction to Logistics Systems Planning and Control, Wiley, Chichester 2004, p. 5.

¹⁵⁹ Martin H., Warehousing and Transportation Logistics: Systems, Planning, Application and Cost Effectiveness, Kogan Page Publishers, London 2018, p. 4.

Krause H. H., Penninger J. M. L., Conversion of Polymer Wastes & Energetics, ChemTec Publishing, Toronto 1994, p. 9.

¹⁶⁰ Monczka R. M., Handfield R. B., Giunipero L. C., Patterson J. L., South-Western, a part of Cengage Learning, Purchasing And Supply Chain Management, Mason 2009, p. 8.

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Procurement logistics, deals with the supply of products, semi-finished products, raw materials or services to the enterprise. “Procurement logistics connects the distribution logistics of the external supplier with the production logistics of one’s own company.”¹⁶¹ Procurement logistics therefore include processes for planning, organizing and controlling procurement processes of an organization or supply chain. Due to the high costs incurred by companies to provide the right amount of materials at a time when the following processes require it without the need for excessive stockpiling, the purchasing subsystem plays a significant role not only in the context of supply planning, but also in relation to establishing relationships with suppliers, policy pricing, but also negotiating and concluding contracts, supply market research or the development of purchasing systems. In the context of procurement planning, the purchasing system can be divided into strategic sourcing, under which the following processes are implemented:

- supply planning,
- supplier selection,
- contracting,

and operative procurement, which includes:

- material ordering,
- expediting,
- paying¹⁶².

The tasks of supply logistics do not only include servicing orders to suppliers, but also organizing physical relocation of goods, accepting and controlling goods, as well as handling information and cash flows. The supply subsystem also plays the role of supply planning tool with respect to the size of stocks maintained. The aim of the supply is to ensure full availability of raw materials or products while minimizing the costs of maintaining stocks¹⁶³.

From the point of view of the whole process, procurement logistics is particularly relevant because the availability of products and services, as well as the ability to provide

¹⁶¹ Kappauf J., Lauterbach B., Koch M., *Logistic Core Operations with SAP Procurement, Production and Distribution Logistics*, Springer, Berlin 2011, p. 60.

¹⁶² Schiele H., *Purchasing and Supply Management in Zijm H., Klumpp M., Regattieri A., Heragu S. (eds.), Operations, Logistics and Supply Chain Management*, Springer, Cham 2019, p. 45.

¹⁶³ Martin H., *Warehousing and Transportation Logistics: Systems, Planning, Application and Cost Effectiveness*, Kogan Page Publishers, London 2018, p. 7.
Gudehus T. Kotzab H., *Comprehensive Logistics*, Springer, Berlin 2012, p. 6.

customers with products tailored to their requirements, determines the competitive strength of the company. Supply logistics therefore plays a key role in ensuring the full availability of goods, which includes minimizing the costs of stock keeping and purchasing processes. The purchase system is designed to ensure not only security and timeliness of deliveries, but also to guarantee the lowest possible price of products, delivery costs and achieving a satisfactory market position for entrepreneurs¹⁶⁴.

The procurement subsystem is aimed not only at ensuring the availability of products at the lowest possible cost, but simultaneously choosing the right supplier, ensuring the safety of processes, providing products of acceptable quality, tracking, tracing and controlling deliveries or scheduling purveyances synchronized with the needs of the production subsystem or the next supply chain participant.

In case of supply chains or companies with various branches dispersed in different locations, supply logistics is a central subsystem controlling the supply of all units. This translates into a greater level of control, lower inventory levels throughout the organization and better relations with suppliers. Speaking about suppliers, it should be pointed out that the supply subsystem may be characterized by the selection of a different number of suppliers depending on the type of product and the related needs. It is possible that a given material is delivered by a single supplier, which translates into the possibility of negotiating favorable delivery conditions and price levels. However, it is associated with a high risk of shortage of the required products or raw materials. If raw materials are supplied by more than one supplier, the company is more likely to succeed. However, it is harder to establish close relationships with all the suppliers. The choice of the most suitable supplier depends not only on such factors as price or quality, but also on the distance between the supplier and the company, on-time deliveries or the length of the order fulfillment cycle¹⁶⁵.

4.1.2. Production subsystem

The major purpose of the **production system** is primarily the processing of raw materials at the entrance to the process into finished products which are the effects of a production at the exit from the given process. Production systems “(...) are special

¹⁶⁴ Schiele H., Purchasing and Supply Management in Zijm H., Klumpp M., Regattieri A., Heragu S. (eds.), Operations, Logistics and Supply Chain Management, Springer, Cham 2019, p. 45.

¹⁶⁵ Waters D., Logistics An Introduction to Supply Chain Management, PALGRAVE MACMILLAN, New York 2003, pp. 230-235.

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performance systems which transform input material into physical goods.”¹⁶⁶ When referring to the phase division of logistics in the context of production systems, one should refer to the next subsystem of the logistics system, which is **production logistics**. The production logistics covers all processes related to planning, organizing and implementing the production process. The purpose here is manufacturing products in accordance with the specified needs. The main aim of the production subsystem is, therefore, to provide the right materials, in the right quantity, location and time, so that production plans can be implemented. The logistics of production also deals with the organization of the flow of raw materials, semi-finished goods and finished products to the enterprise, i.e. in-house transport. The task of the production system is also to organize the flow of information stream within the organization¹⁶⁷. Production logistics is an intermediate system that combines supply and distribution systems¹⁶⁸.

The main purposes of production logistics include: minimizing production costs, minimizing the length of production cycles, optimal utilization of production capacities, avoiding delays and executing the quality standards of manufactured products¹⁶⁹. From the point of view of the efficiency of the production subsystem, planning and scheduling of production processes is highly relevant. Based on forecasts created on the grounds of historical data, a Sales and Production plan is prepared, usually covering a minimum of twelve months. The Production and Sales plan enable creation of the Master Production Schedule which constitutes the basis for (together with BOM (Bill of Materials) and standing customer orders) carrying out the Materials Requirements Plan (MRP), based on which the planning and production control processes are implemented¹⁷⁰. On the basis of the sales plan and the production capabilities of individual work stations, a production plan is created forming the grounds for subsequent production control processes. Creating a production plan also requires knowledge of production cycles, taking into account the time of transport between positions and setup times. Production planning is, thus, a process which

¹⁶⁶ Gudehus T., Kotzab H., *Comprehensive Logistics*, Springer, Berlin 2012, p. 709.

¹⁶⁷ Martin H., *Warehousing and Transportation Logistics: Systems, Planning, Application and Cost Effectiveness*, Kogan Page Publishers 2018, London, p. 7.

¹⁶⁸ Kappauf J., Lauterbach B., Koch M., *Logistic Core Operations with SAP Procurement, Production and Distribution Logistics*, Springer, Berlin 2011, p. 139.

¹⁶⁹ Nyhuis P., Wiendahl H., *Fundamentals of Production Logistics Theory, Tools and Applications* Springer, Berlin 2009, p. 10.

¹⁷⁰ Proud J. F., *Master Scheduling: A Practical Guide to Competitive Manufacturing*, Wiley, New Jersey 2012, pp. 57-58.

Pycraft M., *Operations Management*, Pearson, London 2000, pp. 503-504.

consists of providing both materials and resources required to implement specific production processes.

Control of production processes is carried out in the same way as supply logistics, that is on the basis of push strategy (centralized control processes) or pull strategy (control processes are decentralized). The effectiveness of the system utilization is frequently assessed using key performance indicators, known as KPI. The effectiveness of control using these indicators depends on the type of processes performed in the enterprise and can be determined individually for a given organization. Indicators can be divided into three main groups:

- quantity,
- performance,
- effectiveness.

In addition, the indicators must be standardized and comparable.. The most common indicators include:

- number of orders, for a specific time interval,
- number of complaints in relation to all completed orders,
- completeness of deliveries, concerns the number of deliveries without error,
- average cycle of the production process, compared to the cycle specified in the operation sheets,
- number of delays,
- number of missing items,
- number of defective products¹⁷¹.

When discussing the production processes management as part of the production logistics subsystem, one should firstly refer to the Toyota Production System, whose one of the main pillars is the Just in Time Method. Just in Time is not only used in the sphere of supply, but primarily in the management of the production sphere as a method of delivering the right products in the right quantity at the right time to the workstations, thus allowing, among others, to minimize the level of inventory accumulated by the company. JIT is a pull system assuming consumption-driven production, i.e. production of the number of products

¹⁷¹ Ghiani G., Laporte G., Musmanno R., Introduction to Logistics Systems Management 2nd edition, Wiley, Chichester 2004, pp. 28-30.

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for which there is a demand on the market¹⁷². Just in Time allows not only to reduce the number of errors, process times or increase customer satisfaction, but also to reduce costs and the level of accumulated inventory. However, it requires full commitment on the part of both employees and suppliers, which are required to cooperate fully, without any interruption, which is one of the biggest barriers to the implementation of the concept. In addition, it should also be mentioned that Just in Time is inseparably connected with the philosophy of both Lean and Agile Management.

In the context of managing logistics processes in supply chain management, it is necessary to refer to the principles of Lean Logistics. Lean Logistics therefore assumes lean management of processes implemented within the supply chain to maximize the use of limited resources. Lean Logistics is the transfer of lean management principles to logistics processes implemented within the supply chain or otherwise using the stock replenishment system along the entire consumption-controlled chain. Lean Logistics assumes supplementing the needs of individual links in the chain with the use of small batches of products at the moment when they are needed¹⁷³.

In relation to production processes implemented in the enterprise or from the point of view of the entire supply chain, it is also necessary to draw the reader's attention to the Lean Production concept, which assumes lean management of production processes in the enterprise or the entire supply chain¹⁷⁴. The major purpose of Lean Production is to identify non-value processes and their elimination from the manufacturing process. Lean Production is based on the Toyota Production System (TPS) originated in Japan¹⁷⁵. In order to implement the Lean system, it is necessary to identify the current process using the tool called Value Stream Mapping (VSM). This instrument allows to reflect upon all processes carried out in the company and identify those activities that do not add value¹⁷⁶. The next step is to identify all sources of waste (muda) affecting the process. 8 sources of waste can be distinguished:

- overproduction – production of a larger quantity/number of products than required,

¹⁷² Lei K-H., Cheng T. C. E., *Just-in-Time Logistics*, Gower, Surrey 2019, p. 10.

¹⁷³ Kerber B., Dreckshage B. J., *Lean Supply Chain Management Essentials: A Framework for Materials Managers*, CRC Press, Boca Raton 2011, p. 158.

¹⁷⁴ Baudin M., *Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods*, CRC Press, New York 2004, p. 28.

¹⁷⁵ Jackson T. L., *Implementing a Lean Management System*, CRC Press, Portland 1996, p. 4.

¹⁷⁶ Nicholas J., *Lean Production for Competitive Advantage: A Comprehensive Guide to Lean Methodologies and Management Practices 2nd edition*, Taylor & Francis, Boca Raton 2018, p. 44.

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- inventory – storage of a larger quantity/number of stocks than required, which often leads to damage and deterioration of the products in the inventory,
- defects – quality errors require the reprocessing of the product or additional control, which, in turn, extends the production cycle and disturbs the rhythm of production or assembly line,
- waiting – due to an improperly planned process, production in one step of the process is slowed or halted as it has to wait for the availability of a production resource from another or previous step,
- over-processing – all activities that do not add value to the product or service. This results from incorrectly designed and organized production process,
- transport – moving goods over large distances in the production hall which can be caused by, for example, inappropriate placement of work stations,
- motion – any wasteful movement of the employees or machines, that is not considered as necessary in the process and stemming from the maladjustment of the workstations to the process or placing unnecessary tools on them,
- untapped potential of employees (human potential) - lack of proper use of employees' skills¹⁷⁷.

Another aspect necessary to implement Lean Production is the use of pull strategy in controlling the supply of workstations¹⁷⁸, as well as continuous improvement of the production process by creating further value stream map¹⁷⁹.

Speaking of Lean Production, it is also necessary to refer to Agile Logistics and Agile Production. Agile philosophy is sometimes equated with lean philosophy, however, one should notice the differences between both concepts. Due to the need to eliminate sources of waste and minimize costs, lean philosophy is very often characterized by a low degree of flexibility of processes implemented in the company, while the agile concept assumes greater focus on customer needs, adapting implemented activities to their needs and thus the ability to respond quickly to changes occurring on the market to provide products and services in line with customer requirements. Therefore, agile logistics assumes the integration of

¹⁷⁷ Dennis P., *Lean Production Simplified, Second Edition: A Plain-Language Guide to the World's Most Powerful Production System*, CRC Press, New York 2007, pp. 20-24.

¹⁷⁸ Black J.R., *Lean Production: Implementing a World-class System*, Industrial Press Inc., New York 2008, p. 23.

¹⁷⁹ Nicholas J, *Lean Production for Competitive Advantage: A Comprehensive Guide to Lean Methodologies and Management Practices 2nd edition*, Taylor & Francis, Boca Raton 2018, p. 28.

processes implemented by subsequent links in the supply chain, allowing for quick adaptation of products and services to customer orders. Agile logistics assumes striving for zero lead times, and thus maintaining continuity of supply and material flow, thus ensuring a high degree of control over consumed resources¹⁸⁰. As in the case of the lean concept, the authors referred in their considerations to the concept of Agile Manufacturing, which assumes a comprehensive change in the approach to manufacturing processes. Agile Manufacturing requires individual cooperating departments and within one enterprise or supply chain links to fully cooperate in the field of material flow and, above all, information allowing to react immediately to changes on the market to meet the needs of customers¹⁸¹. The biggest challenge posed by the agile concept is primarily to provide products in the event of changing customer needs or fluctuations in delivery cycles. Agile is most often used for products with short life cycles or for special customer orders¹⁸². The goal of Agile Manufacturing is primarily the redesign of processes and production management system enabling both the implementation of mass production and products or services fully individualized to the needs of customers delivered almost immediately after the emergence of demand¹⁸³.

4.1.3. Distribution subsystem

In the phase division of logistics in the context of the **distribution subsystem**, which aims to provide ensuring the availability of goods to customers and subsequent links in the supply chain in an effective manner both in time and cost, the authors focused on **distribution logistics**, which deals with the flow of material and information streams from the end of the production process through subsequent links in the supply chain, such as logistics centers or wholesalers, to the final recipient. The main aim of distribution logistics is to plan the flow of relevant goods at the right time and place at the lowest possible cost. One of the indirect purposes of distribution subsystem includes planning the location of

¹⁸⁰ Waters D., *Supply Chain Risk Management: Vulnerability and Resilience in Logistics*, Kogan Page Publishers, Philadelphia 2007, p. 64-65.

¹⁸¹ Manivelmuralidaran V., *Agile Manufacturing - An Overview in International Journal of Science and Engineering Applications* Volume 4 Issue 3, 2015, p. 156.

¹⁸² Konecka S., *Lean And Agile Supply Chain Management Concepts In The Aspect Of Risk Management in LogForum* Vol. 6, Issue 4, No 3, 2010, p. 25.

¹⁸³ Gunasekaran A., *Agile Manufacturing: The 21 St Century Competitive Strategy*, ELSEVIER SCIENCE Ltd. Kidlington 2001, p. 26.

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objects in the distribution network and thus, optimizing the process of physical delivery of goods. Distribution logistics also includes customer relationship management¹⁸⁴.

The areas in which distribution subsystem can be used include:

- sales planning,
- orders processing,
- scheduling deliveries,
- choosing the appropriate means of transport,
- handling transport documents,
- monitoring the flow of goods in the distribution process,
- after-sales service,
- processing returns¹⁸⁵.

One of the most frequently used distribution planning method is DRP (Distribution Requirements Planning). DRP is a reflection of the MRP tool in distribution area and consists in planning the demand for products or services in the whole network, starting from the cell closest to the final customer, and up until the beginning of the chain. DRP focuses on planning deliveries to individual locations in the distribution network, taking into account such factors as the level of safety stock, the cycle of stock replenishment, demand forecasts and the size of the delivery batch.

¹⁸⁴ Martin H., *Warehousing and Transportation Logistics: Systems, Planning, Application and Cost Effectiveness*, Kogan Page Publishers, London 2018, pp. 8-9.

Mothes A., Ulrich H., Kramer D., *Leaders' Qualifications in the Logistics Industry - Are There Differences Between the Requirements for Leaders Depending on Their Culture?*, Grin, Munich 2011, pp. 5.

¹⁸⁵ Martin H., *Warehousing and Transportation Logistics: Systems, Planning, Application and Cost Effectiveness*, Kogan Page Publishers, London 2018, pp. 8-9.

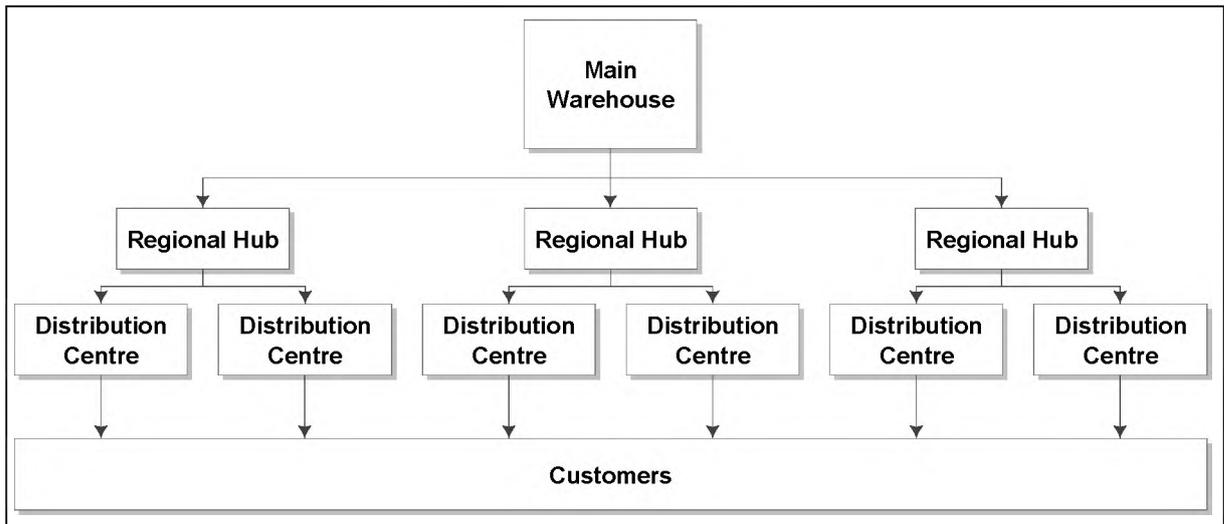


Figure 4.2. Framework of the DRP System

Source: Sople V. V., Logistics Management, Pearson, Dorling Kindersley 2012, p. 88.

The major advantages of using DRP include:

- higher efficiency resulting in improving the level of customer service,
- reduction of inventory maintenance costs,
- decrease in the level of stock maintained,
- reduction of the warehouse space used¹⁸⁶.

Distribution logistics planning requires strict integration with other chain or enterprise systems, which increases the efficiency of the entire network, but also applies to distribution channel planning. The most common distribution network structures are shown in Figure 4.3.

¹⁸⁶ Sople V. V., Logistics Management, Pearson, Dorling Kindersley 2012, pp. 87-88.

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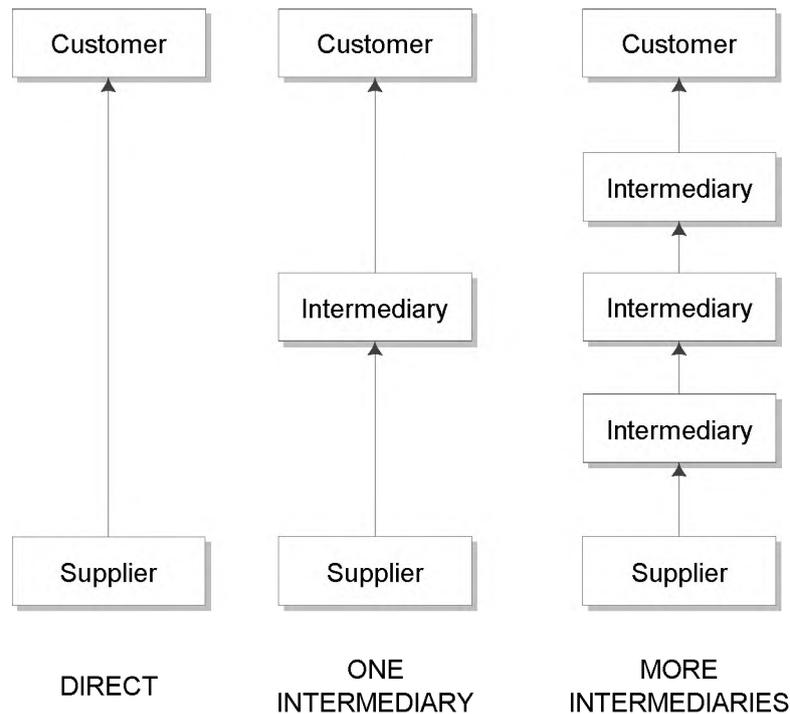


Figure 4.3. The most common structures of distribution

Source: Dent J., *Distribution Channels: Understanding and Managing Channels to Market*, Kogan Page Publishers, London, 2008, p. 12.

Direct distribution is characterized by the absence of intermediaries in processes of finished goods delivered from the supplier to the recipient. This means that the supplier conducts direct sales by executing customer service processes. The supplier has close relations with clients and thanks to that the products can be adapted strictly to their needs. The disadvantage of this structure can be high costs of goods delivery and storage of stocks as well as narrow market.

The one-tier distribution is characterized by the presence of intermediaries in the supply network who directly attend to the customer. The supplier does not sell directly, which may indirectly result in a slightly more difficult contact with the customer, and sometimes a lower level of customer service. The advantage of this structure is the reduction of transport, promotion and inventory costs. The price of products in single-level distribution is normally higher than in direct sales.

A two-tier distribution is characterized by the presence of intermediaries located at two levels of the complexity of the supply network. From the point of view of customers, goods are much more easily available than in the case of direct sales, however, they are

characterized by a much higher price. The supplier has minimal contact with the customer, which means that the product or service cannot always be adapted directly to their needs. As in the case of single-level distribution, this structure is characterized by significantly lower costs of storage and transport of goods, however, the "ways" of delivering products to the final recipient is extended.

Multi-tier distribution is characterized by the presence of intermediaries on at least three levels of structure complexity. The advantages and disadvantages of this structure are similar to the two-level structure¹⁸⁷.

4.1.4. Reverse logistics subsystem

“Reverse logistics is the sector of logistics dealing with product flows (unsold items or returns) from their final destination to the initial producer, or to a facility dedicated to their treatment.”¹⁸⁸ The major purpose of reverse logistics is to“(...) collect, transport, store and recycle or dispose production residues, consumer waste, packaging material, empties, depleted goods and worn out material.”¹⁸⁹ The main tasks of reverse logistics are related to the qualification of products for utilization or reprocessing as well as planning and organization of the physical flow of used products from the final customer to the initial link in the supply chain. Reverse logistics sometimes require the use of the same distribution network as previously used in the material flow processes of a new product from the producer to the final recipient¹⁹⁰. The need to recycle parts of used products or waste disposal stems, to a large extent, from the requirements for the protection of the natural environment concerning activities performed by industrial organizations. Today, there is a huge emphasis on environmental protection and the re-use of some of the used goods, which aims at reducing the impact of industry on the natural environment. In addition, the desire to use

¹⁸⁷ Dent J., *Distribution Channels: Understanding and Managing Channels to Market*, Kogan Page Publishers, London, 2008, pp. 11-13.

¹⁸⁸ Ghiani G., Laporte G., Musmanno R., *Introduction to Logistics Systems Management* 2nd edition, Wiley, Chichester 2004, pp. 9.

¹⁸⁹ Gudehus T., Kotzab H., *Comprehensive Logistics*, Springer, Berlin 2012, pp. 6.

¹⁹⁰ Ghiani G., Laporte G., Musmanno R., *Introduction to Logistics Systems Management* 2nd edition, Wiley, Chichester 2004, pp. 9.

Nikolaidis Y., *Quality Management in Reverse Logistics: A Broad Look on Quality Issues and Their Interaction with Closed-Loop Supply Chains*, Springer, Berlin 2012, p. 40.

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parts recovered from used products sometimes translates into savings resulting from their re-use, the need for maintenance or repair of damaged parts¹⁹¹.

When talking about reverse logistics, it is extremely relevant to indicate the reasons why it is not widely used by enterprises. They include:

- non-adjustment of the logistics infrastructure of the distribution network to returns processing,
- enterprises do not see the financial benefits associated with its use, due to high costs of its implementation,
- it is difficult to predict the number, type and condition of products returned¹⁹².

The reasons for the need to organize reverse logistics arise from:

- damage to products
- manufacturing or acquired defects
- incomplete or late deliveries,
- excessively accumulated stock of products in singular facilities of the distribution network¹⁹³.

According to subject literature, reverse logistics is very often compared to forward trade, which is shown in Table 4.1.

Table 4.1. Differences between forward and reverse logistics

Forward logistics	Reverse logistics
Large quantities of full-value products	Small quantities of part-value products
Short standardized delivery cycle time	Medium or long return cycle time depending on the scale of damage to the products
Costs determined in advance	Costs difficult to predict
Standardized distribution channel structure	The distribution channel structure depends on the purpose of the returned product
High process transparency	Low process transparency

¹⁹¹ Harrison A., van Hoek R., Logistics Management and Strategy. Competing through the supply chain 3rd edition, Pearson, Harlow 2008, p. 130.

Nikolaidis Y., Quality Management in Reverse Logistics: A Broad Look on Quality Issues and Their Interaction with Closed-Loop Supply Chains, Springer, Berlin 2012, p. 42.

¹⁹² Harrison A., van Hoek R., Logistics Management and Strategy. Competing through the supply chain 3rd edition, Pearson, Harlow 2008, pp. 130-131.

¹⁹³ Min H., The Essentials of Supply Chain Management: New Business Concepts and Applications, Pearson, Harlow 2015, p. 207.

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High priority	Low priority
Forecasts easy to develop	Forecasts difficult to develop

Source: Harrison A., van Hoek R. Logistics Management and Strategy. Competing through the supply chain
3rd edition, Pearson, Harlow, 2008, p. 129.

The efficiency of reverse logistics depends primarily on the appropriate management strategy, the elements of which are shaped as follows:

Asset recovery – refers mainly to the return of goods to their producer and re-use in various forms:

- selling new products to other clients,
- repair and re-sale to the same customers,
- repair and re-sale to other clients,
- sale at a reduced price,
- sale as part of the product disposal.

Outsourcing return management – in the case of the lack of the possibility of processing returns and their re-utilization, it is possible to use the services of external operators performing goods return and re-use processes.

Gatekeeping – it mainly concerns the control of returned goods in terms of the legitimacy of their adoption, as well as monitoring whether the returned product was actually delivered by the company performing reverse logistics processes as well as its possible rejection. This not only reduces the costs associated with returns, but also increases the effectiveness of their implementation.

Recycling, refurbishment, and remanufacturing – the strategy of reverse logistics management requires first and foremost proper planning and implementation of the recycled process depending on the technical condition and the possibility of re-using products or parts of them. Sometimes, some elements of the product can be reused in the production or assembly process, some of them must be renewed and the rest must be reprocessed or disposed.

Supplier “zero-return” program – this program assumes accepting returns resulting solely from the fault of the supplier and transferring the costs of reverse logistics, i.e. recycling or re-using goods from the customer at the expense of offering return allowances or special

prices. This program is implemented only by customer production companies which have a full valuation of costs associated with the re-use of products¹⁹⁴.

In addition, it should be noted that in many industries there are companies dealing with the recycling processes, incurring the costs of reverse logistics in exchange for acquiring raw materials and materials used for redevelopment¹⁹⁵.

The concept of reverse logistics also involves waste management, largely involving the development of product packaging. Waste management is very often treated as a separate process and initiated by legal conditions regarding industrial processes. Waste logistics objectives correspond to the purposes of supply or distribution logistics and require planning, organization and implementation of the return of waste intended for reuse or disposal. Waste logistics is also characterized by high costs, which can be curbed, for example, by giving up packaging that cannot be recycled, creating biodegradable packaging, increasing the use of used packaging or using reusable packaging¹⁹⁶.

4.2. Information systems in logistics and supply chain management

4.2.1. Enterprise Resource Planning (ERP)

Information Systems in logistics support the functioning of both the company and the entire supply chains. "All information systems are composed of technology that performs three main functions: data capture and communication; data storage and retrieval; and data manipulation and reporting."¹⁹⁷ Information Systems "(...) are computer-based systems that capture, store, and retrieve data associated with process activities. In addition, they organize these data into meaningful information that organizations use to support and assess these activities."¹⁹⁸ An efficiently functioning enterprise requires, essentially, the use of modern information systems, the use of which translates into acceleration of the processes being carried out, and thus increasing the profits and competitiveness of enterprises. However, the

¹⁹⁴ Min H., *The Essentials of Supply Chain Management: New Business Concepts and Applications*, Pearson, Harlow 2015, pp. 207-209.

¹⁹⁵ Hugos M., *Essentials of Supply Chain Management* 3rd edition, Wiley, New Jersey 2011, p. 94.

¹⁹⁶ Martin H., *Warehousing and Transportation Logistics: Systems, Planning, Application and Cost Effectiveness*, Kogan Page Publishers, London 2018, pp. 9-10.

Waters D., *Logistics An Introduction to Supply Chain Management*, PALGRAVE MACMILLAN, New York 2003, pp. 13-14.

Krause H. H., Penninger J. M. L., *Conversion of Polymer Wastes & Energetics*, ChemTec Publishing, Toronto 1994, p. 14.

¹⁹⁷ Hugos M., *Essentials of Supply Chain Management* 3rd edition, Wiley, New Jersey 2011, p. 109.

¹⁹⁸ Magal S. R., Word J., *Essentials of Business Processes and Information Systems*, Wiley, New Jersey 2009, p. 15.

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implementation of information systems itself is currently insufficient and requires full integration of modules that create one system for managing the organization. The following sections describe business management system as well as the systems that most often form ERP functional modules¹⁹⁹.

Speaking of information systems that are used in modern enterprises, not only logistics, as one of the most frequently implemented systems of managing the organization the Enterprise Resource Planning (ERP) system should be mentioned. Before defining the ERP systems authors considered it necessary to describe MRP I and MRP II system as the basis for further creation of Enterprise Resource Planning.

ERP, constituting a development of MRP I and MRP II systems, was developed at the turn of the 80's and 90's as a comprehensive tool for enterprise management. An important aspect that should be indicated in the ERP class systems is the ability to access the same database that employees of different departments use as part of ERP-forming modules. It means that the system works on one database, in which all changes are accomplished in real time.

The MRP I System was created in the 1970s, initially based on a bill of materials (BOM) and the Master Production Schedule (MPS) and used to materials requirements planning aimed at ensuring the continuity of production and the implementation of the production plan. In the course of time the MRP system has been expanded with further tools included sales planning, customer order processing or pre-planning of production capacities creating Closed-loop MRP.²⁰⁰ Thanks to the Closed-loop MRP, it is possible to determine if the processes previously scheduled in the production plan are real and feasible. The loop allows to verify the production plan in terms of the feasibility of its implementation²⁰¹.

The MRP II System, which was created in the 1980s, has improved the existing MRP I System to plan the availability of resources that are required to implement the scheduled processes. Planning the availability of resources mainly concerns production capacities, but also financial and human resources. In addition to the elements of demand planning, sales, production and the ability to fully integrate them, MRP II also provides, in contrast to MRP I, support in the implementation and execution of planned processes²⁰².

¹⁹⁹ Magal S. R., Word J., *Essentials of Business Processes and Information Systems*, Wiley, New Jersey 2009, pp. 16-17.

²⁰⁰ Sumner M., *Enterprise Resource Planning (1st edition)*, Pearson, Harlow 2014, pp. 2-3.

²⁰¹ Ray R., *Enterprise Resource Planning*, McGraw Hill, New Delhi 2011, pp. 9.

²⁰² Ray R., *Enterprise Resource Planning*, McGraw Hill, New Delhi 2011, pp. 9.
Sumner M., *Enterprise Resource Planning (1st edition)*, Pearson, Harlow 2014, pp. 2-3.

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The MRP II system standards have been defined by D. Landvater and C. Gray and include²⁰³:

- Sales and Operation Planning - is a monthly plan regularly carried out most often by management at the tactical level to find the optimum between supply and demand values, which automatically translates into the possibility of maximizing production, distribution, as well as the implementation of orders from the market²⁰⁴,
- Demand Management – includes identification and demand management, forecasting and order processing,
- Master Production Scheduling – assumes the translation of plans developed in the SOP for specific products, contains terms and quantities to be created to meet the requirements of customers,
- Material Requirements Planning – assumes determining the exact terms for the delivery of materials and assemblies for production for their timely assembly. MRP I takes into account the date of the flow and the cycle of delivery of materials to the production line,
- Bill of Material – includes all assemblies, subassemblies and parts that are included in the finished product together with the relations between them,
- Inventory Transaction Subsystem – includes control of levels of accumulated inventory, their planning and release from the warehouse to ensure continuity of production, but also to minimize the costs of maintaining inventory,
- Schedules Receipts Subsystem – enables control of resources of supplied and manufactured products,
- Shop Floor Control – managing the production department, among others, scheduling production orders and controlling their implementation,
- Capacity Requirements Planning – planning resources (material, human or financial) to be provided in order to implement production plans,
- Input/Output Control – workstation management, referring primarily to the analysis of the use of resources planned for the process with their actual application,

²⁰³ Landvater D. V., Gray C. D., MRP II Standard System: A Handbook for Manufacturing Software Survival, Wiley, Hoboken 1995, p. xiii.

²⁰⁴ Nemati Y., Madhoushi M., Ghadikolaei A. S., Towards Supply Chain Planning Integration: Uncertainty Analysis Using Fuzzy Mathematical Programming Approach in a Plastic Forming Company in Iranian Journal of Management Studies (IJMS) Vol. 10, No.2, 2017, p. 336.

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- Purchasing – subsystem not only responsible for supply management but also for the flow of financial and information streams between the enterprise and its suppliers,
- Distribution Resource Planning – responsible for the distribution of finished products to final customers or subsequent links in the supply chain,
- Tooling – tool record system,
- Financial Planning Interfaces – guarantees connection to financial management systems,
- Simulation – simulation subsystem allowing verification of created plans before they are implemented,
- Performance Measurement – enables measurement of system efficiency.

The development of the MRP II system with additional functionalities has contributed to the transformation of the Manufacturing Resource Planning system into an ERP system²⁰⁵.

There are many applied definitions of the ERP system. Some examples were collected in Table 4.2.

Table 4.2. Definitions of ERP systems

Author	Definition
APICS (2019)	“ERP is a framework for planning all of the resources of a business, from strategic planning through execution. Information technology tools and software can automate process links, sharing information across functional areas and processing business transactions efficiently. ERP systems also support the organization of data for decision making and analysis, and are typically organized around modules that support functional areas such as finance, marketing, human resources, operations, purchasing, and logistics. Real-time sharing of data is enabled by using a common database across these modules.”
Myerson (2015)	“ERP systems are an extension of a MRP system to tie in all internal processes as well as customers and suppliers. It allows for the automation and integration of many business processes, including finance, accounting, human resources, sales and order

²⁰⁵ McGaughey R. E., Gunasekaran A., Evolution of Enterprise Resource Planning in Information Resources Management Association, Business Information Systems: Concepts, Methodologies, Tools and Applications: Concepts, Methodologies, Tools and Applications, IGI Global, Hershey 2010, p. 272.

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	entry, raw materials, inventory, purchasing, production, scheduling, shipping, resource and production planning, and customer relationship management.”
Ray (2011)	“ERP is an integrated information system built on a centralized database and having a common computing platform that helps in effective usage of enterprise’s resources and facilitates the flow of information between all business functions of the enterprise (and with external stakeholders).”
Hossain, Patrick and Rashid (2002)	“Enterprise Resource Planning systems or enterprise systems are software systems for business management, encompassing modules supporting functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance transportation and e-business.”
American Production and Inventory Control (2001)	“a method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in manufacturing, distribution or service company.”
Davenport (1998)	“ERP (...) comprises of a commercial software package that promises the seamless integration of all the information flowing through the company – financial, accounting, human resources, supply chain and customer information.”
Kumar and Van Hillebergersberg (2000)	“ERP system and configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization.”

Source: Myerson P. A. Supply Chain and Logistics Management Made Easy, Pearson, Old Tappan 2015, p. 216. Ray R. Enterprise Resource Planning, McGraw Hill, New Delhi 2011, pp. 4. Hossain L., Patrick J. D. and Rashid M. A. Enterprise Resource Planning: Global Opportunities and Challenges, Idea Group Publishing, Hershey 2002, pp. 2-4. Kumar, K., & van Hillebergersberg, J. Enterprise resource planning: introduction. Communications of the ACM, 43(4), 2000, pp. 22-26. <http://www.apics.org/apics-for-individuals/apics-magazine-home/resources/ombok/apics-ombok-framework-table-of-contents/apics-ombok-framework-5.1> [access 2019-04-16].

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Therefore, ERP class systems should be defined as systems used to manage all processes in an enterprise. They are comprehensive tools applicable in the areas of production management, distribution, storage, information flow, human resources, finances or accounting. ERP systems are used to manage all resources that the company has at its disposal, including both human work and the use of machines, devices or financial resources required to achieve the assumed organizational objective. In addition, ERP systems guarantee appropriate planning of the management processes of available resources, so they focus on their effective use, and thus on the appropriate planning and implementation of all activities performed by the company.

The ERP System is a modular system, consisting of specific applications adjusted to the expectations of the enterprise. Depending on the requirements and the specificity of business, some modules can only cooperate with the implemented ERP System, while some applications, such as Human Resource Management or Customer Relationship Management, are part of the system²⁰⁶. Table 4.3 presents the most frequently used modules in ERP Systems.

Table 4.3. ERP modules

ERP modules		
Sales & Distribution	Customer activity	Order processing Product configuration Delivery quotations Pricing Promotions Availability Shipping options
	Distribution	Distribution requirements Transportation management Shipping Schedules Export controls Billing Invoicing Rebate processing
Materials Management	Materials Management	Purchasing Inventory Warehouse functions Supplier evaluation JIT deliveries

²⁰⁶ Hossain L., Patrick J. D. and Rashid M. A., Enterprise Resource Planning: Global Opportunities and Challenges, Idea Group Publishing, Hershey 2002, pp. 3.

Olson D. L., Keshawani S., Enterprise Information Systems. Contemporary Trends and Issues, World Scientific, Singapore, 2010, pp. 49-50.

Ray R., Enterprise Resource Planning, McGraw Hill, New Delhi 2011, pp. 7.

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		Invoice verification
	Production Planning	CAD Process planning Bill of Materials Product costing MRP
Quality Management	Supply Chain Quality Management	
	Plant Maintenance	
	Customer Service	
Human Resources	Personnel Management	Workforce planning Employee scheduling Training and Development Payroll and benefits Travel expense reimbursement Applicant data Job description Organisation charts Work flow Analysis
Project Management	Controlling the Project Phases	Quotation to design and Approval Resource management Cost settlement
Financial & Accounting		Financial accounting Investment management Cost control Treasury management Asset management Enterprise controlling Cost centres Profit centres Activity Based Costing Capital budgeting Profitability analysis Enterprise measures performance

Source: Shehab E. M., Sharp M. W., Supramaniam L., Spedding T. A. Enterprise resource planning. An integrative review in Business Process Management Journal · August 2004, p. 363.

ERP enables comprehensive evaluation of the company as one functioning system based on several modules cooperating with each other, thanks to which it is possible to analyze global processes implemented in the enterprise and to thoroughly control all departments of the company using one tool²⁰⁷. The modular structure of ERP systems allows to adapt the tools used strictly to the needs of enterprises which can implement only those areas of the system that are used in a given company. The high flexibility of the system

²⁰⁷ Bradford M., Modern ERP. Select, implement & use today's advanced business systems, LuLu, Morrisville 2015, pp. 2.

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makes Enterprise Resource Planning Systems much more complex than both MRP I or MRP II Systems.

ERP systems permitted users to use a common database, access to which is available to all company departments. In addition, they enabled a significant acceleration of processes, as well as an increase in their efficiency. However, these systems have disadvantages, which include high implementation costs and time-consuming effective implementation of the system. Table 4.4 indicates both the advantages and disadvantages of ERP Systems.

Table 4.4. Advantages and disadvantages of ERP Systems

Advantages of ERP Systems	Disadvantages of ERP Systems
Full data integration in all modules	Inappropriate use of the tool by the employees
Cost reduction and increase in profits	Long-standing implementation process
Improving the efficiency of data management	
System customization due to the company's needs (Modular system construction)	High implementation costs
Simplification of the process by eliminating duplicate data and operations	
Global reach (Supply Chain Management and Customer Relations Management Modules)	Implementation of the system may involve additional costs associated with the purchase of appropriate equipment or training for employees
Reduction of production and transport cycles	
Real time access to data	The implementation of ERP may be difficult in decentralized enterprises with separate business processes
Greater transparency of processes	

Source: Ray R., Enterprise Resource Planning, McGraw Hill, New Delhi 2011, pp. 10-13.

Hossain L., Patrick J. D. and Rashid M. A., Enterprise Resource Planning: Global Opportunities and Challenges, Idea Group Publishing, Hershey 2002, pp. 5-6.

Bradford M., Modern ERP. Select, implement & use today's advanced business systems, LuLu, Morrisville 2015, pp. 6-9.

Due to the continuous development of supply chains and their digitization, the use of solutions that largely support the implementation of systems such as ERP is gaining attention. In the era of digitization of supply chains, most organizations strive to automate many processes carried out by individual links cooperating with each other in order to deliver

products and services to end customers. The use of such support tools as cloud computing is on the increase.

“Cloud computing can be defined as a new style of computing in which dynamically scalable and often virtualized resources are provided as a services over the Internet.”²⁰⁸ Cloud computing creates opportunities for using the software as well as the functionality of many computer applications that do not have to be installed on the hardware in the organization. Enterprises do not have to purchase expensive licenses, and the use of computer applications is facilitated only for the time they are used by appropriated organizations offering them as services²⁰⁹.

Within the framework of cloud computing three types of clouds should be specified: private clouds, public clouds and hybrid clouds. Private clouds are characterized by the fact that although they are provided by an external service provider, only the organization has access to the cloud space. In case of public clouds, enterprises use the space made available to more users. Hybrid clouds assume that parts of the services are based on the functionality of public clouds, and the remaining parts are based on private clouds. An advantage of cloud systems is access to unlimited computing possibilities resulting from the use of software on web servers. The systems do not only guarantee access to the cloud space, but also allow only "ad-hoc" use of applications, which is a chance for development especially for small enterprises that cannot afford expensive licenses²¹⁰.

In case of ERP systems, the processes of enterprise management are being increasingly implemented in architecture adapted strictly to cloud systems. Cloud systems include a range of services offered to their users, which are very often offered in the so-called layered architecture. The three most common services offered within cloud systems are Software-as-a-Service, Platform-as-a-Service and Infrastructure-as-a-Service.

Software-as-a-Service

The Software as a Service guarantees its users access to many computer applications as well as systems currently used in process management using cloud computing placed on servers of service providers. This solution not only improves the system's functioning by enabling adaptation of a suitable software strict to the recipients requirements, but also affects the development of organizations that have not been able to use similar applications prior to

²⁰⁸ Furlht B., Escalante A. (eds.), *Handbook of Cloud Computing*, Springer, London 2010, p. 3.

²⁰⁹ Sosinsky B., *Cloud Computing Bible*, Wiley, Chichester 2011, p. 4.

²¹⁰ Buyya R., Broberg J., Goscinski A. (eds.), *CLOUD COMPUTING Principles and Paradigms*, Wiley, New Jersey 2011, p. 15.

cloud computing implementation. SaaS enables users to access the software at the moment they need it without having to pay license fees even if the application is used sporadically²¹¹.

Platform-as-a-Service

The Platform as a Service is most often used by the programming environment due to the fact that its main functionality is to provide a virtual workplace for the organization's staff. This service allows developers to create new applications in cloud space, performing any modifications and improvements of their infrastructures. PaaS enabling utilization of standards such as HTML or Java, thus creating unlimited programming possibilities, as well as support for newly created and existing applications. One of the most important advantages of Platform-as-a-Service is the ability to control user behavior and modify the functioning of the application by optimally adapting it to the requirements of customers²¹².

Infrastructure-as-a-Service

The Infrastructure as a Service assumes providing the authorized user access to computer infrastructure owned by the service provider on an outsourced basis. The key advantage of this solution is the ability to reduce the costs associated with the purchase and servicing of computer hardware, as well as maintaining the IT department in the enterprise. As a service, infrastructure offers not only access to virtual equipment, but also to elements such as disk space, computing power or memory. IaaS is a service similar to SaaS, because it can also offer users access to software²¹³.

As part of the use of cloud systems, it is necessary to indicate several types of clouds that can be used by their users, namely:

- private cloud – as part of this cloud, users are authorized to use their own infrastructure and software located either physically in the organization or on the servers of the service provider without the possibility of providing computing power to other organizations,

²¹¹ Jamsa K., *Cloud Computing*, Jones & Bartlett Publishers, Burlington 2011, p. 17.

Rittinghouse J. W., Ransome J. F., *Cloud Computing Implementation, Management, and Security*, CRC Press, London 2016, p. 50

²¹² Sosinsky B., *Cloud Computing Bible*, Wiley, Chichester 2011, p. 70.

Wang L., Ranjan R., Chen J., Benatallah B., *Cloud Computing: Methodology, Systems, and Applications*, CRC Press, London 2011, p. 79.

²¹³ Kavis M., *Architecting The Cloud. Design Decisions For Cloud Computing Service Models (SaaS, PaaS, and IaaS)*, Wiley, New Jersey 2014, p. 13.

Furht B., Escalante A. (eds.), *Handbook of Cloud Computing*, Springer, London 2010, p. 5.

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- public cloud – clouds placed on the servers of the organization or service providers assume the access of several enterprises that may but do not have to cooperate with each other,
- hybrid cloud – assumes the integration of functionalities of both private and public clouds²¹⁴.

The major reason for using cloud systems to implement ERP is the ability to access data relevant in the management processes, the analysis of which allows the user to make appropriate business decisions. In addition, the use of the ERP system and the SaaS service allows not only to reduce the costs associated with not having to invest in computer equipment, expensive licenses, but also the service or the requirement to hire staff responsible for its implementation²¹⁵. Due to the continuous development of organizations with the main goal of providing the right products, tailored and most suitable to the customers' expectations at the time when the recipient of the enterprise requires them, companies are striving to automate processes implemented in supply chains with a view to generating ever larger amounts of data. However, due to limited capabilities of ERP, it is necessary to continuously develop it with further modules supporting the comprehensive management of the company. This development is becoming possible thanks to transferring the software used so far to cloud systems characterized by unlimited computing power²¹⁶.

The most important advantages of using ERP Cloud include:

- cost reduction – mainly related to the possibility of resigning from expensive licenses and demanding equipment, as well as reducing the number of staff due to no further need of maintaining the ERP service department,
- access to the system from anywhere in the world – Internet access is the easiest condition to fulfill,
- high level of security – guaranteeing not only protection of the system itself, but mainly of the data collected in it,

²¹⁴ Youssef A. E., Exploring Cloud Computing Services and Applications in Journal of Emerging Trends in Computing and Information Sciences VOL. 3, NO. 6, July 2012, p. 839.

²¹⁵ Raihana G. F. H., CLOUD ERP – A SOLUTION MODEL in IRACST - International Journal of Computer Science and Information Technology & Security (IJCSITS), ISSN: 2249-9555 Vol. 2, No. 1, 2012, p. 78.

²¹⁶ Youssef A. E., Exploring Cloud Computing Services and Applications in Journal of Emerging Trends in Computing and Information Sciences VOL. 3, NO. 6, July 2012, p. 843.

- the possibility of buying a temporary license for specific modules – it allows access to required applications while traditional systems required the purchase of several-year licenses,
- simplifying system management – due to the availability of support from the service provider,
- the possibility of system integration with additional modules or systems used within the supply chain²¹⁷.

The most demanding challenges of the system include:

- high level of risk,
- low level of trust in data exchange within supply chains,
- difficulties in adapting individual modules to customer requirements and their integration,
- high technological requirements in relation to, for example, the quality of the Internet connection,
- initial problems related to financing the implementation of ERP Cloud²¹⁸.

The following sections focus on the characteristics of information systems used in the management of logistics systems and supply chains. Some of them are at the same time ERP class system modules.

4.2.2. Supply Chain Management (SCM)

Defining the SCM system requires definition of the supply chain, which sometimes, often incorrectly, is used interchangeably with the concept of Supply Chain Management. The supply chain is a set of cooperating enterprises, employees, activities and information,

²¹⁷ Goel S., Kiran R. , Garg D., Impact of Cloud Computing on ERP implementations in Higher Education in (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No. 6, 2011, p. 147.

Kiadehi E.F., Mohammadi S., Cloud ERP: Implementation of Enterprise Resource Planning Using Cloud Computing Technology in Journal of Basic and Applied Scientific Research No 2(11), 2012, p. 1425.

²¹⁸ Purohit G. N., Jaiswal M. P., Pandey S., Challenges Involved in Implementation of ERP on Demand Solution: Cloud Computing in International Journal of Computer Science Issues, Vol. 9, Issue 4, No 2, July 2012, p. 486.

Goel S., Kiran R. , Garg D., Impact of Cloud Computing on ERP implementations in Higher Education in (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No. 6, 2011, pp. 147-148.

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material and cash flows that cooperate with each other in the framework of product flow from the raw materials phase through production and storage, to the final recipient²¹⁹. "Supply chains are therefore processes of planning, flow, storage of products or services from the supplier to the recipient."²²⁰

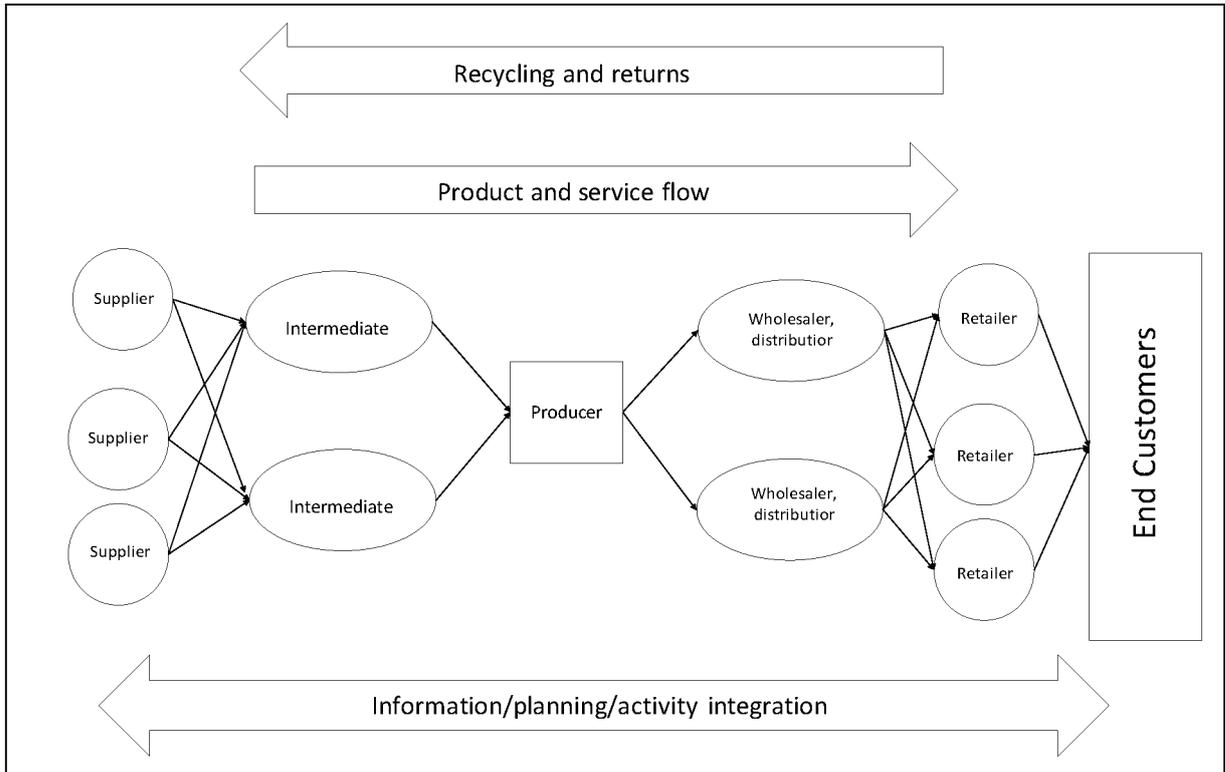


Figure 4.4. A Generic Supply Chain

Source: Wisner J. D., Tan K., Keong Leong G. Principles of Supply Chain Management: A Balanced Approach, South – Western, Mason, 2012, p. 6.

Enterprises cooperating with each other within supply chains focus primarily on fulfilling the requirements of customers who decide to purchase a specific product or service based on its quality, availability, price or pre-sale service. In addition, the importance of reverse logistics, which is also organized within the existing supply chains, should be

²¹⁹ Myerson P. A., Supply Chain and Logistics Management Made Easy, Pearson, Old Tappan 2015, pp. 4. Wisner J. D., Tan K., Keong Leong G., Principles of Supply Chain Management: A Balanced Approach, South – Western, Mason 2012, p. 6.

Lu D., Fundamentals of Supply Chain Management, Ventus Publishing ApS, Frederiksberg 2011, p. 9.

²²⁰ Myerson P. A., Supply Chain and Logistics Management Made Easy, Pearson, Old Tappan 2015, p. 4.

emphasized²²¹. Supply chains should be considered in terms of 4 types of flows: material, information, financial and commercial. **Material flow** includes processing of raw materials from the first link in the chain, to the delivery of a final product tailored to the needs of the recipient. **Information flow** is related to providing appropriate data from the market regarding the demand for products or services and feedback, i.e. analysis, forecasting, production planning or transport. The information flow takes place in two directions in distribution channels (both to and from the recipient market) and is one of the most relevant components of the channel. **Financial flow** refers to cash transferred from the final recipient as part of the payment for the received product or service. **Commercial flow** focuses on material flow, including the transfer of ownership of products. Commercial flow takes place between all links in a given supply chain²²².

Supply Chain Management, therefore, refers to the integration of processes carried out by various links in the supply chain, namely supply processes, production processes, transport, storage, as well as distribution and sales processes.

Referring to literature review, it is often possible to notice the blurring of boundaries between the concept of supply chain management and logistics. However, it should be pointed out that there is a clear difference between processes implemented within supply chains and processes strictly in the area of logistics²²³. As indicated by M. Hugos, logistics processes traditionally refer only to one organization within which they are implemented, while in the case of managing the entire supply chain, these processes are carried out as part of a multifaceted cooperation of many enterprises collectively planning and organizing processes in chains. While typical logistics processes are: procurement, storage, inventory management and distribution, SCM processes focus also on information, financial, promotional flows, as well as customer service²²⁴.

The SCM system is very often used as an ERP system module, due to the fact that firstly, an enterprise must systematize processes implemented internally, in order to be able to effectively carry out activities within the whole supply chain. The supply chain management system is characterized by the use of five main SCM controllers, which are

²²¹ Wisner J. D., Tan K., Keong Leong G., *Principles of Supply Chain Management: A Balanced Approach*, South – Western, Mason 2012, pp. 6.

²²² Lu D., *Fundamentals of Supply Chain Management*, Ventus Publishing ApS, Frederiksberg 2011, pp. 10-11.

²²³ Myerson P. A. (2015). *Supply Chain and Logistics Management Made Easy*, Pearson, Old Tappan 2015, p. 4.

Hugos M., *Essentials of Supply Chain Management 3rd edition*, Wiley, New Jersey 2011, p. 4.

²²⁴ Hugos M., *Essentials of Supply Chain Management 3rd edition*, Wiley, New Jersey 2011, p. 5.

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used to implement specific processes. Together, they lead to achieving higher efficiency of the entire system. SCM determined controllers can be distinguished as follows:

- **PRODUCTION** – defining the throughput of the chain indicating its production and storage capacity.
- **INVENTORY** – the quantities maintained in individual links of the stocks depend, to a large extent, on demand and channel capacity. Here, consecutive types of stocks can be distinguished: cyclical, seasonal, security, etc.
- **LOCATION** – strictly refers to the geographical distribution of the chain's participants and the adaptation of processes depending on the distance among subsequent links in the chain,
- **TRANSPORT** – indication of the appropriate means of transport depending on the demand, the specifics of the distributed goods and also logistics infrastructure available.
- **INFORMATION** – a binder that combines the other four aspects used in chains, used for providing optimal decisions regarding individual SCM controllers²²⁵.

The most frequently indicated strengths of SCM systems include:

- increase in the ability to adapt products and services to the specialized requirements of clients,
- cost reduction,
- shortening process implementation times,
- the ability to quickly respond to changes taking place on the market,
- increase in the effectiveness of forecasting processes,
- increase in customer satisfaction and customer loyalty.

The biggest risks associated with the use of SCM included:

- high implementation costs,
- limited access to the system by all economic entities, especially small enterprises,
- obstructed integration of systems used in various organizations²²⁶.

²²⁵ Hugos M., *Essentials of Supply Chain Management* 3rd edition, Wiley, New Jersey 2011, pp. 10-17.

²²⁶ Jespersen B. D., Skjott-Larsen T., *Supply Chain Management: In Theory and Practice*, Copenhagen Business School Press D, Copenhagen 2005, p. 53.

Misra V., Khan M. I., Singh U. K., *Supply Chain Management Systems: Architecture, Design and Vision*, *Journal of Strategic Innovation and Sustainability* vol. 6(4) 2010, pp. 102-103.

4.2.3. Customer Relationship Management (CRM)

Customer Relationship Management (CRM) is defined by L. Jha as „(...) a multifaceted process, mediated by a set of information technologies, that focuses on creating two-way exchanges with customer so that firms have an intimate knowledge of their needs, wants, and buying patterns.”²²⁷.

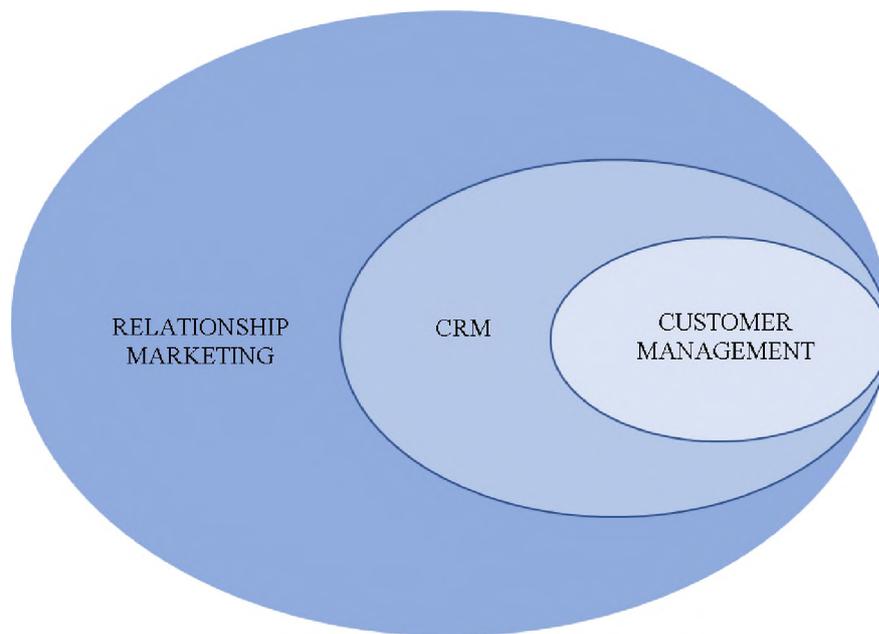


Figure 4.5. Dependencies between Relationship Marketing, CRM and Customer Management

Source: Payne A., Frow P., Customer Relationship Management: A Strategic Perspective, Journal of Business Market Management vol. 3 2009/1, pp.10.

Payne A. and Frow P. define customer relationship management as an intermediate concept between relationship marketing and customer management. Taking a broader perspective, the authors state that relationship marketing can be considered as: “(...) strategic management of relationships with all relevant stakeholders in order to achieve long term shareholder value. Critical tasks include the identification of relevant relational forms for different stakeholders and the segments and subgroups within them and the optimal

²²⁷ Jha L., Customer Relationship Management: A Strategic Approach, Global India Publications, New Delhi 2008, pp. 1.

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management of interactions within these stakeholder networks.”²²⁸ Relationship marketing involves establishing and maintaining a long-term relationship with all institutional partners of a given company. Customer Management is “(...) concerned with tactical aspects of CRM implementation that relate to the management of customer interactions, including the use of tools such as campaign management, sales force automation, web-enabled personalization and call centre management.”²²⁹ CM constitutes direct contact with customers, which is a kind of CRM system tool that uses specific sales activation techniques. CRM system is “(...) a cross-functional strategic approach concerned with creating improved shareholder value through the development of appropriate relationships with key customers and customer segments. It typically involves identifying appropriate business and customer strategies, the acquisition and diffusion of customer knowledge, deciding appropriate segment granularity, managing the co-creation of customer value, developing integrated channel strategies and the intelligent use of data and technology solutions to create superior customer experiences.”²³⁰ CRM could be defined as “(...) a business strategy to select and manage customers to optimize long-term value. CRM requires a customer centric business philosophy and culture to support effective marketing, sales, and services.”²³¹ CRM assumes establishing and maintaining long-term contacts with the company's clients in order to recognize their requirements, adapt the offered products and services to the specialized needs of recipients. This can translate into improving the efficiency of processes and increasing profits. Customer Relationship Management is concerned with maintaining close relations with clients, and its usage translates into improved communication processes, data exchange, delivery of products or services as well as financial flows²³².

S. Shanmugasundaram indicates three types of CRM structures²³³:

- operational CRM - refers to the direct contact of employees of the enterprise with customers, ultimately affecting further business processes.
- analytical CRM - consists in carrying out analyzes of the needs and specificity of clients resulting in subsequent segmentation of recipients due to specific criteria,

²²⁸ Payne A., Frow P., Customer Relationship Management: A Strategic Perspective, Journal of Business Market Management vol. 3 2009/1, pp.10.

²²⁹ Payne A., Frow P., Customer Relationship Management: A Strategic Perspective, Journal of Business Market Management vol. 3 2009/1, pp.11.

²³⁰ Payne A., Frow P., Customer Relationship Management: A Strategic Perspective, Journal of Business Market Management vol. 3 2009/1, pp.11.

²³¹ Das S., Customer Relationship Management, Excel Books India, New Delhi 2007, pp.3.

²³² Das S., Customer Relationship Management, Excel Books India, New Delhi 2007, pp.6.

²³³ Shanmugasundaram S., Customer Relationship Management: Modern Trends And Perspectives, PHI Learning Pvt. Ltd., New Delhi 2008, pp. 4.

- common CRM area - covers both direct and indirect contact with the recipient enabling the collection and processing of data, which, effectively analyzed, can lead to establishing long-term relationships with clients.

Furthermore CRM can be divided into phases as shown in the Figure 4.6.

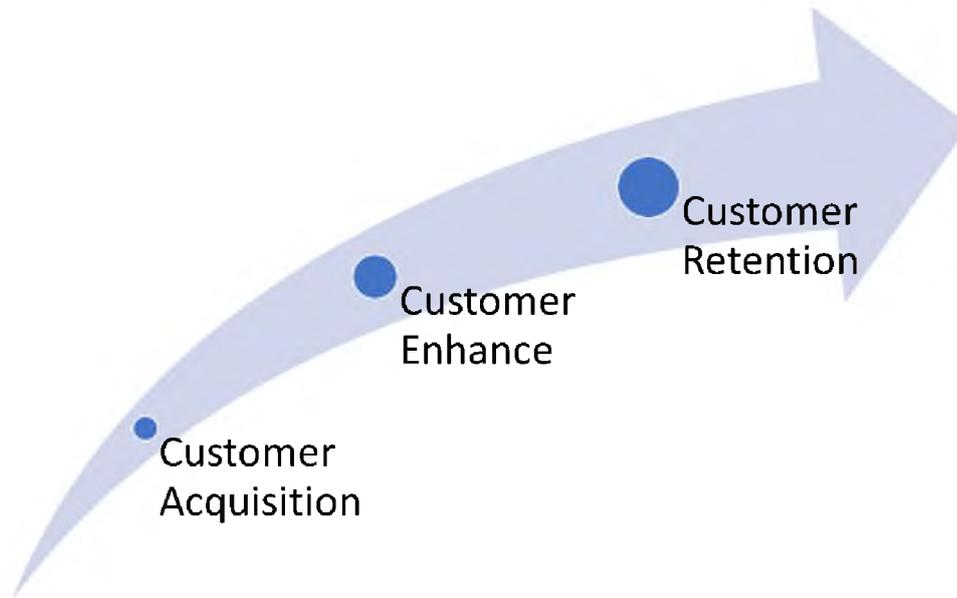


Figure 4.6. Phases of CRM System

Source: Bagad V. S. Management Information Systems, Technical Publications, Pune 2008, pp. 12-4.

With reference to the above figure, it can be said that customer acquisition is related to methods, techniques and tools, the use of which results in establishing relationships with recipients. Customer enhance can be performed through the use of specific tools and techniques, e.g. in the form of a rebate policy and customer retention possible to achieve e.g. by customer satisfaction surveys, after-sales service or providing access to new marketing channels²³⁴.

The CRM IT system, which is the most common ERP system module, should ensure that key enterprise objectives are performed, including especially:

- increasing knowledge of the needs and requirements of clients,
- implementing enterprise strategy assumptions into the system,
- providing unlimited possibilities of information exchange with clients,
- ensuring access to realization of specialized customer needs.

²³⁴ Bagad V. S., Management Information Systems, Technical Publications, Pune 2008, pp. 12-6.

The CRM system also requires full replacement of conventional contact channels in order to ensure the flow of information, e.g. using the Internet or telephone channels. In addition, the system should meet the needs of the company in terms of customer segmentation, its full analysis and required parameters²³⁵.

It should also be pointed out that the relationship between loyalty and customer satisfaction can be effectively developed by implementing and using CRM systems. The higher customer satisfaction (satisfaction with service, contact with the company, access to required information, quality of products and services, the ability to customize the product or service to individual customer order or price / quality ratio), the higher the consumer loyalty²³⁶, which is shown in the Figure 4.7.

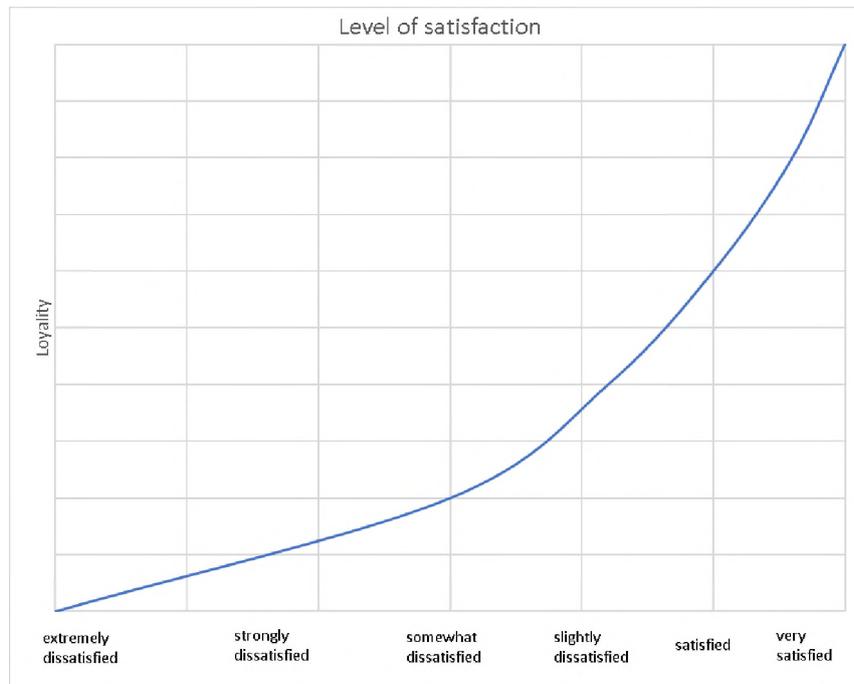


Figure 4.7. Level of loyalty chart

Source: Heskett J. L., Jones T. O., Loveman G. W., Sasser W. E., Schelsinger L. A. Putting the service profit chain to work, Harvard Business Review No. 72(2), 1994, pp. 167.

²³⁵ Peelen E., Customer Relationship Management, Pearson, Harlow 2005, pp. 10-11.

Tarnowska K., Ras Z. W., Daniel L., Recommender System for Improving Customer Loyalty, Springer, Berlin 2019, pp. 14.

²³⁶ Abdullah R. B., The relationship between store brand and customer loyalty in relating in Malaysia. Asian Social Science, Volume 8, Issue 2, 2012, pp 117-185.

Loyalty can be defined as the probability that the customer will re-use services or products of a given company due to specific criteria. When customer loyalty is greater due to his or her attachment to the organization, the company is more likely to sell products and services²³⁷.

The biggest advantages of CRM systems include²³⁸:

- indication of potentially most profitable clients of the company, which translates into focusing on those customers who generate the biggest profits,
- the possibility of adjusting the product to specific consumer requirements, thus avoiding the phase of prototyping and testing of products or services,
- customer identification based on data collected in a shared database, which simplifies the procedures for their use,
- analysis of clients in terms of various criteria allows their effective segmentation.

The disadvantages of CRM systems include²³⁹:

- very high implementation costs related to the adaptation of the system to the needs of the enterprise, the specifics of the industry and the type of processes,
- lengthy system customization process in terms of adopting it to the needs resulting from the diversity of enterprises using the system and the types of clients served, lack of ability to service all clients, especially those customers who prefer traditional forms of contact and exchange of information with the organization.

4.2.4. Warehouse Management System (WMS)

Warehouse management system (henceforth WSM) is one of the most frequently used IT systems in logistics, in addition to ERP, SCM and CRM systems. These systems gained popularity in the 1970s²⁴⁰ According to M. Hugos “Warehouse Management Systems (WMS) support daily warehouse operations. They provide capabilities to efficiently run the

²³⁷ Brink A., Berndt A., Relationship Marketing and Customer Relationship Management, Juta and Company Ltd, Lansdowne 2009, pp. 41.

Rai A. K., Customer Relationship Management: Concepts And Cases, PHI Learning Pvt. Ltd, New Delhi 2012, pp. 145-146.

Cavallone M., Marketing and Customer Loyalty: The Extra Step Approach, Springer, Berlin 2017, pp. 40.

²³⁸ Bagad V. S., Management Information Systems, Technical Publications, Pune 2008, p. 12-5.

Bock M., The advantages and disadvantages of relationship management, Grin, Munich 2008, pp. 3-4.

²³⁹ Bock M., The advantages and disadvantages of relationship management, Grin, Munich 2008, pp. 8-12.

²⁴⁰ Min H., The Essentials of Supply Chain Management: New Business Concepts and Applications, Pearson, Harlow 2015, p. 199.

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ongoing operations of a warehouse. These systems keep track of inventory levels and stocking locations within a warehouse and they support the actions needed to pick, pack, and ship product to fill customer orders.”²⁴¹ WMS systems are “(...) technologies that integrate software, bar coding equipment, and radio frequency communications to provide computerized process management and inventory control within the four walls of a storage and distribution facility.”²⁴² WMS can be also defined as “(...) *real-time* inventory-tracking, resource management, and communication system that links corporate-level production, purchasing, scheduling, and logistics activities through improved supply chain visibility.”²⁴³ Currently, enterprises are striving to take a competitive position on the market and are endeavoring at providing their customers with the shortest possible cycles of order fulfillment, satisfactory service level or adaptation of services to specialized consumer requirements.

WMS systems were created primarily to efficiently manage warehouse processes, i.e. to shorten the cycles of warehouse processes, to prevent shortages, and thus to effectively plan inventories, manage the distribution of products in warehouses and the availability of real time information on inventory. In addition, these systems are constantly developed and are gaining new functionalities, such as management of internal transport, planning and execution of warehouse operations²⁴⁴.

The major aim of Warehouse Management Systems is to manage the processes of receiving, arranging in the warehouse space, picking, packing and issuing goods from warehouses. These systems often constitute modules of ERP systems, but sometimes they can work as separate software only adapted to the structure of the Enterprise Resource Planning system used in a given enterprise²⁴⁵.

The implementation of these system is necessitated not only by the growing demands on the customers’ side, but also the organization itself forced to fulfill clients’ requirements. The efficient functioning of the warehouse contributes to the effectiveness of other areas of the company’s operation and consequently the entire supply chains. The ability to control warehouse process in real time determines, for example, the effectiveness of sales processes

²⁴¹ Hugos M., *Essentials of Supply Chain Management* 3rd edition, Wiley, New Jersey 2011, p. 119.

²⁴² USAID, *Guidelines for Warehousing Health Commodities*, DELIVER, Boston 2005, p. 55.

²⁴³ Min H., *The Essentials of Supply Chain Management: New Business Concepts and Applications*, Pearson, Harlow 2015, pp. 198-199.

²⁴⁴ Min H., *The Essentials of Supply Chain Management: New Business Concepts and Applications*, Pearson, Harlow 2015, p. 198.

Tompkins J. A., Smith J. D., *The Warehouse Management Handbook*, Tompkins Press, Raleigh 1998, p. 17.

²⁴⁵ Myerson P. A., *Supply Chain and Logistics Management Made Easy*, Pearson, Old Tappan 2015, p. 143.

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or communication with the client. It should be noted, however, that WMS do not only focus on inventory management. WMS is used primarily for inventory control and planning, in-house transport or optimization of surface use. They require full real time access to data, which conditions effective communication and cooperation with other systems used in enterprises. The abovementioned aspects distinguish WMS from classic systems used for inventory management²⁴⁶. The following constitute functions frequently implemented by WMS²⁴⁷:

- order processing – receiving, planning and implementation,
- planning and scheduling deliveries – indicating order number, the number of pallets, the type of transported goods and automatically allocating the place of unloading and subsequent storage,
- controlling of the compliance of delivery with the order,
- storing – handling and controlling goods stored in the warehouse,
- picking, completing, packaging and consolidating – according to customer orders,
- continuous monitoring of inventory levels – indicating the need to make an order,
- planning processes in the warehouse,
- data collecting and analyzing.

The most important advantages of WMS systems include²⁴⁸:

- access to real-time stock and warehouse data,
- reduction of order fulfillment cycles,
- reduction of numbers of errors and complaints,
- the ability to automatically plan and replenish inventory,
- optimization of the use of storage space,
- increase in the level of customer service and reduction in the number of paper documents.

Integration of the WMS with the ERP system used in the organization is crucial in many aspects. The most important of these include the ability to control all processes in one

²⁴⁶ Richards G., Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse, Kogan Page Publishers, London 2011, p. 138.

²⁴⁷ Min H., The Essentials of Supply Chain Management: New Business Concepts and Applications, Pearson, Harlow 2015, pp. 200-201.

²⁴⁸ Richards G., Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse, Kogan Page Publishers, London 2011, pp. 138-139.

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software in order to increase their efficiency. Using one database reduces the risk of making mistakes to a minimum, and thus translates into an increase in customer satisfaction. In addition, systems that are integrated with each other guarantee higher efficiency of process handling than the same systems operating separately. The WMS very often uses technologies that support the control of the flow of goods in the warehouse, such as barcode scanners, RFID or audio signals. These devices must be synchronized with the database used in the enterprise, which allows access to information in real time²⁴⁹.

The integration of WMS with the tool Electronic Data Interchange (EDI), which allows data transmission between systems in the form of a standard message, is particularly significant. EDI enables to reduce the amount of operations performed in the system due to the possibility of using a common database, to improve information flow and minimize the number of documents generated in the systems²⁵⁰.

RFID (Radio Frequency Identification) is a technology that uses radio signals to wirelessly read information provided on labels concerning goods and services²⁵¹. The bar code system, as the most commonly used loading unit identification system in the warehouse, employs information coded in the shape of black and white rectangles or squares that are readable by the most common mobile barcode scanners²⁵². The most common bar code imageries are EAN, UPC or SSCC in the symbolism of GS1 or Matrix Codes (Aztec, QR Code, MaxiCode, Data Matrix Code, Dot Code A)²⁵³.

In addition, modern picking technologies are also often used. This covers the processes of handling orders both in material and information approach. Signals, most often sound and light, enable non-contact handling of many processes in the warehouse, affecting the improvement of warehouse efficiency as well as employee satisfaction and convenience²⁵⁴. WMS systems in the near future will use solutions introduced in Logistics 4.0 guaranteeing the use of devices enabling the collection, storage and analysis of product data (such as dimensions, manufacturer, batch number, etc.) or the number of products on the pallet. This

²⁴⁹ Myerson P. A., *Supply Chain and Logistics Management Made Easy*, Pearson, Old Tappan 2015, p. 143.

²⁵⁰ Payne J. E., Anderson R. H., *Electronic Data Interchange (EDI) Using Electronic Commerce to Enhance Defense Logistics*, Rand, Santa Monica 1991, p. 2-3.

²⁵¹ Hompel M., Schmidt T., *Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems*, Springer, Berlin 2006, p. 214.

²⁵² Heinrich M., *Warehousing and Transportation Logistics: Systems, Planning, Application and Cost Effectiveness*, Kogan Page Publishers, London 2018, pp. 608-609.

²⁵³ Hompel M., Schmidt T., *Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems*, Springer, Berlin 2006, pp.200-212.

²⁵⁴ Min H., *The Essentials of Supply Chain Management: New Business Concepts and Applications*, Pearson, Harlow 2015, pp. 204-205.

information is then automatically transferred to the WMS, thus ensuring the ability of real time inventory management. In addition, at the entrance to the warehouse, it is possible to scan loads and indicate defective products that are immediately removed and replaced with the appropriate ones to reduce the risk of failure or errors in the later stages of the process²⁵⁵.

4.2.5. Business Intelligence (BI)

Business Intelligence (henceforth BI) systems are derived from Decision Support System (DSS) and focus on providing available and structured information to make effective decisions²⁵⁶. DSS uses data and analyses that supports the most suitable, under particular circumstances, decisions. DSS, as complete systems, support various areas of the economy, such as production management, supply chain, marketing, finances or personnel management. Decisions taken repeatedly by DSS were gradually supported by modern tools based on computer techniques, which in the 1990s began to be widely referred to as Business Intelligence²⁵⁷. The concept of Business Intelligence was first proposed by R. M. Devens in 1865, and then by H. P. Luhn in 1958²⁵⁸. According to Stackowiak et al. "Business intelligence is a process of taking large amounts of data, analyzing that data, and presenting a high-level set of reports that condense the essence of that data into the basis of business actions, enabling management to make fundamental daily business decisions."²⁵⁹ Golfarelli et.al point out that "BI (...) includes effective data warehouse and also a reactive component capable of monitoring the time-critical operational processes to allow tactical and operational decision-makers to tune their actions according to the company strategy."²⁶⁰

BI refers first of all to the use of available tools and analyses to effectively perform decision-making processes and to productively implement organizational processes in the

²⁵⁵ Macaulay J., Buckalewm L., Chung G., Internet Of Things In Logistics, DHL Customer Solutions & Innovation, Troisdorf 2015, p. 14.

²⁵⁶ Azevedo A., Santos M., Integration of Data Mining in Business Intelligence Systems, IGI Global, Hershey 2014, p. 2.

²⁵⁷ Sharda R., Delen D., Turban E., Business Intelligence and Analytics Systems for Decision Support 10th edition, Pearson, Harlow 2014, pp. 43-44.

²⁵⁸ Azevedo A., Santos M. F., Integration of Data Mining in Business Intelligence Systems, IGI Global, Hershey 2014, p. 2.

Castellanos M., Dayal U., Sellis T., Business Intelligence for the Real-Time Enterprise: Second International Workshop, BIRTE 2008, Auckland, New Zealand, August 24, 2008, Revised Selected Papers, Springer, Berlin 2009, p. 75.

²⁵⁹ Stackowiak R., Rayman J., Greenwald, R., Oracle Data Warehousing and Business Intelligence Solutions, Wiley Publishing, Inc, Indianapolis 2007, pp. 30.

²⁶⁰ Sturdy G., Customer Relationship Management using Business Intelligence, Cambridge Scholars Publishing, Cambridge 2012, pp. 150.

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company. Due to the fact that one of the overarching purposes of ERP systems is the successful exchange of data among computer applications users, including between suppliers and clients, processes of acquiring and analyzing huge amounts of data appear to be important. An ERP system without the required modules does not provide organizations with the functionalities required for their purposes. Systems that constitute ERP modules such as SCM, CRM or technologies such as RFID support the functioning of the enterprise management system, effectively influencing the efficiency of the process. Therefore, the ultimate goal of BI systems is structuring and effective distribution of data flowing into the enterprise²⁶¹. As a result of implementing SCM systems, Business Intelligence has become a tool for sorting huge amounts of data that are provided to enterprises, by applying modern information technologies. Utilizing resulting BI analyses allows for effective decision-making²⁶². Business Intelligence consists of four major components, i.e. data warehousing, constituting a source of data used in analyses, business analytics, which is a tool used to search and analyze existing information, Business Performance Management (BPM) that controls the effectiveness of business processes, and user interface which provides information exchange between system users²⁶³.

²⁶¹ Sturdy G. R., *Customer Relationship Management using Business Intelligence*, Cambridge Scholars Publishing, Cambridge 2012, pp. 144-145.

²⁶² Myerson P. A., *Supply Chain and Logistics Management Made Easy*, Pearson, Old Tappan 2015, pp. 216.

²⁶³ Sharda R., Delen D., Turban E., *Business Intelligence and Analytics Systems for Decision Support* 10th edition, Pearson, Harlow 2014, pp. 45.

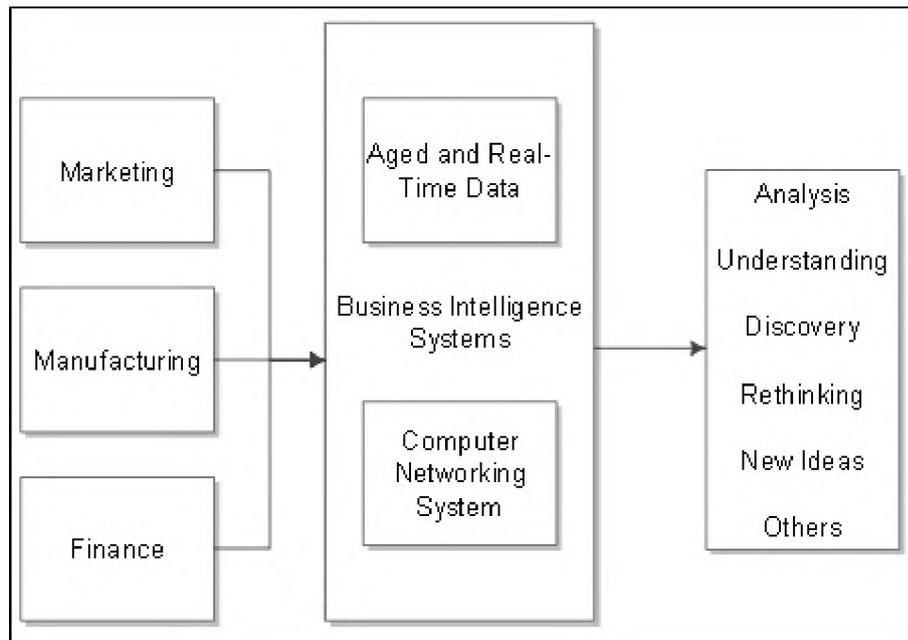


Figure 4.8. Business Intelligence System Infrastructure

Source: Thierauf R. J. Effective Business Intelligence Systems, Quorum Books, London, 2001, pp. 6.

The life cycle of each BI system is shown in Figure 4.9.

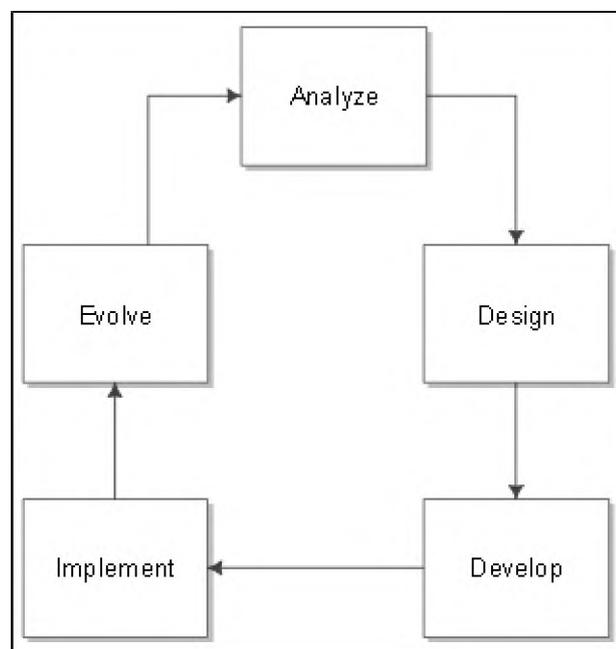


Figure 4.9. Life cycle of Business Intelligence System

Source: Gangadharan G. R., Swami S. N., Business Intelligence Systems: Design and Implementation Strategies in 26th Int. Conf. Information Technology Interfaces ITI, June 7-10, Cavtat 2004, pp. 141.

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BI systems play a particularly crucial role in the organizational development of the company. Effective implementation of the BI system requires, essentially, a proper vision, financial resources, and adaptation of the organizational structure²⁶⁴.

BI systems enable to comprehensively demonstrate the company's vision from three perspectives: past, present and future, using both data from the recipient market and competitors, hence the name external data, as well as those from individual departments of the company (internal). Business Intelligence enables primarily to make effective choices and make decisions based on a wide range of data from both the environment and the organization of the company. Decision-making processes are implemented in both strategic and tactical terms and refer predominantly to the positioning and pricing policy of enterprises²⁶⁵.

The most important components of Business Intelligence systems are:

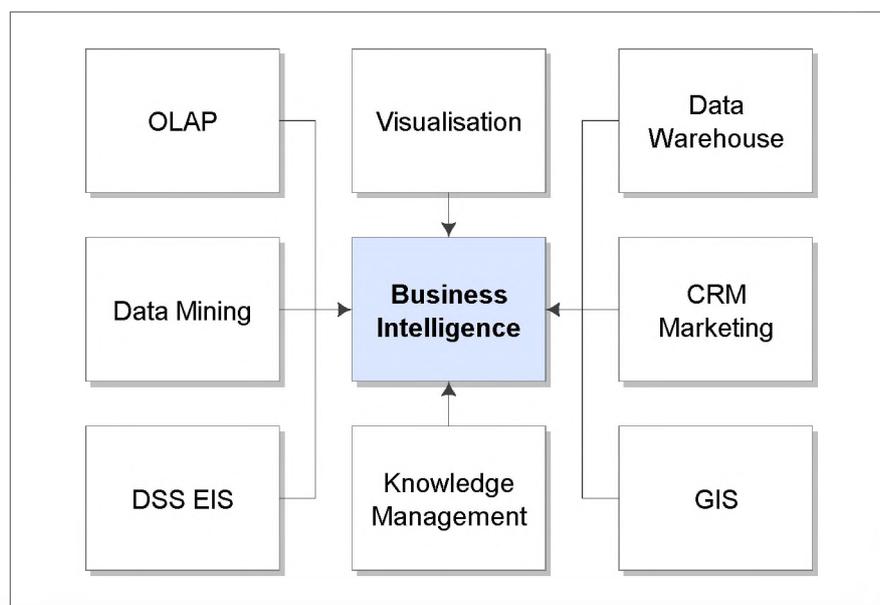


Figure 4.10. Components of Business Intelligence System

Source: Sturdy G. R. Customer Relationship Management using Business Intelligence, Cambridge Scholars Publishing, Cambridge, 2012, pp. 151.

One of the most frequently applied tools is Data Warehousing, which is responsible for acquiring, aggregating, storing, selecting, analyzing and distributing obtained

²⁶⁴ Thierauf R. J., Effective Business Intelligence Systems, Quorum Books, London 2001, p. 3.

²⁶⁵ Bentley D., Business Intelligence and Analytics, Library Press, New York 2017, p. 1.

information²⁶⁶. Data Mining focuses on acquiring and analyzing a large amount of data from various areas of the company's operations to identify the relationship between data and the construction of appropriate models for the implementation of predictive activities²⁶⁷. One of the most important components of BI is OLAP (OnLine Analytical Processing), in which computer applications, using mathematical and computational models, analyze huge data sets²⁶⁸. OLAP systems can be divided into particular categories. The first one is ROLAP (relational OLAP), which stores data in the source form and uses relational databases to provide information to the user at the moment he requests it. The next one, MOLAP (multidimensional OLAP) stores data in multidimensional warehouses, in contrast to ROLAP, which employs relational database. The last category is HOLAP (hybrid OLAP), which is a combination of the two previous ones²⁶⁹. Furthermore, Business Intelligence includes the following components²⁷⁰:

- Multidimensional aggregation and allocation,
- Denormalization, tagging and standardization,
- Realtime reporting with analytical alert,
- A method of interfacing with unstructured data sources,
- Group consolidation, budgeting and rolling forecasts,
- Statistical inference and probabilistic simulation,
- Key performance indicators optimization,
- Version control and process management,
- Open item management.

The use of the BI system implemented in an enterprise can be characterized by the possibility of achieving significant organizational benefits, essentially increasing the company's profits, effectively managing risk, establishing relations with both suppliers and clients, or adapting its products or services to special customer requirements²⁷¹.

²⁶⁶ Sturdy G. R. (2012). *Customer Relationship Management using Business Intelligence*, Cambridge Scholars Publishing, Cambridge 2012, pp. 151-152.

²⁶⁷ Kelidbari H. R. R., Rayat M., *The Effects of Business Intelligence on the Effectiveness of the Organization (Case Study: Airline Companies in Iran)*, *Review of European Studies*; Vol. 9, No. 3/2017, Canadian Center of Science and Education 2017, p. 179.

²⁶⁸ Bentley D., *Business Intelligence and Analytics*, Library Press, New York 2017, p. 22.

²⁶⁹ Sharda R., Delen D., Turban E., *Business Intelligence and Analytics Systems for Decision Support* 10th edition, Pearson, Harlow 2014, pp. 141-142.

²⁷⁰ Bentley D., *Business Intelligence and Analytics*, Library Press, New York 2017, pp. 1-2.

²⁷¹ Thierauf R. J., *Effective Business Intelligence Systems*, Quorum Books, London 2001, p. 13.

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G. Gottlob indicates modern tools characterized by increasing influence on Business Intelligence systems, which include²⁷²:

- Data Modeling and ETL Support)
- Big Data,
- Visualization, Visual Mining, and Reporting,
- Process Mining,
- Text Mining.

Particularly interesting from the point of view of the development of the BI system is its connection with cloud systems, which resulted in the creation of Business Intelligence Service Management (BISM). The system is based on the processing of countless amounts of data in the cloud, allowing the analysis of data in the virtual world, which is accessible to authorized users from anywhere on Earth with access to the Internet. BISM facilitates the management of decision-making processes in the enterprise and increases the flexibility of the company to meet customers' expectations. It also advisable to discuss the risks associated with the utilization of cloud systems and related to the concerns of many users about the security and confidentiality of data. However, it is anticipated that soon cloud systems will become the everyday reality used globally in international enterprises²⁷³.

²⁷² Gottlob G., *Fundamentals of Business Intelligence*, Springer, Berlin 2015, pp. 329-340.

²⁷³ Gupta P., Dubey A., *Business Intelligence : Techniques And Integration With Datamining, Knowledge Management And Cloud*, *International Journal of Engineering Researches and Management Studies* No. 3(12)/2016, pp. 59-60.

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5. PROCESSES MANAGEMENT

5.1. Process definition

Process management requires defining the concept which is the process, i.e. “Any activity or group of activities that takes one or more inputs, transforms them, and provides one or more outputs for its customers.”²⁷⁴ Furthermore “(...) every part of any business is concerned with managing processes.”²⁷⁵

The processes are enforced by performing a series of individual operations and thanks to performing them subscribers achieve previously assumed business objectives. They include activities such as product manufacturing or service performance obtained as part of managing the manufacturing processes of an enterprise. Operations are primarily focused on converting raw materials into finished goods²⁷⁶. Krajewski et al. defines operations as “a group of resources performing all or part of one or more processes.”²⁷⁷

The purpose of processes is, therefore, to manufacture products and services as a result of the implementation of operations specified in it in a way that allows achieving business objectives of the organization. The concept of operations management was created as a result of the transformation of the production management concept over the years, which initially referred strictly to management of the processing raw materials into finished products. Operations management can, therefore, be defined as “(...) management of work, or (...) the management of any productive activity.”²⁷⁸ Operations management refers to both products resulting from the physical processing of raw materials into finished goods and intangible services provided to the client. Operations management also involves ensuring an effective course of planned operations. “Operations Management is a systematic approach to address all the issues pertaining to the transformation process that converts some inputs into output

²⁷⁴ Krajewski L. J., Malhotra M. K., Ritzman L. P., Operations Management PROCESSES AND SUPPLY CHAINS, Pearson, Harlow 2016, p. 637.

²⁷⁵ Slack N., Brandon-Jones A., OPERATIONS AND PROCESS MANAGEMENT. Principles and Practice for Strategic Impact, Pearson, Harlow 2018, p. 2.

²⁷⁶ Slack N., Brandon-Jones A., OPERATIONS AND PROCESS MANAGEMENT. Principles and Practice for Strategic Impact, Pearson, Harlow 2018, p. 2.

Myerson P. A., Supply Chain and Logistics Management Made Easy, Pearson, Old Tappan 2015, pp. 7.

²⁷⁷ Krajewski L. J., Malhotra M. K., Ritzman L. P., Operations Management PROCESSES AND SUPPLY CHAINS, Pearson, Harlow 2016, p. 23.

²⁷⁸ Galloway R. L., Operations Management: The Basics, Cengage Learning EMEA, London 1996, p. 2.

that are useful, and could fetch revenue to the organization.”²⁷⁹ Processes can be seen as a set of related activities performed in accordance with a specific scheme to meet the customer’s specialized needs²⁸⁰.

Processes constitute a set of activities used to implement both the tactical plans of the company (and, thus, the effective production of finished products or provision of services), and tactical or strategic plans, the implementation of which results in achieving business objectives of the organization. Enterprises operating on the market are characterized by a specific approach to managing business decisions. The first one is process approach with emphasis placed primarily on ensuring the maximum effectiveness of organizational processes. In process approach, enterprises present the efficiency of their business processes in addition to the functions of specific units in the organization. The overall goal here is to support effective process enforcement.

Functional approaches are primarily characterized by a small degree of business process integration provided in the enterprise. Particular departments of enterprises or partners in the value chain focus on fulfilling individual aims instead of seeking to increase the efficiency of collectively performing processes towards enhancing business process integration level²⁸¹.

Process approach differs significantly from the functional approach and has become the basis for an effective increase in KPIs and profits of many organizations.

Business processes can be defined as “(...) a set of functions in a certain sequence that delivers at the end a value for an internal or external client.”²⁸² In other words “a business process is a collection of tasks and activities (business operations and actions) consisting of employees, materials, machines, systems, and methods that are being structured in such a way as to design, create, and deliver a product or a service to the consumer.”²⁸³ Business processes constitute collections of activities performed in a specific sequence, which if effectively performed can be conducive to achieving business objectives and meeting the needs of customers. The more the tangible and intangible resources utilized by the enterprise

²⁷⁹ Mahadevan B., *Operation Management: Theory and Practice*, Pearson, New Delhi 2009, p. 5.

²⁸⁰ von Rosing M., Scheer A., von Scheel H. (eds.), *The Complete Business Process Handbook. Body of Knowledge from Process Modeling to BPM*, Elsevier, Waltham 2015, p. 1-2.

²⁸¹ Jeston J., Nelis J., *Management by Process. A Roadmap to Sustainable Business Process Management*, Elsevier, Oxford 2008, p. 90-93.

²⁸² Kirchmer M., *High Performance Through Process Excellence. From Strategy to Execution with Business Process Management*, Springer, Berlin 2011, p. 2.

²⁸³ von Rosing M., Scheer A., von Scheel H. (eds.), *The Complete Business Process Handbook. Body of Knowledge from Process Modeling to BPM*, Elsevier, Waltham 2015, p. 2.

are integrated, the higher the probability of effectively managing processes. Only joint management of processes and resources available in the organization or supply chain ensure achieving a satisfactory financial result. This indicates the importance of managing business processes in economic activity²⁸⁴.

As part of implementing business processes, it is necessary to effectively use IT systems supporting the organization, enforcing and controlling subprocesses, which are implemented as part of business processes of enterprises. Business subprocesses include: customer service, and sales or raw material purchase processes. In order for business subprocesses to achieve their organizational purposes, it is crucial to guarantee an adequate flow of information between IT systems integrated within a given organization. A common database used by various departments such as production, distribution or sales management is required so that business processes implemented by the company enable profit generation in the shortest possible time and at the lowest cost. Business processes usually consist of three components: material flow, information flow and data flow performed towards effective process management²⁸⁵.

The processes currently implemented by many organizations can be characterized by several important parameters presented below²⁸⁶:

- size – the number of activities performed as part of a given process; the less steps, the simpler the process,
- complexity – a feature slightly related to size, referring to the complexity level of the process,
- cycle of the process – time which is needed from the beginning of the first operation until the end of the last operation in the cycle,
- sensitivity to delays – the process may feature varying degrees of delay sensitivity; if a business process has high sensitivity to delays, subsequent execution of any operation may result in a delay in the entire process (no time reserve), low sensitivity to delays indicates that the process is characterized by a certain time reserve.

²⁸⁴ Weske M., *Business Process Management. Concepts, Languages, Architectures*, Springer, Berlin 2007, p. 4.

²⁸⁵ Verma N., *Business Process Management: Profiting from Process*, Global India Publications, New Delhi 2009, p. 4.

²⁸⁶ Kumar A., *Business Process Management*, Routledge, New York 2018, p. 6-7.

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Three types of processes executing by organizations can be indicated²⁸⁷:

- Management Processes – “planning, budgeting, control, oversight, and monitoring of main or supporting processes”,
- Main Processes – transformation process of specific input elements into output,
- Supporting Processes – designed to provide all appropriate conditions to enforce the main processes.

In addition, the types of processes should be indicated due to the level of operations and decisions taken by individual company units²⁸⁸:

- Governance Process – referring to the planning, organization and control of activities aimed at achieving strategic objectives,
- Management Process – processes aimed at ensuring undisturbed materials and information flow and effective enforcement of previously planned activities,
- Operational Process – managing operations at the operational level, e.g. controlling workstations.

Each business process consists of specific components, which include²⁸⁹:

- decision points – points in time referring to the order of operations performed in the process, in which it is necessary to make appropriate decisions which significantly impact the further implementation of business activities,
- participants – this group includes employees, suppliers, recipients,
- infrastructure – equipment, systems essential to implement business processes,
- physical objects – equipment of individual departments with appropriate devices, raw materials, consumables, finished products,
- intangible objects – related, for example, to electronic circulation of documentation.

In order to effectively implement business objectives, it is necessary to have in place appropriate management processes. Consequently, controlling the correctness of the way in

²⁸⁷ von Rosing M. Scheer A., von Scheel H. (eds.), *The Complete Business Process Handbook. Body of Knowledge from Process Modeling to BPM*, Elsevier, Waltham 2015, p. 162.

²⁸⁸ Kirchmer M., *High Performance Through Process Excellence. From Strategy to Execution with Business Process Management*, Springer, Berlin 2011, p. 6.

²⁸⁹ Dumas M., La Rosa M., Mendling J., Reijers H. A., *Fundamentals of Business Process Management*, Springer, Berlin 2013, p. 4.

which individual operations and processes are performed is of utmost importance. Section 5.2. provides an analysis of the concept of **Business Process Management**.

Speaking about business process management, it is also necessary to refer to the Value Stream Mapping tool, which is most often used as part of the lean management philosophy. In the context of BPM, VSM is an important element that enhances not only the identification of value adding processes but also improvement of business processes management activities.

Value Stream Mapping is a method used to analyze and improve production and service processes based on Lean philosophy (lean management). The value stream map shows the material and information flow in the process under investigation. The course of the method includes several basic stages. The first one is a diagnosis of the current state of the process, carried out by gathering all relevant information about it and illustrating the current flow.

Then, by analyzing the map of the present state, it should be indicated where the process is wasteful and where improvements can be made by using the small steps method. The second map is the current material and information flow with the Kaizen ideas. Based on the visualization of the implementation of suggestions for improvement proposed in this map, a map of the future state is created, presenting a vision of the target state. This map is the basis for the creation of a plan for improvement and the introduction of improvements to business practice (Figure 5.1)²⁹⁰.

²⁹⁰ Nash, M.A., Poling S.R., *Mapping the Total Value Stream*, Publishing House: Taylor & Francis Group, New York 2008.

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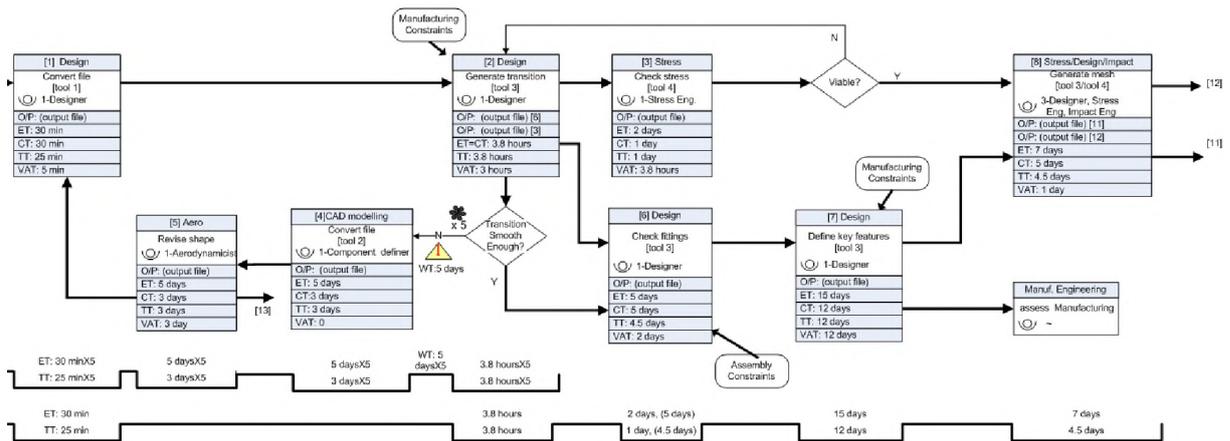


Figure 5.1. Sample of proposed VSM method

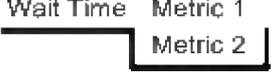
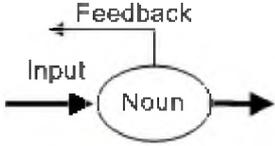
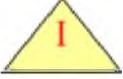
Source: Shehab E., Haque B., Al-Ashaab A., *Value Stream Mapping and Analysis of Product Development (Engineering) Processes*, Proceedings of the 8th International Conference on Manufacturing Research ICMR 2010.

Table 5.1 shows the main symbols and concepts that were adapted from different methods. Additional details and concepts were added in order to allow further utilization of the proposed tool.

Table 5.1. Proposed VSM main symbols and concept

Sources/Symbols		PDVSM (McManus 2005)	Transactional VSM (Nash and Poling 2008)	Role Activity Diagram (Ould 1995)	Learning to see VSM (Rother and Shook 2003)	Proposed by authors of this paper
 x 5	Number of iterations: within or across activities			X		
 Noun	Burst: A Kaizen symbol that intends to draw attention	X	X		X	

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	Timeline: drawn below the activities flow path	X	X		X	
	External Constraint or Requirement	X				
	Review of the process	X				
 <p>Wait Time</p>	The waiting time it takes for the information to be pre-processed by the engineer	X	X			
 <p>Queue Time</p>	The time that the information has to wait due to queuing system	X	X		X	
Activity Box	N: is the sequence number of the activity.	X				
	Function: indicates where the activity takes place					X
	M The number of engineers/designers		X		X	
	Automated activity: indicated by the absence of the number					X
	Role: of the users, ex designer					X
	Tool: the software or tool used for the activity					X
Activity: within the function, ex: create mesh	X	X		X		

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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px;">O/P: file format type</td></tr> <tr><td style="padding: 2px;">Metric 1:</td></tr> <tr><td style="padding: 2px;">Metric 2:</td></tr> </table>	O/P: file format type	Metric 1:	Metric 2:	Chosen metrics, ex Rework, Cycle time	X	X		X	
O/P: file format type									
Metric 1:									
Metric 2:									
	Output file format					X			
→ [D]	D: Indicates the destination of the output file					X			

Source: Shehab E., Haque B., Al-Ashaab A., Value Stream Mapping and Analysis of Product Development (Engineering) Processes, Proceedings of the 8th International Conference on Manufacturing Research ICMR 2010.

VSM assumes the implementation of two types of maps, the current state map (as is), on the basis of which all activities that are the bottlenecks of the process are performed as well as their compensation methods provided using the future state map (to be).

5.2. Business Process Management

Business Process Management Lifecycle

The need to manufacture products characterized by a higher level of process quality appeared in the 1980s as a result of not only increased needs and requirements of recipients, but also under the influence of rising competitiveness and product availability. Quality Management focused on providing the right quality of products and services through the use of concepts such as Total Quality Management, Six Sigma or later also Business Process Reengineering. The use of automation in the processes implemented in enterprises and the increase in the application of ERP systems (primarily used to increase the efficiency of processes), became the reality thanks to the employment of modern business process management systems. BPM systems are derived from the concept of Workflow responsible for the ability to design the flow of products and services within processes²⁹¹. **Workflow Management System (WfMS)** enabled the development of process management transforming it into Business Process Management System.

WfMS is responsible not only for the processes of planning the flow of goods, but also for the integration of both systems and employees involved in specific processes. The

²⁹¹ Jeston J. Nelis J., Management by Process. A Roadmap to Sustainable Business Process Management, Elsevier, Oxford 2008, pp. 90-93.

difference between WfMS and BPM results from the scope of operations carried out by both concepts. While WfMS mainly deals with the automation of business processes, BPM includes not only automation, but also analysis, integration, organization and management of business processes²⁹². The most common WfMS systems include:

- production workflow - the most common system due to a wide range of operations performed as part of production processes. First and foremost, it requires a high level of process automation of both products between workstations as well as automated document circulation. This accelerates the process, reduces the number of errors, and also minimizes costs incurred by the organization. Production workflow can be used as one of the ERP system modules, which certainly allows for a higher degree of process integration. It can also be used as an autonomous system that needs to be adapted to the system used in the enterprise.
- administrative workflow - refers primarily to all administrative processes carried out by various departments of the organization, for example sales or purchases. This module can also be used to generate efficiency reports of the system, based on which it is possible to implement system improvements leading to the growth of its efficiency, this system is usually much less structured than the production workflow.
- ad hoc workflow - a highly individualized system used in case of sporadically and non-invariable processes. In case of this system, the user designs the process and its flow independently, therefore the degree of process standardization is low.
- collaborative (groupware) workflow - includes the principles according to which cooperation between employees in a given organization takes place. It also defines general rules of conduct, information flow, workflow. However, these rules are determined individually by employees. Users can easily exchange data and information and share documentation with colleagues.
- case handling workflows - a system that provides the user with only necessary information for further processing without the need to present a well-designed business model²⁹³.

²⁹² van der Aalst W. M. P., *Business Process Management: A Comprehensive Survey*, International Scholarly Research Notices Software Engineering Volume 2013, p. 1.

Chang J. F., *Business Process Management Systems: Strategy and Implementation*, CRC Press, New York 2016, p. 132.

²⁹³ Chang J. F., *Business Process Management Systems: Strategy and Implementation*, CRC Press, New York 2016, pp. 133-136.

Dumas M., La Rosa M., Mendling J., Reijers H. A., *Fundamentals of Business Process Management*, Springer, Berlin 2013, pp. 307-308.

Total Quality Management

Total Quality Management is an approach that assumes that only by modernizing and improving the management of the organization, one can increase the efficiency of all the processes. TQM assumes that only the management of all activities and processes in the company, may result in achieving a satisfactory organizational result towards the competition and consumers. Total Quality Management is a systemic approach that assumes that only by integrating all processes in the company and their continuous and qualitative improvement, the intended organizational objectives are likely to be achieved²⁹⁴.

²⁹⁵.TQM “(...) is the application of quantitative methods and human resources to improve all the processes within an organization and exceed customers needs now and in the future.”²⁹⁶

P. Charantimath recognized the most important elements of Total Quality Management which are: products, processes, systems, personnel and leadership, also called the five pillars of TQM. The right quality of products and processes guarantees an increase in the efficiency of the enterprise, the highly advanced system is responsible for ensuring undisturbed product and services flow in business processes, while proper management of personnel by the managerial staff enables the enterprise to develop sustainably²⁹⁷.

Speaking of quality management, eight principles of TQM philosophy should also be indicated:

- 1) Customer focus,
- 2) Leadership,
- 3) Involvement of people,
- 4) Process approach,
- 5) Systems approach to management,
- 6) Continual improvement,
- 7) Factual approach to decision-making,
- 8) Mutually beneficial supplier relationships²⁹⁸.

²⁹⁴ Omachonu V. K., Ross J. E., Principles of Total Quality Management, CRC Press, Boca Raton 2004, pp. 5.

²⁹⁵ Omachonu V. K., Ross J. E., Principles of Total Quality Management, CRC Press, Boca Raton 2004, pp. 5.

²⁹⁶ Besterfield D. H. (ed.), Total Quality Management, Pearson, New Delhi 2011, p. 1.

²⁹⁷ Charantimath P. M., Total Quality Management, Pearson, New Delhi 2001, p. 59.

²⁹⁸ Torkildsen G., Torkildsen's Sport and Leisure Management, Taylor & Francis, Abingdon 2010, np. 460.

The most relevant advantages of Total Quality Management include:

- customer service quality increase,
- achieving higher quality of products and services,
- development of the company's operations not only in terms of competitiveness, but also the internal organization of its operation,
- increased staff satisfaction, which translates into an increase in the quality of order processes,
- reduction in the number of process disruptions translating into their liquefaction,
- increasing the company's profits²⁹⁹.

One of the best-known quality management systems is the International Standard Organization (ISO) established in Geneva in 1946, which contains a number of quality standards, and once these standards are met, products manufactured or services can obtain quality certificates. The most well-known quality regulation according to International Standard Organization is the ISO 9001 standard³⁰⁰.

Six Sigma (6σ) is a tool created by Motorola brand to minimize the number of quality errors due to the maximum reduction of variance (variability) specified in the parameter process from the adopted normative values. The name Six Sigma means a six times the standard deviation which is also a scale of demand volatility. The lower the deviation from the norm, the higher the control and the more efficient the management of the process³⁰¹. Six Sigma refers to both the quality of the products offered and the quality of the processes implemented. Their parameters must achieve the standards set by the organization³⁰².

The Six Sigma approach consists of five phases (DMAIC lifecycle)³⁰³:

- define – this stage identifies the process, its basic disturbances and sources of defects; this stage is also responsible for the identification of customers and their expectations, measure – this stage is used to evaluate the process, resulting in relevant process data used at later stages of the method; in the measurement phase, the effectiveness of the measuring tool is also verified,

²⁹⁹ Besterfield D. H. (ed.), *Total Quality Management*, Pearson, New Delhi, p. 11.

Charantimath P. M., *Total Quality Management*, Pearson, New Delhi 2011, p. 78.

³⁰⁰ Emmanuel M., *Methodology of Business Studies*, Pearson, New Delhi 2010, p. 72.

³⁰¹ Draheim D., *Business Process Technology. A Unified View on Business Processes, Workflows and Enterprise Applications*, Springer, London 2010, pp. 28-29.

³⁰² Truscott W., *Six Sigma*, Routledge, Burlington 2012, p. 2.

³⁰³ Hartung M., *Lean - Six Sigma: Quality & Process Management for Managers & Professionals*, BoD – Books on Demand 2010, pp. 19-22.

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- analyze – at this stage, information gathered in the measurement stage is analyzed with respect to previously assumed criteria,
- improve – this stage serves the purpose of introducing appropriate improvements to the process to the extent that ensures minimization of errors, and also results in an increase in the efficiency of the process,
- control – this stage serves the purpose of continuous monitoring of the process to verify the effects of improvements made and possible response in the event of errors being detected, thus enabling their full compensation.

Six Sigma assumes that most product damage is due to inadequate product quality, so the overriding goal of this concept is to detect any defects as early as possible as a result of identification, analysis, measurement, improvement and control processes introduced by change in management activities³⁰⁴.

“In business process management the definition and fulfillment of service-level agreements is crucial; in the Six Sigma approach the characteristics that are critical to quality and assumed impact factors of existing processes as well as their relationship are the object of investigation.”³⁰⁵

Business Process Management, as part of process integration, allows primarily to increase the efficiency of operations of entire organizations, as well as cooperating links in the supply chain. The increase in the efficiency of processes is manifested both in financial growth as well as in the increase in the degree of customer service, KPI values or cost reduction generated by enterprises. Business Processes Management can be understood as “a management discipline focused on using business processes as a significant contributor to achieving an organization’s objectives through the improvement, ongoing performance management and governance of essential business processes”³⁰⁶ BPM can be also described as “(...) process that ensures continued improvement in an organization’s performance.”³⁰⁷. The primary purpose of BPM is to identify processes implemented in organizations, their analysis in terms of effectiveness as well as design and implementation of solutions improving these processes to achieve greater efficiency of the entire enterprise. Business

³⁰⁴ Hartung M., *Lean - Six Sigma: Quality & Process Management for Managers & Professionals*, BoD – Books on Demand 2010, pp. 6-8.

³⁰⁵ Draheim D., *Business Process Technology. A Unified View on Business Processes, Workflows and Enterprise Applications*, Springer, London 2010, pp. 28-29.

³⁰⁶ Jeston J., *Business Process Management*, Routledge, New York 2014, p. 6.

³⁰⁷ Burlton R., *Business Process Management: Profiting From Process*, Pearson, Harlow 2001, p. 12.

Process Management is intended to serve as an improvement of the production processes, products and services provided to clients through processes of continuous analysis, design and management of business processes of the enterprise³⁰⁸.

Business Process Management pursue managing integrated processes that are implemented using functionally connected systems. “Business Process Management System is the convergence of the various integration technologies that culminate in a process-centric information technology (IT) platform for delivering business process management solutions.”³⁰⁹ To put it differently “The purpose of a BPMS is to coordinate an automated business process in such a way that all work is done at the right time by the right resource.”³¹⁰ Business process management systems are, thus, utilized to facilitate organizational processes executed by individual enterprises through the application of appropriate IT support. Due to the fact that the processes implemented within the framework of BPMS, can include both the employees of the organization and the installed machines and devices, N. Verma distinguishes three types of processes that can occur in business process management systems. These include such processes as: system-to-system, person-to-system and person-to-person.

System-to-system processes

These processes provide a fully automated information exchange among the integrated software used by a given organization to accelerate and unify business processes management procedures. In order to fulfill this, it is necessary to standard formatted document models supported by both order management systems and warehouse management and delivery planning schemes that can be used by all systems implemented within the organization or supply chain.

Person-to-system processes

These processes are most often initiated by the employees of the responsible for conducting the process. Further stages of process implementation are performed automatically between the systems used, as in the case of system-to-system processes.

Person-to-person processes

³⁰⁸ Chang J. F., *Business Process Management Systems: Strategy and Implementation*, CRC Press, New York 2016, p. 31.

³⁰⁹ Verma N., *Business Process Management: Profiting from Process*, Global India Publications, New Delhi 2009, p. 185.

³¹⁰ Dumas M., La Rosa M., Mendling J., Reijers H. A., *Fundamentals of Business Process Management*, Springer, Berlin 2013, p. 298.

Processes executed in the organization are performed by the employees responsible for generating relevant documents and then sharing relevant data with colleagues from other departments, which makes these processes more complex and similar to traditional business processes management³¹¹.

The Life Cycle of the System indicates the next phases that a given system achieves through the implementation of particular activities and operations. In case of a system like BPM, this cycle is continuous. It assumes that repetitive sequences of the same activities indicated by a specific model are repeated in order to continuously improve the processes. According to its definition “(...) lifecycles are used to explain the building blocks of business process management. Business process management products – both technologies and consultant services – often come with their own lifecycle model.”³¹²

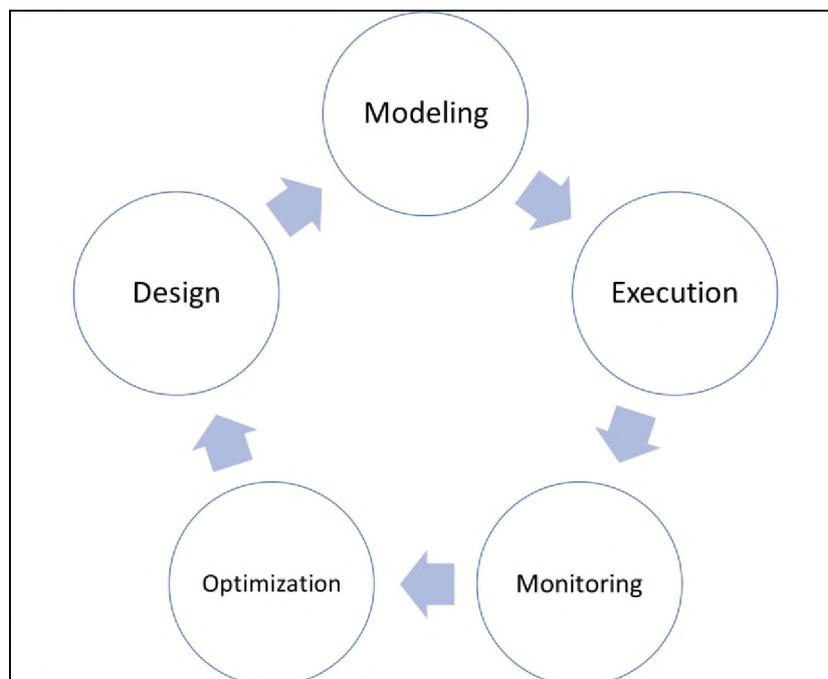


Figure 5.2. Business process management lifecycle

Source: Draheim D. Business Process Technology. A Unified View on Business Processes, Workflows and Enterprise Applications, Springer, London, 2010, p. 27.

³¹¹ Verma N., Business Process Management: Profiting from Process, Global India Publications, New Delhi 2009, p. 185-190.

Draheim D. Business Process Technology. A Unified View on Business Processes, Workflows and Enterprise Applications, Springer, London, 2010, p. 27.

As can be seen in relevant literature, authors define the life cycle of the BPM system and its components in various ways. These cycles consist of several phases, repeated continuously, which only indicates the lack of possibility to stop the management of business processes. The division of the BPM life cycle is conventional because some authors have listed up to six phases of the life cycle, and some only three. The cycle located in Figure 5.2. assumes the existence of five phases, which include: designing, modeling, implementation, controlling and optimization of business processes.³¹³ Dumas et al. indicates the existence of six phases of the cycle, which include: identification, recognition, analysis, redesign, implementation and process control³¹⁴, whereas Weske proposed a model consisting of the following stages: assessment, design and analysis, configuration and process management³¹⁵.

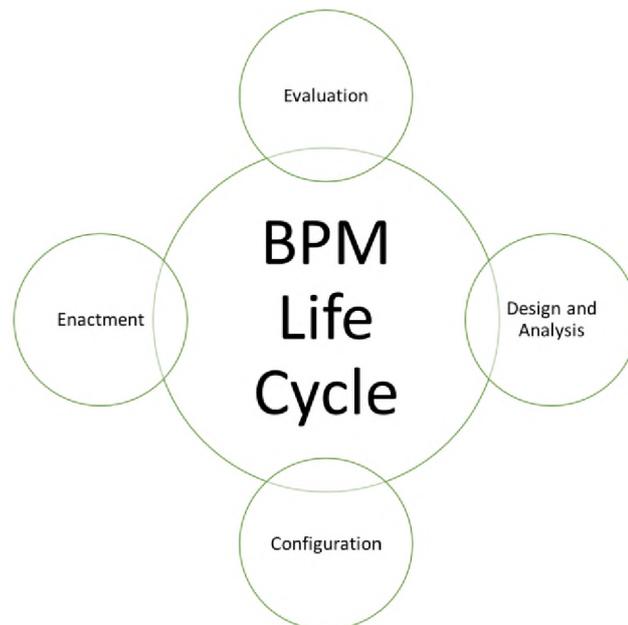


Figure 5.3. BPM Life Cycle

Source: Weske M. Business Process Management. Concepts, Languages, Architectures, Springer, Berlin, 2007, p. 12.

³¹³ Kumar A., Business Process Management, Routledge, New York 2018, p. 7.

³¹⁴ Dumas M., La Rosa M., Mendling J., Reijers H. A., Fundamentals of Business Process Management, Springer, Berlin 2013, p. 4.

³¹⁵ Weske M., Business Process Management. Concepts, Languages, Architectures, Springer, Berlin 2007, p. 12.

Another paradigm of the BPM life cycle model is the framework proposed by van der Aalst. This model is based on four phases, which include³¹⁶:

- process design – phase used to illustrate the state of the system before changes suggest ways of improving its functionality,
- system configuration – which involves adapting the system to the newly planned process, most often using an appropriate IT tool to accelerate this phase,
- process management – the phase that occurs after a full system configuration,
- diagnostics – the purpose of which is to verify the effectiveness of the implemented solution.

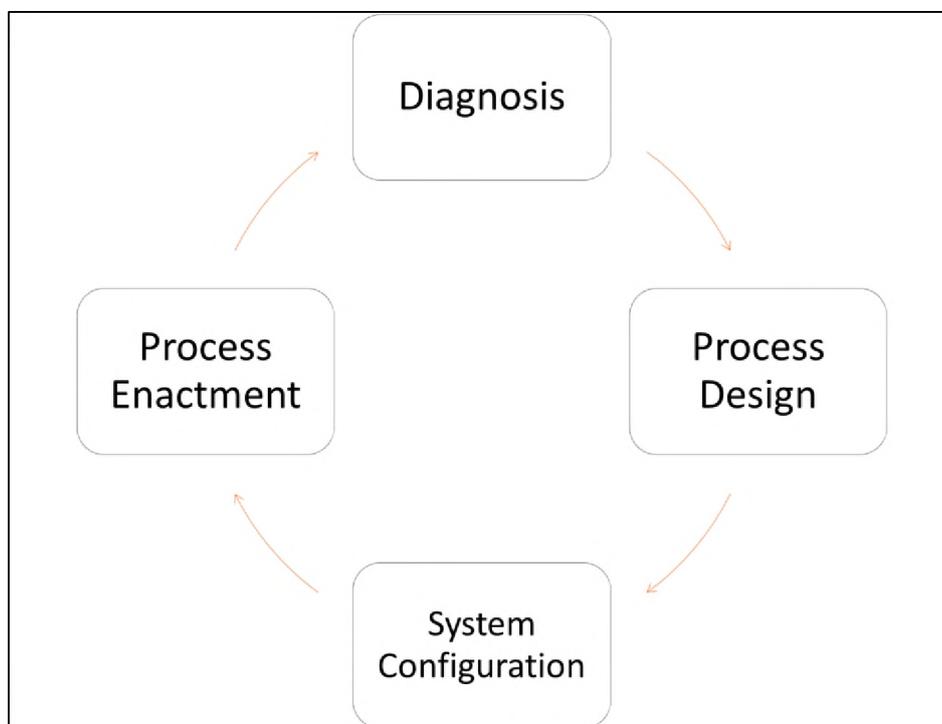


Figure 5.4. van der Aalst's BPM Life Cycle Model

Source: van der Aalst W. M. P. Business Process Management: A Comprehensive Survey, International Scholarly Research Notices Software Engineering Volume 2013, p. 5.

³¹⁶ van der Aalst W. M. P., Business Process Management: A Comprehensive Survey, International Scholarly Research Notices Software Engineering Volume 2013, pp. 4-5.

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Models of BPM life cycles very often rely on the cycle (circle) of Deming P-D-C-A, which illustrates the principle of continuous improvement. The name P-D-C-A stands for³¹⁷:

- plan – illustrates real activities that should be pursued to achieve organizational objectives and improve the process,
- do – implementation of previously planned solutions,
- check – evaluation of the effects of implemented improvement activities and deployment of the objectives set,
- act – if the implemented solution brings the intended effects, it should be considered as a new standard and the next process limitation should be identified. If the provided solution does not meet expectations, it is necessary to have it improved and re-checked.

The authors of this handbook have decided to propose an original BMP system cycle containing such elements as identification, analysis, measurement of effectiveness and improvement of existing processes aimed at improving the efficiency of activities currently implemented in enterprises.

³¹⁷ Kreitner R., Principles of Management, Cengage Learning, Boston 2008, p. 482.
Draheim D., Business Process Technology. A Unified View on Business Processes, Workflows and Enterprise Applications, Springer, London 2010, p. 27.

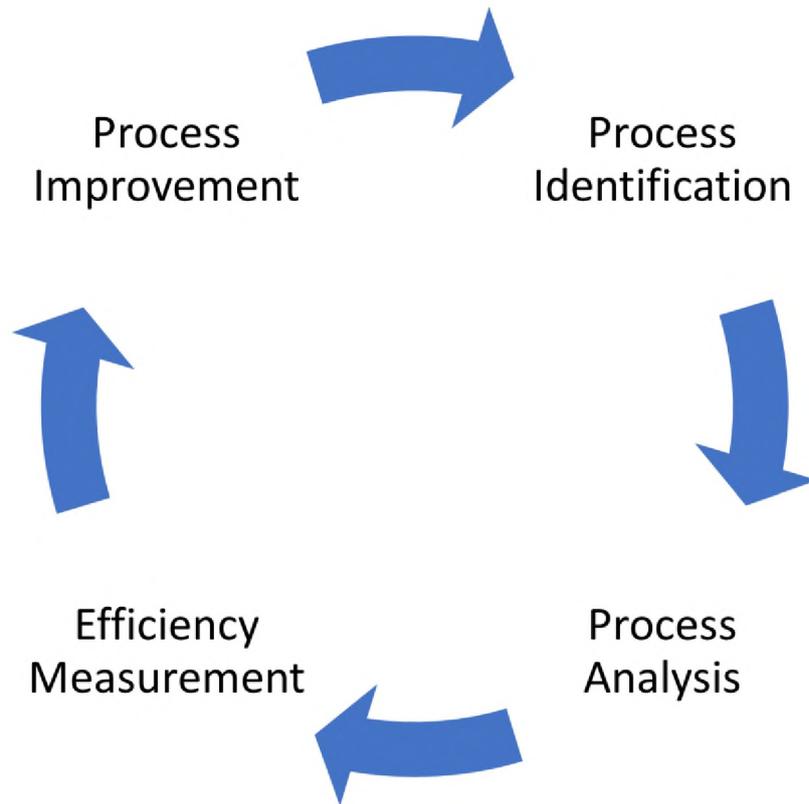


Figure 5.5. Model of Business Process Management Life Cycle

Source: own study.

The next section contains the description of Business Process Management Life Cycle shown in the Figure 5.5.

Effective management of business processes is possible provided that appropriate methods for process identification are used. Recognition of operations performed in the organization is crucial from the point of view of taking actions aimed at improving processes. In order to identify processes, one needs to recognize those that are executed in the enterprise, as well as the indicate the relationships that occur among them³¹⁸. As part of process identification, it is necessary to distinguish processes with respect to their relevance to the organization. Some of the processes include major activities for the primary part of the business. Other processes are auxiliary and their main task is to support the effective functioning of fundamental operations performed by the company³¹⁹.

³¹⁸ Dumas M., La Rosa M., Mendling J., Reijers H. A., Fundamentals of Business Process Management, Springer, Berlin 2013, pp. 21-22.

³¹⁹ Nebl T., Production Management, Walter de Gruyter GmbH & Co. KG, Munich 2018, p. 62.

It seems important that the key factor influencing the increase in the effectiveness of achieving organizational goals is the identification and improvement of the company's basic processes not only from the point of view of increasing profits, but also reducing costs. However, one needs to be aware of the fact that the improvement of the companies major activities is associated with enormous financial risk to which modern organizations are exposed, hence the need to carefully analyze individual operations. As far as the effectiveness of improvement processes is concerned, it is crucial to specify not only the processes that need to be improved, but also organizational purposes and priorities of individual companies³²⁰. To identify processes one also needs to define a set of criteria on the basis of which one can distinguish individual operations performed in the company, as well as dependences among them. The identification of processes results in the development of the so-called architecture of processes used at later stages to develop models for implementing improvement activities³²¹.

Process Analysis

The previously mentioned process architecture is a set of interrelated processes performed in an enterprise, the main purpose of which is to provide a product tailored to the client's needs while at the same time allowing to achieve profits at a level satisfactory for the organization. Therefore, business process architecture enables such integration of processes that results in achieving specific business objectives. Business process architecture used by enterprises assumes not only the need to define organizational aims, or to divide processes into main and auxiliary processes by identifying them, but also to indicate the acceptable methodologies suitable for evaluating the processes analyzed in further steps or identifying the staff responsible for the effective enforcement of operations³²². One of the most important motivations for using business process analysis in BPM is the possibility of gaining insight into the impact of individual actions on the effectiveness of all operations performed in an organization. Performance of processes naturally translates into productivity, which is associated with the financial profit that is achieved by the company. Properly conducted analysis allows, to a large extent, to appropriately identify all non-value

³²⁰ Laguna M., Marklund J., *Business Process Modeling, Simulation And Design* 2nd Edition, CRC Press, Boca Raton 2013, pp. 80-81.

³²¹ Dumas M., La Rosa M., Mendling J., Reijers H. A., *Fundamentals of Business Process Management*, Springer, Berlin 2013, p. 33.

³²² Harmon P., *Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals*, Elsevier, Burlington 2010, p. 82.

activities, the process of their elimination and improvement of individual operations. The effectiveness of the process re-designed depends on the success of analysis³²³.

Key elements that need to be determined in the analysis of business processes include³²⁴:

- input and output components of the process,
- indication of the process flow as part of the implementation of individual operations,
- performance level for each activity,
- identification and manners to compensate for the constraints (bottleneck).
- creating an **as is** diagram depicting all processes carried out by the enterprise, along with subordinate processes, as the basis for further analyzes,
- defining the scope of all activities identified in the process
- diagram analysis to identify all irregularities in the process,
- indication of the main objectives of the improvement by illustrating the state of the future process using the **to be** diagram.

Process Effectiveness

Furthermore, one of the key elements of analyzing business processes is to determining their performance, which is directly reflected in subsequent improvement processes. Efficiency assessment signifies the simultaneous indication of the effects of operations performed as well as determining the expenditures incurred by the organization in a given unit of time. Performance sometimes allows a company to determine the efficiency that an enterprise can achieve with certain parameters, and to estimate how productivity will change when improving the process and improving some of the process attributes. Efficiency can also sometimes be considered as the ratio of process output elements to input elements³²⁵.

³²³ Sople V. V., Business Process Outsourcing A Supply Chain Of Expertises, PHI Learning Pvt. Ltd., New Delhi 2016, p. 205.

Dziubich K., Business Process Modelling And Enterprise Improvement Analysis, Task Quarterly vol. 19, No 4, 2015, p. 434.

³²⁴ Sople V. V., Business Process Outsourcing A Supply Chain Of Expertises, PHI Learning Pvt. Ltd., New Delhi 2016, p. 205.

Harmon P., Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals, Elsevier, Burlington 2010, p. 366-369.

³²⁵ Harmon P., Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals, Elsevier, Burlington 2010, p. 306.

Process Improvement

Process identification, its analysis, as well as the identification of key activities and their efficiency allows recognizing all aspects that contribute to the decline in the efficiency of business operations. The ability to identify those activities which lead to lowering the effectiveness of the company or prevent economic growth, most often requires improvement operations. Their main objective is not only to eliminate all non-value activities, but also to increase the performance levels of the processes. Actions aimed at improving the enforcement of business processes can be identified as Business Process Improvement (BPI)³²⁶. The major aim of BPI is to analyze all activities undertaken by the organization in order to adapt them to fulfilling the requirements of recipients in the shortest possible time. Business Process Improvement supports the improvement of processes in companies to a large extent, and also affects the efficiency and performance of the whole supply chain³²⁷.

The concept of BPI was first presented in the 1990s by J. Harrington. His assumptions are based on four aspects, the method of **quick expert analyzes** aimed at developing improvement activities, **benchmarking**, aimed at performing comparative analyzes of business processes implemented by market leaders, **business processes redesigning** (Business Process Redesign) to improve existing processes and **business processes reengineering**, the aim of which is to diametrically redesign business processes in an enterprise³²⁸. Redesigning just as reengineering processes are described below as the most relevant components of Business Process Management..

Process Redesign

The terms Business Process Redesign and Business Process Reengineering are very often confused with each other due to the fact that both refer to the redesign of business processes. Business Process Redesign, however, has a much narrower scope of activities because it mainly involves redesigning processes as a result of changes in the way of supplying resources or uses process implementation tools. Business Process Reengineering

³²⁶ Blokdijk G., Business Process Management BPM 100 Success Secrets: 100 Most Asked Questions on BPM Implementation, Process, Software, Tools and Solutions, Emereo Publishing, Brisbane 2008, p. 93.

³²⁷ Harvard Business Review, Improving Business Processes, Harvard Business Press, Boston 2010, p. 12.

³²⁸ Petryk I., Identification of Business Process in Integrated Structures, Regional Barometer. Analysis and forecasts, No. 2 (40), 2015 pp. 96-97.

focuses primarily on a radical, diametrical redesign of business processes including all changes in the management of business activities³²⁹.

The main activities presumed as part of redesigning business processes consist in the analysis of operations executed in order to accelerate the cycle of a given process and, consequently, increase its efficiency. The analysis of business processes will allow not only to notice all activities that do not add value, but also enable a significant simplification of processes. Identifying excessive activities often contributing to the unnecessary complexity of business processes, as well as a significant extension of their delivery cycles directly affect the company's unsatisfactory position on the market. Therefore, sometimes an effective analysis and proposing improvements to the process leading to their redesign is a sufficient activity to boost the efficiency of many operations carried out by a given organization³³⁰. As for Business Process Redesign, it should also be noted that sometimes not only the major processes need to be enhanced, but also such aspects as, for example, improper flow of information or inadequate training of employees. In such cases, minor changes in the work system and the way data is exchanged between IT systems are sufficient to improve business processes³³¹.

In situations of business processes requiring only a gentle redesign, Business Process Design is an appropriate form that does not require huge amounts of labor and investment costs. Still, it can result in the possibility of reducing costs and improving the functioning of the company and sometimes also the entire supply chains. However, when it is impossible to introduce minor changes or they do not result in increased efficiency or achieving the organizational aims of the enterprise, it seems necessary to expand a form of business processes improvement to Business Process Reengineering.

Process Reengineering

Business Process Reengineering is a concept that assumes a radical redesign of business processes in order to increase their efficiency. This approach was created in the 1990s and assumes that key aspects affecting the performance levels of processes implemented in the enterprise include: quality, customer service, rate of processes, reaction

³²⁹ Mansar S. L., Reijers H. A., Best practices in business process redesign: use and impact, *Business Process Management Journal* Vol. 13 No. 2, Emerald Group Publishing Limited, 2007, pp. 194-195.

³³⁰ Veeke H. P. M., Ottjes J. A., Lodewijks G., *The Delft Systems Approach: Analysis and Design of Industrial Systems*, Springer Science & Business Media, Berlin 2008, p. 4.

³³¹ Grover V., Kettinger W. J., *BUSINESS PROCESS CHANGE: Concepts, Methods and Technologies*, IDEA GROUP PUBLISHING, Harrisburg 1998, p. 36.

to crisis situations, speed and innovations. Main assumptions of reengineering are frequently presented using BPR cycle, which assumes the necessity of continuous improvement of business processes through radical changes introduced in individual activities. Figure 5.6. presents BPR life cycle, which includes elements such as process identification, analysis, design, implementation and control.

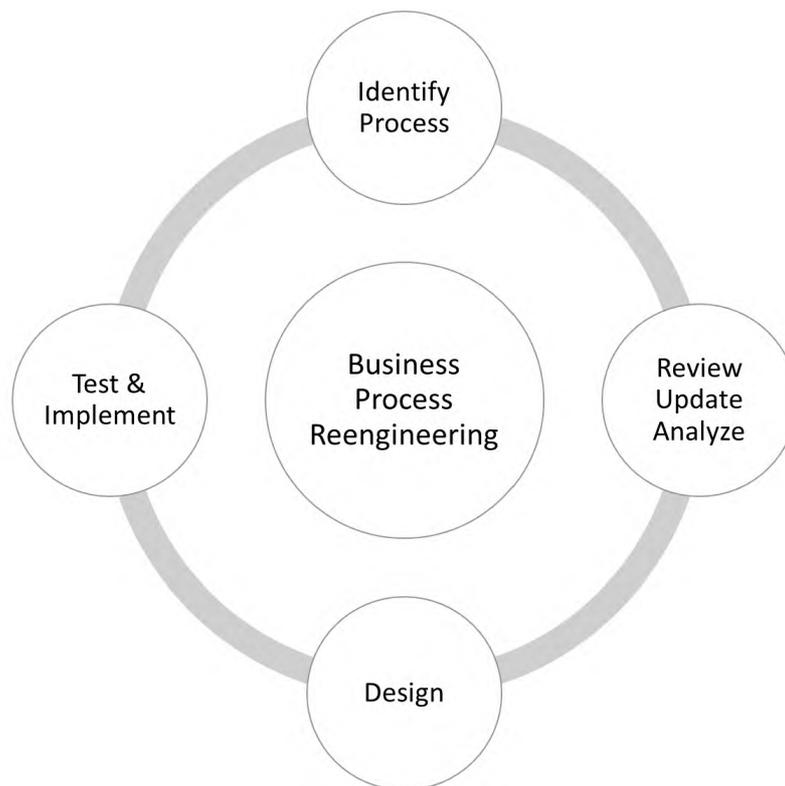


Figure 5.6. Business Process Reengineering Life Cycle

Source: Braun R., Chaczko Z., Neilson M., Aslanzadeh S. A Practical Approach for Redesigning System Engineering Processes, ITHEI 2012, 11th International Conference on Information Technology Based Higher Education and Training, Istanbul, 2012.

The essence of reengineering can also be presented using the 6R methodology, which distinguishes six components leading, in a clearly defined manner, to effective redesign of business processes. The concept of 6R includes³³²:

- **Realization** – noticing the necessity to implement significant changes in the processes and making a decision on their implementation,

³³² Khosrowpour M., Cases on Information Technology and Business Process Reengineering, Idea Group Inc (IGI), Hershey 2006, pp. 156-157.

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- **Requirements** – radical redesign of business processes requires recognition of consumer expectations so as to enable planning and implementing processes which create a basis for fulfillment of the needs of customers,
- **Rethink** – essentially, it requires planning activities, using tools or supporting processes that enable achieving organizational objectives and meeting the needs of customers,
- **Redesign** – implementation of new processes planned in accordance with the accepted principles of reengineering,
- **Retool** – adaptation of used systems and tools to newly implemented business processes,
- **Reevaluate** – measuring the effectiveness of processes implemented by reengineering.

As part of the implementation of the Business Process Reengineering concept, R. Radhakrishnan and S. Balasubramanian considered seven phases that accompany the implementation of BPR.

- phase 1: organizational changes,
- phase 2: construction of the reengineering structure,
- phase 3: identification of BPR opportunities,
- phase 4: understanding of the executed processes,
- phase 5: redesigning processes,
- phase 6: planning new processes,
- phase 7: implementation of plans.

Phase 1 assumes primarily the perception of the need to redesign processes by increasing organizational efficiency. In addition, it is also necessary to indicate the objectives that the company intends to achieve by redesigning individual aspects of the business. **Phase 2** involves both the creation of an appropriate organizational unit responsible for changes in processes, as well as an indication of the manager directing the given unit. **Phase 3** allows not only to recognize the capabilities of BPR systems, but also allows to compare the objectives that are set by the organization with the capabilities of the unit responsible for the redesign of processes. This phase verifies the degree of change that can be achieved. **Phase 4** can be understood as the identification of the processes executed, the relationships between

them, as well as the analysis performed in order to verify the scope of activities that require improvement as well as indicating non-value =operations and set of parameters characterizing the efficiency of business processes. **Phase 5** involves planning changes that aim at increasing the efficiency of the organization's processes and the entire chain, and thus increase customer satisfaction as a result of meeting their expectations. **Phase 6** assumes verification of the implementation capabilities of the designed processes and fulfillment of all the requirements for newly designed processes. This stage involves the selection of implementation methods, as well as work schedules, enforcement of which enables achieving organizational aims. **Phase 7** assumes the implementation of planned processes, their monitoring and the introducing of continuous and long-term improvements aimed at achieving the intended organizational purposes³³³.

The most important advantages of using BPR include:

- increase in the efficiency of processes,
- growth in profits and reduction of expenditures,
- elimination of non-value processes,
- increase in customer satisfaction due to the extension of their service level,
- shorter process cycles,
- boost of effectiveness of communication (also within the supply chain),
- the opportunity to detect areas which, if improved, will ensure the development of the organization.

The BPR's disadvantages include³³⁴:

- costly, labor- and time-consuming implementation,
- impossible to implement in some organizations,
- requires radical changes in the approach to business management,
- sometimes the solution cannot be implemented due to the high complexity of the tool,
- inability to integrate with other participants in the supply chain.

³³³ Radhakrishnan R., Balasubramanian S., BUSINESS PROCESS REENGINEERING: Text and Cases, PHI Learning Pvt. Ltd., New Delhi 2008, pp. 45-51.

³³⁴ Newton N. et al., QFinance: The Ultimate Resource, Bloomsbury, London 2009, p. 974.

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Regardless of whether the activities executed by the organization as part of business process management relate only to the redesign or radical change of processes, they should be implemented in a continuous manner, in accordance with the philosophy of continuous improvement. Business processes should be monitored and controlled continually, however, economic growth is possible only through the implementation of specific steps, such as:

- identification of processes performed in the organization, and thus recognition of the current status of individual activities and operations, as well as the links between them,
- analysis of the effectiveness, which requires measurement of the productivity of the processes executed,
- redesigning, planning and re-implementing the processes performed, continuous control and improvement of the organization's functioning.

It should also be noted that any process, regardless of whether it is subject to improvement processes or not, requires constant monitoring of its effectiveness consisting in process control, the degree of resource utilization and implementation of organizational objectives of enterprises. If it is impossible to fulfill organizational purposes, each process should be analyzed in order to identify all activities that do not add value, all irregularities should be compensated for by improving them.

Business Process Modeling

Managing business processes requires a definition of process modeling. Effective management of business processes is doable only when it is appropriately modeled. Due to the number of operations performed in the enterprise and in all supply chain organizations, a well-planned process model is particularly important. It does not only guarantee the smoothness of the process itself, but also affects the time of its implementation, the level of consumer satisfaction and, consequently, also profits

In view of the growing number of processes executed and their complexity, the utilization of information systems is inevitable. Moreover, it requires the use of appropriate tools to support their analysis and subsequent management. Process modeling also allows determining the initial state (as it is) of the tested system, any intermediate states and finally

the final state (as it can be), which results in a stable, manageable process³³⁵. One of the most important aims of process modeling is striving for full automation of operations increasing the flexibility of a given process. However, only part of the modeled process can be subject to automation failures³³⁶. The greatest benefits of using process modeling include³³⁷:

- understanding of currently implemented processes through their modeling and analysis, which allows their subsequent improvement through automation or re-planning,
- increase in the efficiency of the process through its level of synchronization enhancement, elimination of unnecessary activities and improvement of the internal circulation of the product / service in the process,
- increase in productivity and decrease in expenditures by reduction of processes cycle length and the possibility of carrying out many activities with the involvement of fewer human resources,
- simplifying the process by eliminating unnecessary activities.

The most common techniques used in business process modeling include³³⁸:

- flowcharting,
- IDEF Techniques,
- Petri Nets,
- Simulation,
- Knowledge-based Techniques,
- Data Flow Diagramming,
- Entity-Relationship Diagramming,
- State-Transition Diagramming,
- Unified Modeling Language (UML),
- Business Process Modeling Notification (BPMN).

³³⁵ van der Aalst W. M. P., Business Process Management: A Comprehensive Survey, International Scholarly Research Notices Software Engineering Volume 2013, p. 4.

Smith P. R., Sarfaty R., Creating a strategic plan for configuration management using Computer Aided Software Engineering (CASE) tools, 1993 National Department of Energy (DOE)/contractors and facilities data acquisition and control user's group meeting, Livermore, CA (United States), 13-16 Apr 1993, p. 35

³³⁶ August-Wilhelm Scheer A., Kruppke H., Jost W., Kindermann H. (eds.), AGILITY by ARIS Business Process Management, Springer, Berlin 2006.

³³⁷ Havey M., Essential Business Process Modeling, "O'Reilly Media, Inc.", Sebastopol 2005, p. 8.

³³⁸ Giaglis G., A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques, International Journal of Flexible Manufacturing Systems – April 2001, p. 6-14.

Flowcharting

The earliest process modeling technique from the 1960s. This tool assumes the use of graphic elements, usually in the form of rectangles, rhombuses and arrows, to show the course of the process and any dependencies between a given process and its users. All components must be connected to each other in a transparent manner to present the process and enable its identification only on the basis of the diagram shown. This method is rarely used due to the limited possibilities of its application (it allows only the identification of the process and its graphic representation)³³⁹.

IDEF (Integrated Definition for Function Modeling) Techniques

The IDEF family comes from the 1970s. It was initiated in the ICAM program (Integrated Air Aided Manufacturing), and its major objective was to support business process design using specialized models and computer applications. “The IDEF languages aim to cover a large domain, i.e. function and information / data modeling, simulation, object-oriented analysis and design, and knowledge acquisition.”³⁴⁰ The most commonly used languages are IDEF0, IDEF3 and IDEF1X.

IDEF0 is used for processes modeling, however, due to its limited functionality, it can only identify some features of operations. This sometimes results in the inability to determine the initial state of the process. In addition, it is a passive tool illustrating only activities performed within processes, thus not taking into account such aspects as material flows or process cycle time³⁴¹. The main purpose of IDEF0 is to use a group of experts to support the decision-making process presented graphically in a direct manner using an appropriate tool. Sometimes, simplicity is just indicated as the biggest advantage of IDEF0. “IDEF0 supports process modeling by progressively decomposing higher-level ICOMs into more detailed models that depict the hierarchical decomposition of activities.”³⁴²

³³⁹ Giaglis G., A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques, *International Journal of Flexible Manufacturing Systems* – April 2001, p. 6.

Kumar A., *Business Process Management*, Routledge, New York 2018, p. 13.

³⁴⁰ Noran O., An Ontology-Based Comparative Study Of Uml And Idef In View Of Business Modelling, 6th *International Conference on Enterprise Information Systems (ICEIS 2004)*, At Porto 2004, p. 1.

³⁴¹ Grover V., Kettinger W. J., *BUSINESS PROCESS CHANGE: Concepts, Methods and Technologies*, IDEA GROUP PUBLISHING, Harrisburg 1998, p. 332.

³⁴² Giaglis G., A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques, *International Journal of Flexible Manufacturing Systems* – April 2001, p. 7.

IDEF3 can be described as “(...) a scenario-driven process flow modeling method created specifically for these types of descriptive activities”.³⁴³ IDEF3 was created to illustrate the order of particular activities within the modeled process, as well as the dependencies between all performed operations³⁴⁴.

IDEF1x finds application in “(...) developing a logical model of data and a graphical modeling technique for constructing semantic data models.”³⁴⁵ IDEF1x is used primarily for creating and analyzing databases, so that it is possible to use properly structured and integrated information systems that fulfill the requirements of users. IDEF1x is fully integrated with IDEF0 or IDEF3, which allows comprehensive complementarity of their functioning. IDEF1x also combines modeling processes using advanced computer systems, as well as models created directly by system users³⁴⁶.

Petri Nets

Petri's networks initiated in 1962 are now used to create models of concurrent systems and to indicate the relationship between them. These networks are most often used to illustrate processes in which many activities are performed concurrently, e.g. in production processes. These networks allow not only describing, but also indicating the optimal ways to implement and control flow processes characterized by many activities performed simultaneously in enterprises. Petri nets are therefore used to control the flow of processes in the organization³⁴⁷.

Entity-Relationship Diagramming

This tool is most often used to model data structures and present interactions between them. These tools employ sets and attributes of a given entity and also indicate the relationships that occur between entities. The entity enables displaying the element stored in the database. The attribute describes an entity that can take the form of a number, text or logical value. Diagrams show mutual relations between entities. The main objective of ERD is to depict

³⁴³ Grover V., Kettinger W. J., *BUSINESS PROCESS CHANGE: Concepts, Methods and Technologies*, IDEA GROUP PUBLISHING, Harrisburg 1998, p. 266.

³⁴⁴ El-Haik B., Roy D. M., *Service Design for Six Sigma: A Roadmap for Excellence*, Wiley, Harlow 2005, pp. 181-182.

³⁴⁵ Dickerson C. E., Mavris D. N., *Architecture And Principles Of Systems Engineering*, CRC Press, London 2010, p. 139.

³⁴⁶ Giaglis G., *A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques*, *International Journal of Flexible Manufacturing Systems* – April 2001, p. 14.

³⁴⁷ Havey M., *Essential Business Process Modeling*, "O'Reilly Media, Inc.", Sebastopol 2005, p. 55.

Cardoso J., *Handbook of Research on Business Process Modeling*, IGI Global, New York 2009, pp. 96-97.

the structure of a given system or process, including all elements and relationships between them. These diagrams do not provide data on the cycles of individual operations or the functioning of specific objects. This can sometimes influence in a negative way its usefulness for many analyses of system functioning³⁴⁸.

Unified Modelling Language (UML)

UML is a concept that has been used since 1997. This language is most often used for graphic presentation of information system objects and links between them. UML is officially defined by the Object Management Group (OMG) and used mainly for defining computer applications, however, it is very often used to identify and analyze business processes in enterprises. There are five types of diagrams created using UML³⁴⁹:

- use case diagram – it contains three elements, which include actors, use cases and relationships between them. Actors are usually users of a given system. A system user who interacts with use cases cannot be part of the system. The use case is a description of the activities, requirements of the actor or the functionality of the system. Dependencies are used to indicate the connection between the actor and the use case. It is often directional, that is, indicates who is responsible for the action. The use case diagram illustrates the functionality of a given system, emphasizing the requirements of its users³⁵⁰,
- class diagram – usually used to describe an object-oriented system. Class diagram is a static diagram describing the individual components included in its composition and the relations among them. The system can be described by identifying its classes and indicating the dependencies between individual classes. Classes are sets of objects with the same attributes and parameters. Class diagram distinguishes three types of relations between classes: association (the relationship between objects from two classes), aggregation (stronger than the association, the relationship between two

³⁴⁸ Dennis A., Wixom B. H., Roth R. M. (2012). *System Analysis and Design*, Wiley, New Jersey 2009, pp.224-230.

Bagui S., Earp R., *Database Design Using Entity-Relationship Diagrams*. CRC Press, New Jersey 2011, pp. 6-7.

Giaglis G., *A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques*, *International Journal of Flexible Manufacturing Systems* – April 2001, p. 12.

Purba S., *Handbook of Data Management*, CRC Press, New York 1999, p. 129.

³⁴⁹ Dickerson C. E., Mavris D. N., *Architecture And Principles Of Systems Engineering*, CRC Press, London 2010, pp. 64.

³⁵⁰ Bittner K., Spence I. (2003). *Use Case Modeling*, Addison-Wesley Professional, Boston 2003, pp. 28.

Holt J. (2004). *UML for Systems Engineering: Watching the Wheels*, IET, London 2007, pp. 138.

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classes in the whole-part relation, some objects can function without the whole), generalization (is characterized by inheritance relationships, i.e. the subclass “inherits” the property of the parent class)³⁵¹,

- package diagram – allows to present packages included in the system and the relationship between them. Package refers to a collection of elements from the system, which have been arranged by assigning them to appropriate groups. Packages can contain both actors, use cases and relationships between them, as well as other packages. Packages are files folders that can be implemented in any UML diagram³⁵²,
- object diagram – usually supplementing class diagrams, because they allow to present a specific structure presented earlier in the class diagram. By using the object diagram, it is easier to understand some structures with high and incomprehensible level of complexity in class diagram.. This diagram consists of a set of objects and relations that exist between them³⁵³,
- sequence diagram – is adynamic diagram that shows interaction between objects of the system, simultaneously putting emphasis on the sequence of performed activities and their timing. This diagram focuses not only on the interaction, but also on the messages and the order in which they are sent by individual system objects. A sequence diagram is a collection of objects that interact with each other to accomplish a specific task. Sequence diagrams are characterized by reference to the life cycle of the object showing the changes occurring in it over the passage of time and focusing on the control of the functioning of given objects³⁵⁴.

³⁵¹ Seidl M., Scholz M., Huemer C., Kappel G. (2015). UML @ Classroom: An Introduction to Object-Oriented Modeling, Springer, Berlin 2015, pp. 49.

Dickerson C. E., Mavris D. N., Architecture And Principles Of Systems Engineering, CRC Press, London 2010, pp. 66.

Tonella P., Potrich A., Reverse Engineering of Object Oriented Code, Springer Science & Business Media, Berlin 2007, pp. 43-44.

³⁵² Ambler S. W., The Elements of UML(TM) 2.0 Style, Cambridge University Press, Cambridge 2005, pp. 73.

Stephens R., Beginning Software Engineering, Wiley, New Jersey 2005, pp. 107.

Karney J., Introduction to Business Architecture, Cengage Learning, Boston 2011, pp. 38.

³⁵³ Gopal A., Patil N., Magnifying Object-oriented Analysis and Design , PHI, New Delhi 2010, pp. 62-63.

Fowler M., Kobryn C., UML Distilled: A Brief Guide to the Standard Object Modeling Language, Addison-Wesley Professional, Boston 2004, pp. 87-88.

³⁵⁴ Popovic M., Communication Protocol Engineering, CRC Press, London 2018, pp. 64-65.

Unhelkar B., Verification and Validation for Quality of UML 2.0 Models, Wiley, New Jersey 2005, pp. 71-73.

Windle D. R., Abreo L. R., Software Requirements Using the Unified Process: A Practical Approach, Prentice Hall Professional, pp. New Jersey 2003, 116-117.

Business Process Modeling Notation

Business Process Model Notation (BPMN) is a standard for business process modeling that provides graphic notation for specifying business processes in a Business Process Diagram (BPD), based on traditional flowcharting techniques.³⁵⁵ BPMN uses certain standards that reflect system elements and the relationships between them that are used in the description of modeled processes³⁵⁶.

The major purpose of BPMN is to support the modeling of business processes both from the point of view of its creators and users³⁵⁷.

BPMN describes three types of processes³⁵⁸:

- private (internal),
- public (external),
- cooperation processes.

Private processes cover actions executed by a specific organization, marked in a BPMN notation as a pool. Particular activities performed by specific units in a given organization are pursued as part of the swimlines. As part of private processes both, executable and non-executable (do not contain data required for the performance of a particular process) processes can be distinguish. In private processes, no activity can cross the boundaries of the organization's pool.

Public processes, also referred to as 'collaborative', are processes that illustrate only those activities that indicate the exchange of information, the interaction between the process performed in a given organization and other processes (executed in a different company) or participants of supply chain.

Cooperation processes illustrate interaction between processes performed by at least two different organizations. Interaction is takes place through an exchange of messages between users' pools³⁵⁹.

³⁵⁵ von Rosing M. Scheer A., von Scheel H. (eds.), *The Complete Business Process Handbook. Body of Knowledge from Process Modeling to BPM*, Elsevier, Waltham 2015, p. 630.

³⁵⁶ Jeston J., Nelis J., *Business Process Management Practical Guidelines to Successful Implementations*, Elsevier, Burlington 2008, p. 209.

³⁵⁷ von Rosing M. Scheer A., von Scheel H. (eds.), *The Complete Business Process Handbook. Body of Knowledge from Process Modeling to BPM*, Elsevier, Waltham 2015, p. 630.

³⁵⁸ Briol P., *BPMN: the Business Process Modeling Notation Pocket Handbook*, Lulu Press, Morrisville 2013, p 13.

³⁵⁹ von Rosing M. Scheer A., von Scheel H. (eds.), *The Complete Business Process Handbook. Body of Knowledge from Process Modeling to BPM*, Elsevier, Waltham 2015, pp. 632-635.

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The most commonly used shapes illustrating the components constituting the BPMN language are described below³⁶⁰:

- circles symbolizing events,
- rectangles symbolizing the activities performed,
- rhombuses symbolizing gateways,
- arrows symbolizing the direction of the token flow.

³⁶⁰ Weske M., Business Process Management. Concepts, Languages, Architectures, Springer, Berlin 2007, p. 91.

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6. HUMAN RESOURCE MANAGEMENT

6.1. The origin and key assumptions of the HRM term

The introduction of the term human resource management (HRM) can be attributed to R.E. Miles, who published an article in 1965 which is considered to be a milestone for this discipline³⁶¹. In his concept, he referred to four trends: scientific approach to management, the second one related to the creation of organizational structures and functioning within the framework established by them, the third one relying on intentional and planned shaping of interpersonal relations in the workplace, and the fourth based on compliance with the personal character of each organization. Despite the groundbreaking nature of Miles's concept, his work was not really used in practice over the following years. HRM became popular only after the fuel crisis of the 1970s, when the need arose to seek new sources of efficiency improvement. HRM was supposed to simplify the way in which companies adapted to the new reality and also to partially mitigate the effects of the crisis. This meant, in particular, increasing the effectiveness of employment, improving the competitiveness of work, reducing obsolete costs, specializing and increasing the importance of competence.

With this aim in mind, in 1982 two major American universities (Michigan and Harvard) developed two HRM models. The one from Michigan was placed in a traditional enterprise management model, in which strategic objectives and plans of the organizations were determined first, and then the structure and resources (including human resources) were adapted to it. This approach was based on the following sequence: strategy, structure, resource³⁶². Michigan model was established on the basis of the cycle of human resource. The elements of the cycle include³⁶³:

- selection – adjusting the available human resources to workplaces,
- appraisal or motivating – management by effects,
- rewards – the remuneration system, commonly used in an improper way, by the managers as a means of improving the organization's results,

³⁶¹ Miles R.E., *Human relations or Human Resources?*, Harvard Business Review, July-August 1965, pp.148-163.

³⁶² Ehnert I., *Sustainable Human Resource Management. A Conceptual and Exploratory Analysis from a Paradox Perspective*. Physica-Verlag Berlin Heidelberg 2009, pp. 86-87.

³⁶³ Armstrong M., *Zarządzanie zasobami ludzkimi*, Oficyna Ekonomiczna, Kraków 2005, p. 46.

- development – making it possible for good employees to self-develop.

The model from Harvard is sometimes referred to as the “multiple stakeholder theory”. It points to a much broader context of human resources. Top level of employees (e.g. resulting from good education) should not only be of interest to employers, but also other participants of the socio-economic life. Some people claim that the Michigan model rewarded the “tough” (utilitarian) approach to HRM based on meters and indicators of work efficiency, while the Harvard model stimulated the development of “soft” (humanitarian) approach to HRM and was responsible for an increase in the importance and role of the human factor in company in the last years of the 20th century³⁶⁴.

In the second case, it was assumed that employees should be enabled to take joy in work and they should also be given the possibility of self-development. Both of these approaches significantly contributed to a change in the attitude towards human resource management. HRM started relying on procedures of selection, short listing and development of human resources as well as systems of remuneration, training and work assessment that were appropriate for the company and people working in it. Similarly, motivation became one of the most crucial functions of HRM. It covered the creation of such conditions and the use of such incentives so that the employees would behave in accordance with the needs of the organization. As a result, the most important goals of the human resource management process were defined. These goals include:

- developing a coherent personnel and employment policy that has a positive impact on the company's development, innovation and teamwork,
- creating appropriate working conditions,
- effective use of possibilities and skills of all the engaged individuals,
- ensuring such a division of tasks so as to enable the employees to use their skills and capabilities,
- shaping the culture of the organization based on commitment, ingenuity and flexibility.

The objectives enumerated above translated into activities undertaken in HRM departments including:

- planning of employment on the basis of strategic plans,

³⁶⁴ Ehnert I., Sustainable Human Resource Management. A Conceptual and Exploratory Analysis from a Paradox Perspective. Physica-Verlag Berlin Heidelberg 2009, pp. 86-87.

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- planning and verifying the range and structure of remuneration (payroll table, promotion rules, possibilities of obtaining financial awards and bonuses),
- selecting recruitment methods,
- defining the preferred forms of employment,
- selecting and recruiting,
- negotiating employment conditions, entering into contracts,
- creating conditions for quick adaptation of new employees,
- designing and assessing regularly the work system,
- shaping labor standards,
- motivating and rewarding employees,
- carrying out activities in favor of the integration of employees,
- building the loyalty of employees,
- planning career paths,
- creating possibilities of improvement and professional development,
- implementing the concept of employee-friendly organization,
- examining the needs and expectations of employees,
- preparing systems of financial and non-financial incentives,
- establishing rules for interpersonal communication,
- developing standards and principles of internal and external communication,
- shaping the identity and culture of the organization,
- supervising compliance with labor law and cooperating with control bodies,
- cooperating with trade unions,
- cooperating with consulting and training companies, tax office and social security institutions,
- analyzing general employment costs,
- dismissing employees,
- performing administrative duties related to controlling the use of holidays, archiving data on employees (e.g. training), paying contributions to health, pension and disability insurance, and accounting for sick leaves,
- handling other employee and personnel matters.

There are also many HRM activities that require the cooperation of HR staff with other units of a given company. This includes:

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- analyzing safety and working conditions,
- providing a friendly working environment,
- determining position requirements in accordance with the competencies of employees,
- introducing and implementing new employees to their tasks in the workplace,
- assessing actual skills and competences,
- transferring employees between departments,
- determining the division of labor and the allocation of duties,
- defining and choosing methods and tools for assessing work results,
- evaluating work efficiency and employees,
- identification of training needs and methods for performing those trainings,
- organizing trainings, assessing their effectiveness,
- controlling employees,
- shaping work efficiency,
- accounting for employees' working time,
- analysing labor costs.

At the end of the 20th century, the main aim of personnel policy in many companies was connecting the expectations of employees and their satisfaction with the success of the organization. Nowadays, personnel policy of companies concentrates on making full use of the existing potential of employees. The increase in competencies of workers, especially those highly-qualified (e.g. in the case of logistics specialists), makes it necessary for companies to develop innovative ways and methods of preparing and motivating competent staff. In the case of logistics, these are skills in using IT tools, as well as other technical skills related to new solutions in the transport, storage and communication, knowledge of laws and regulations regarding transported loads and possible transport and storage options. On the one hand, this can be obtained by acquiring employees with appropriate qualifications, on the other by consistently training them and developing the necessary skills. In the case of logistics, the quantity of new and innovative solutions is high. This applies both to transport (knowledge about new regulations on permissible exhaust emissions is especially important when planning routes internationally), storage (important in the case of storage of goods with a relatively short shelf-life) and communication based on new telecommunications and IT solutions. New communication systems or new IT systems, increasing the possibilities of

accurate analysis, are becoming crucial when planning extended logistics solutions for clients creating increasingly complex and complicated supply chains.

6.2. Contemporary trends in the area of Human Resources Management

In business, administrative issues related to HRM often come to the fore. Performing typical administrative activities, such as calculating wages and contributions for health, retirement and disability insurance, and keeping personnel records is often the main scope of work in this area. This can be attributed to the risk of serious consequences in case of a mistake. In extreme cases, irregularities may lead to the intervention of the tax office, labor inspection or the institution supervising social security issues. For this reason, great attention is paid here to the formal side. It is of utmost importance to organize the documentation and make sure one does not commit a mistake.

However, it is also possible to observe a more audacious approach to HRM which translates into gradual shift of the main emphasis. Typically, key responsibilities of HR departments consisted in administrative and operational tasks, while in the newer approach to HRM, development of staff and implementation of the company's strategy are of utmost importance. Activities in the area of HRM are becoming less focused on traditional administration and begin to accentuate the strategic level with increasing frequency³⁶⁵.

Currently, the basic goal of activities related to HRM is the development of human resources and their adaptation to changes taking place in the modern world. This involves employing carefully selected candidates, which also implies the necessity to introduce an increasingly complex selection process and increasingly intensive training of staff or new employees.

In light of the above considerations, it is worth noting the existence of a common retreat from the use of the concept of human resources in favor of the newer category of human capital³⁶⁶. Human capital combines all tangible and intangible resources of an organization transforming them into competitive assets owned by a given entity. Building human capital by acquiring qualified employees and further developing their skills is considered a strategic task facing HRM.

³⁶⁵ Szierbowski-Seibel K., Kabst R., The impact of HR outsourcing and strategic HR integration on the HR-to-employee ratio. An empirical evaluation of the HR function over the last decade, *International Journal of Manpower*, Vol. 39 No. 2, 2018, p. 283.

³⁶⁶ Lipka A., Od zarządzania zasobami ludzkimi do gospodarowania kapitałem ludzkim. *Przegląd Organizacji* 2005 nr 4, p. 22-25.

In particular, the recruitment process is treated as an activity influencing the quality of human capital³⁶⁷. It plays a key role in building human capital of a company. The fundamental objective of employing new staff is acquiring specialists with skills that are needed by the organization at a given moment. Candidates are supposed to have the knowledge and experience necessary for work in a given position. Hiring better-educated and more productive employees translates into a higher level of human capital³⁶⁸. Human capital refers to the knowledge, skills and experience of employees that can be used in an organization to support ongoing and innovative activities³⁶⁹. Human capital is the ability of individual employees to perform tasks efficiently. It can also be seen as organizational culture, company values and the philosophy of operation on which the business is based³⁷⁰. This capital includes the employees of an organization and their attributes such as knowledge, experience, engagement and motivation³⁷¹. Human capital also constitutes a collection of individual character traits, skills, abilities, qualifications and health. From the point of view of a company, human capital, at large, can be perceived as predispositions, knowledge, skills and abilities that can be utilized during the performance of specific tasks³⁷².

T.W. Schultz defined human capital as innate and acquired skills, thanks to which, in the case of properly conducted human resources policy, the company's potential can be developed and enriched³⁷³. Generally, human capital refers to the level of education of an individual and their life experiences which can increase their ability to make decisions³⁷⁴. Competences of employees which constitute human capital include³⁷⁵:

- *know-how*,

³⁶⁷ David R., Banerjee P., Ponnampalnam A., Risks perceived regarding recruitment process outsourcing: stakeholder concerns, *Journal of Global Operations and Strategic Sourcing*, Vol. 10 No. 1, 2017, p. 112.

³⁶⁸ McGuirk H., Lenihan H., Hart M., Measuring the impact of innovative human capital on small firms' propensity to innovate, *Research Policy* 44 (2015), p. 967.

³⁶⁹ Danquah M., Amankwah-Amoah J., Assessing the relationships between human capital, innovation and technology adoption: Evidence from sub-Saharan Africa, *Technological Forecasting & Social Change* 122 (2017), p. 25.

³⁷⁰ Gierszewska G., Romanowska M., *Analiza strategiczna przedsiębiorstwa*, PWE, Warszawa 2017, p. 166.

³⁷¹ Kianto A., Sáenz J., Aramburu N., Knowledge-based human resource management practices, intellectual capital and innovation, *Journal of Business Research* 81 (2017), p. 12.

³⁷² Bal-Woźniak T., *Zarządzanie twórcze w organizacji*, w: *Zarządzanie innowacjami. Podstawy zarządzania innowacjami*, red. J. Łunarski, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2007, p. 58.

³⁷³ Schultz T.W., *Investing in People: The Economics of Population Quality*, University of California, Berkeley, 1981, p. 21.

³⁷⁴ Jerzak K., The essence of human capital in a building company - selected aspects, *Procedia Engineering* 122 (2015), p. 97.

³⁷⁵ David R. Williams, Human and financial capital as determinants of biopharmaceutical IPO de-listings, *Journal of Business Research* 66 (2013), p. 2613.

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- education,
- individual predispositions,
- knowledge related to the job,
- competences related to the job.

The majority of skills influencing a person's job performance are derived from general education and work experience. Human capital is, therefore, a result of an interplay between general education and professional experience³⁷⁶. According to G. Becker, knowledge and skills are an outcome of an investment in human capital which comprises education, training and accumulated job experience³⁷⁷. The theory of human capital formulated by Becker concerns the role of human capital in processes related to the economic activity and incentives to invest in skills on various levels, starting from education in a period preceding the beginning of employment (it refers to education on a secondary and academic level), and ending with investment in human capital on the part of a given company (in the form of trainings)³⁷⁸. It can be introduced by new employees of the organization, as well as created (or developed) in an organization (e.g. development of specific skills by means of trainings)³⁷⁹. The theory of human capital is the basis for a better understanding of the role of employees in the process of increasing work efficiency, innovation and implementation of new technologies³⁸⁰. T. W. Schultz confirmed the measurable importance of human capital and the influence it has on economic activity³⁸¹. The theory of human capital suggests that company results can be predicted, to some extent, based on the assessment of managerial attitudes³⁸². Human capital of employees is positively and significantly related to productivity. This means that investing in employees' human capital leads to increased

³⁷⁶ Onkelinx J., Manolova T.S., Edelman L.F., The human factor: Investments in employee human capital, productivity, and SME internationalization, *Journal of International Management* 22 (2016), p. 353.

³⁷⁷ Becker G., *Human Capital*. The University of Chicago Press, Chicago 1964.

³⁷⁸ Becker G., *Human Capital*. The University of Chicago Press, Chicago 1964.

³⁷⁹ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne* Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, p. 53.

³⁸⁰ Danquah M., Amankwah-Amoah J., Assessing the relationships between human capital, innovation and technology adoption: Evidence from sub-Saharan Africa, *Technological Forecasting & Social Change* 122 (2017), p. 25.

³⁸¹ Schultz T.W., *Investing in People: The Economics of Population Quality*, University of California, Berkeley, 1981.

³⁸² Williams D.R., Human and financial capital as determinants of biopharmaceutical IPO de-listings, *Journal of Business Research* 66 (2013), p. 2613.

productivity³⁸³. T.W. Schultz has proven that it is more profitable to invest in human capital through education and training in the United States than in physical capital³⁸⁴.

In accordance with the theory of human capital, high level of human capital leads to entrepreneurial success³⁸⁵. Employees increase their possibilities by learning new skills in the workplace, simultaneously using the knowledge and improving the skills they acquired at school and in previous workplaces³⁸⁶. Individuals can have knowledge typical for a given industry and specific one, closely related to the know-how of one particular company operating in a given industry³⁸⁷.

Hence, the need arises to look for employees with experience in a given industry. However, human capital specific for a company represents a unique set that consists of: knowledge of processes, procedures, mechanisms and tools of formal and informal communication. This set has limited value outside of a company from which it originated³⁸⁸. Companies differ in many ways which is why this knowledge is difficult to replace. Know-how typical for a company implies the ability to solve problems and communicate. Know-how is a description of what defines current practices in a company, and knowledge of how to organize work³⁸⁹. In many production companies it is the engineers who know the entire production process, and hence, they have become a critical element of human capital which differentiates one company from another³⁹⁰. This is why, it is frequently difficult to find a new employee who will quickly learn the know-how typical of a given company.

Companies are not to be considered as the owners of human capital in a strict meaning of this word because, in fact, this capital leaves the company after finishing work (in case of using the employer's premises) or is ultimately lost the moment they resign from work³⁹¹.

³⁸³ Onkelinx J., Manolova T.S., Edelman L.F., The human factor: Investments in employee human capital, productivity, and SME internationalization, *Journal of International Management* 22 (2016), p. 358.

³⁸⁴ Schultz T.W., *Investing in People: The Economics of Population Quality*, University of California, Berkeley, 1981.

³⁸⁵ Unger J.M., Rauch A., Frese M., Rosenbusch N., Human capital and entrepreneurial success: A meta-analytical review, *Journal of Business Venturing* 26, (2011), p. 343.

³⁸⁶ Onkelinx J., Manolova T.S., Edelman L.F., The human factor: Investments in employee human capital, productivity, and SME internationalization, *Journal of International Management* 22 (2016), p. 353.

³⁸⁷ Williams D.R., Human and financial capital as determinants of biopharmaceutical IPO de-listings, *Journal of Business Research* 66 (2013), p. 2613.

³⁸⁸ Williams D.R., Human and financial capital as determinants of biopharmaceutical IPO de-listings, *Journal of Business Research* 66 (2013), p. 2613.

³⁸⁹ Kogut B., Zander U., *Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology*, [w:] *Innovation and Knowledge Management*, red. Neil Anderson, Ana Cristina Costa, Sage, Los Angeles, London 2010, p. 7.

³⁹⁰ Kuo Y.K., Kuo T.H., Ho L.A., Enabling innovative ability: knowledge sharing as a mediator, *Industrial Management & Data Systems*, Vol. 114 No. 5, 2014 p. 696.

³⁹¹ Kianto A., Sáenz J., Aramburu N., Knowledge-based human resource management practices, intellectual capital and innovation, *Journal of Business Research* 81 (2017), p. 12.

Human capital does not constitute company's property as it is the case with other kinds of capital (i.e. physical capital, technological capital, financial capital). Therefore, the moment an employee resigns from work, the company's human capital is diminished³⁹². Resignation of an employee constitutes a phenomenon in the area of management that has been researched for many years. The source of this interest comes from negative effects it has for an organization.

Numerous research on resignation from work as a result of employee's decision indicates that the highest scale of leaving applies to the best and the weakest employees³⁹³. The goal of research on the topic of why employees are leaving is to obtain information that can be useful in reducing the phenomenon unfavorable to the company (i.e. resignation of the best employees), identifying the actual reasons for leaving and implementing remedial actions. The reasons may be objective, e.g. clearly higher wages from another employer or moving to another city or country for family reasons, they may also be subjective, e.g. bad atmosphere at work, conflict with the supervisor, rumors about planned layoffs.

Companies build their human capital by paying competitive wages, trying to attract and keep well-educated experienced and qualified workers, and by investing in training programs with a view to developing workers' skills and abilities. Gaining qualified workforce thanks to paying competitive salaries and organizing attractive trainings in the workplace are indispensable to increase efficiency. Companies investing in their employees' remuneration and trainings have better chances of increasing the quality of work³⁹⁴. The theory of human capital indicates that workers want to gain financial benefits adequate to time invested in building their individual capital of skills and competencies³⁹⁵. High salaries are treated as a return on investment. People who invested more in their skills want to be given higher salaries for the time that they devoted to gaining them. In comparison to people who invested less in the development of their capital, they will try to achieve more profit³⁹⁶.

³⁹² McDowell W.C., Peake W.O., Coder L.A., Harris M.L., Building small firm performance through intellectual capital development: Exploring innovation as the "black box", *Journal of Business Research* 88 (2018), p. 322.

³⁹³ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne* Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, p. 420-421.

³⁹⁴ Onkelinx J., Manolova T.S., Edelman L.F., The human factor: Investments in employee human capital, productivity, and SME internationalization, *Journal of International Management* 22 (2016), p. 358.

³⁹⁵ Unger J.M., Rauch A., Frese M., Rosenbusch N., Human capital and entrepreneurial success: A meta-analytical review, *Journal of Business Venturing* 26, 2011, p. 343.

³⁹⁶ Unger J.M., Rauch A., Frese M., Rosenbusch N., Human capital and entrepreneurial success: A meta-analytical review, *Journal of Business Venturing* 26, 2011, p. 343.

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Company pay policy is, to a great degree, connected with a macro-economic situation of a given country. In a developing country, a person will be given smaller salary for the same kind of job than a person from a developed country. Generally, in spite of intensification of global processes and internationalization of business activity, there are still stark contrasts between countries.

Differences in nominal (and usually not at all smaller in real) level of remuneration between neighboring countries (e.g. between Poland and Germany or Mexico and the USA) have serious socio-economic consequences. A result of this includes, for example, economic emigration and resignation from work in a country with lower wages. In extreme cases, this phenomenon may lead to a situation where there is shortage of labor in a given industry in a country. In Poland, such a situation began to be visible after 2015 in construction and healthcare. Transferring economic activity to countries (or regions) with a low level of wages (which is one of the main motives for off-sourcing, i.e. transferring economic activity to other countries) is a radically different effect. This process applies especially to production that requires a lot of manual work, for example the production of footwear, clothing, toys or assembly of electronic products, where it is difficult to fully automate the production process. Either it is too expensive or impossible to use for technical reasons. It is true that Adidas is building a new sports footwear factory in Germany, in which there will be practically no manual sewing and gluing of shoes (they are to be fully automated), but for now it is avant-garde.

A vast majority of production companies offering clothing and shoes, which also serve European, North-American and some Asian markets, are based on manual labor production and use human resources of such countries as Bangladesh, India, Vietnam and, to a lesser extent, China. As far as intangible services (e.g. call centers) are concerned, it is thanks to ICT technologies that those services can be provided from distant places (e.g. from another continent). For example, due to the ease of learning English by Indians, many such services are provided in India to clients living in English-speaking countries. In case of transferring business activity to other countries in order to use cheap labor, it is difficult to talk about sophisticated solutions in the field of human resource management. Numerous examples of violating employee rights in countries such as Bangladesh, India, Cambodia, Pakistan and

before China are the best proof of this³⁹⁷. This translates into strategic decisions related to capital allocation. Five categories of enterprise capital can be identified:

- financial capital,
- physical capital - technologies, devices, buildings, land, location, IT networks,
- human capital, which is created by employees and their knowledge,
- social capital,
- organizational capital including the internal organizational structure, processes, organizational culture, shaping formal and informal relationships as well as organizational behavior patterns, gathering information to facilitate the recruitment and selection of employees aimed at acquiring the most suitable people to perform specific tasks³⁹⁸.

Social capital can be defined as a set of formal and informal values and norms accepted by the members of a given group, which make it possible for them to cooperate on the basis of trust and certainty regarding the intentions of the other party³⁹⁹. Developing social capital creates trust, reciprocity of services and a tight network of interpersonal relationships between members of the team⁴⁰⁰. Social capital on a higher level is an effect of regular and repetitive contacts between people performing various activities aimed at achieving goals and leading to lasting (as it is assumed, also positive) results for an individual and an organization. Elements of social capital includes: participation in the structures of the society, networks of interrelationships and relationships, access to and use of competences and knowledge⁴⁰¹. The quality of social relationships such as trust and recognition depend on the results of the mutual learning process, which is deeply rooted in social life and which is carried out when introducing new innovative solutions⁴⁰².

³⁹⁷ Robertson R., Di H., Brown D., Deheji R., *Working Conditions, Work Outcomes, and Policy in Asian Developing Countries*, ADB Economics, Working Paper Series, No. 497, September 2016.

³⁹⁸ Gierszewska G., *Zarządzanie wiedzą w przedsiębiorstwie – modele, podejścia, praktyka*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011, p. 137.

³⁹⁹ Bal-Woźniak T., *Zarządzanie twórcze w organizacji*, w: *Zarządzanie innowacjami. Podstawy zarządzania innowacjami*, red. J.Łunarski, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2007, p. 61.

⁴⁰⁰ Gierszewska G., *Zarządzanie wiedzą w przedsiębiorstwie – modele, podejścia, praktyka*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011, p. 147.

⁴⁰¹ Gierszewska G., *Zarządzanie wiedzą w przedsiębiorstwie – modele, podejścia, praktyka*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011, p. 136.

⁴⁰² Christensen J.L., Lundvall B.Å., *Product innovation – on why and how it matters for firms and the economy*, w: *Product innovation, interactive learning and economic performance*, red. J.L.Christensen, B.Å.Lundvall, Elsevier, 2004, p. 4.

Organizational capital is defined as a collection of intellectual property of an organization, including: processes and work methods, executive procedures, data bases, communication and information infrastructure⁴⁰³. Organizational capital influences, for example, the engagement of personnel, customs related to sharing knowledge, or rewards for innovative attitudes⁴⁰⁴. Both human and organizational capital as well as social (relational) constitute intellectual capital of the company⁴⁰⁵. Initially, intellectual capital was a derivative of the human capital of the organization, because it was directly related to people, their capabilities, acquired knowledge, attitudes shaped in the process of learning, upbringing and practical action⁴⁰⁶. Subsequent definitions of intellectual capital highlight other aspects related to its importance and impact on value creation^{407 408}. In a broader sense, intellectual capital refers to the knowledge, experience, customer relationships and professional skills that give the company a competitive advantage on the market. In other words, intellectual capital is the sum of all knowledge-related intangible resources that the organization uses to create value⁴⁰⁹.

⁴⁰³ Chomiak-Orsa I., *Kapitał relacyjny stymulatorem przewagi konkurencyjnej współczesnej organizacji*, w: Wybrane problemy zarządzania wiedzą i kapitałem intelektualnym w organizacji, red. D.Jelonek, Częstochowa 2012, Sekcja Wydawnictw Wydziału Zarządzania Politechniki Częstochowskiej, p. 50.

⁴⁰⁴ Bal-Woźniak T., *Zarządzanie twórcze w organizacji*, w: Zarządzanie innowacjami. Podstawy zarządzania innowacjami, red. J.Łunarski, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2007, p. 60.

⁴⁰⁵ Bratnicki M., Stróżyna J., *Przedsiębiorczość i kapitał intelektualny*, Wydawnictwo Akademii Ekonomicznej im. K.Adamieckiego w Katowicach, Katowice 2001, p. 70.

⁴⁰⁶ Chomiak-Orsa I., *Kapitał relacyjny stymulatorem przewagi konkurencyjnej współczesnej organizacji*, w: Wybrane problemy zarządzania wiedzą i kapitałem intelektualnym w organizacji, red. D.Jelonek, Częstochowa 2012, Sekcja Wydawnictw Wydziału Zarządzania Politechniki Częstochowskiej, p. 48.

⁴⁰⁷ Edvinsson L., Malone M.S., *Intellectual capital – the proven way to establish your company's real value by measuring its hidden brainpower*, Piatkus, London 1997, p. 22.

⁴⁰⁸ Kaufmann L., Schneider Y., *Intangibles. A synthesis of current research*, Journal of Intellectual Capital 2004, Vol. 5, no. 3, pp.366-388.

⁴⁰⁹ Kianto A., Sáenz J., Aramburu N., *Knowledge-based human resource management practices, intellectual capital and innovation*, Journal of Business Research 81 (2017), p. 12.

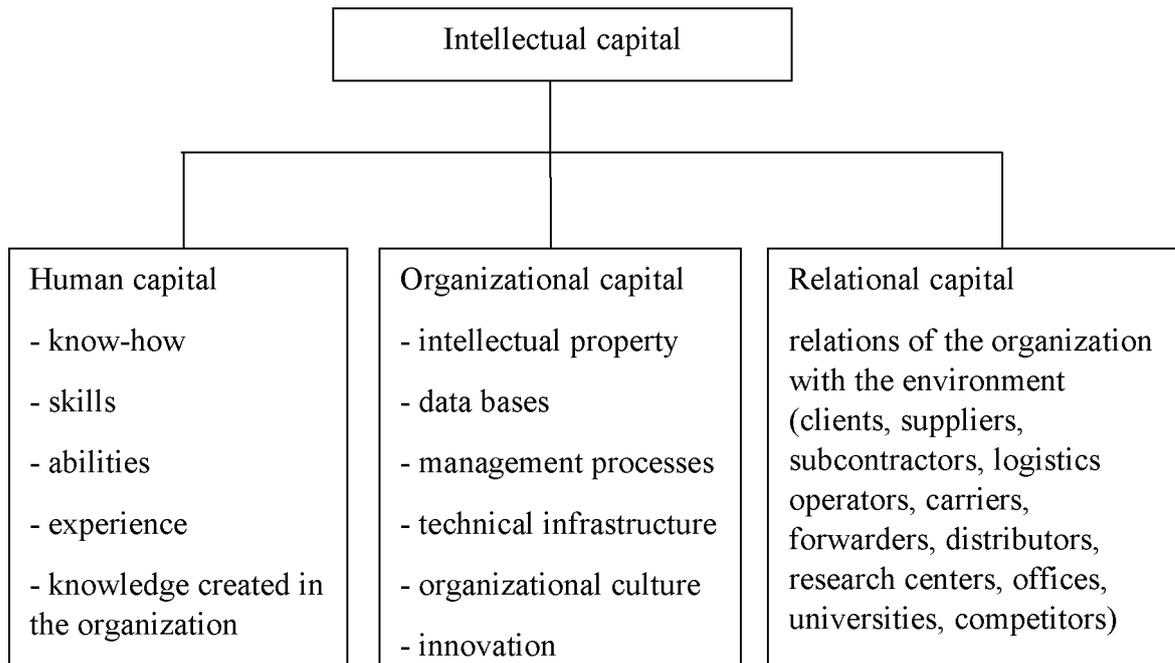


Figure 6.1. Model of intellectual capital classification

Source: G.Petrash, *Dow's Journey to Knowledge Value Management Culture*, European Management Journal, August 1996, No 14, p 37.

Relational capital, also known as market capital, takes the form of interrelationships with the environment and includes such concepts as: image, brand value, relationships with customers, suppliers, long-term relationships, intensity, diversity and multilevel cooperation, membership in economic networks, ways of concluding contracts, shaping business ties, degree of partnership development⁴¹⁰. Relational capital is closely tied with social capital. N. Bontis pointed to the importance of human capital that together with interpersonal interactions are indispensable to create company values. This translates into the creation of a new value⁴¹¹. Relational capital, also known as external social capital, refers to knowledge that is ingrained in customer relations, suppliers, institutions and other external entities⁴¹². Relational capital contributes to creating innovation because external relationships can help companies introduce new inventions by sharing solutions existing

⁴¹⁰ Bal-Woźniak T., *Zarządzanie twórcze w organizacji*, w: *Zarządzanie innowacjami. Podstawy zarządzania innowacjami*, red. J.Łunarski, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2007, p. 61.

⁴¹¹ Bontis N., *Intellectual capital: an exploratory study that develops measures and models*, Management decision, vol. 36, No.2, 1998, pp. 63- 76.

⁴¹² Kianto A., Sáenz J., Aramburu N., *Knowledge-based human resource management practices, intellectual capital and innovation*, Journal of Business Research 81 (2017), p. 12.

elsewhere or combining knowledge from various external sources. The potential of external contacts of an organization is determined on the basis of: relationships with suppliers, customers, research institutions, the scale of cooperation with other enterprises and even competitors, the intensity of contacts with experts and consultants, the frequency of joining initiatives of local, regional or state authorities (environmental protection, local infrastructure).

Building relational capital requires⁴¹³:

- close relations allowing to respond to weak stimuli coming from the market or the environment which can be a sign of upcoming market threats or chances,
- developing and building close relations which can lead to creating new products or services,
- shortening the time to inform partners about the implementation of new solutions,
- constant monitoring of current relationships as well as potentially interesting ones,
- quick response to the need to change the range of manufactured products or services provided through flexible allocation of resources,
- conscious shaping of an organizational culture in which change, learning new skills, assimilation of new members and cultures are highly valued, mistakes are tolerated and learning from mistakes is appreciated.

Relational capital is defined as a key stimulator of organization's growth of competitiveness, as well as an ability to create and maintain close and lasting relationships based on trust and cooperation. Relational capital can determine efficient functioning of a company and its success on the market⁴¹⁴. Open links between companies and universities are a crucial factor contributing to the increase in human capital⁴¹⁵. Engagement of customers in development activities also incentivizes the search for new solutions⁴¹⁶. Many

⁴¹³ Chomiak-Orsa I., *Kapitał relacyjny stymulatorem przewagi konkurencyjnej współczesnej organizacji*, w: Wybrane problemy zarządzania wiedzą i kapitałem intelektualnym w organizacji, red. D.Jelonek, Częstochowa 2012, Sekcja Wydawnictw Wydziału Zarządzania Politechniki Częstochowskiej, p. 54.

⁴¹⁴ Chomiak-Orsa I., *Kapitał relacyjny stymulatorem przewagi konkurencyjnej współczesnej organizacji*, w: Wybrane problemy zarządzania wiedzą i kapitałem intelektualnym w organizacji, red. D.Jelonek, Częstochowa 2012, Sekcja Wydawnictw Wydziału Zarządzania Politechniki Częstochowskiej, p. 52.

⁴¹⁵ Doran J., Ryan G., *Regulation and firm perception, eco-innovation and firm performance*, European Journal of Innovation Management, Vol. 15 No. 4, 2012, p. 425.

⁴¹⁶ Kianto A., Sáenz J., Aramburu N., *Knowledge-based human resource management practices, intellectual capital and innovation*, Journal of Business Research 81 (2017), p. 12.

authors believe that the most important element of intellectual capital is human capital due to the fact that companies cannot achieve anything without it⁴¹⁷.

Human capital is the most crucial ingredient of the intellectual capital of a company because it consists of people who have knowledge and by using it, they can interact with the surrounding environment. They are motivated, supported and can create value for the company. As Subramaniam and Youndt⁴¹⁸ claim, a critical part of knowledge and skills needed for innovation is owned by specific people. Creative and competent employees are more eager to develop new and innovative ideas or to question the existing approaches and practices⁴¹⁹. Human resource management includes recruiting employees with high intellectual potential, and then integrating them into the existing structures, transforming their individual knowledge into corporate knowledge capital, and transforming acquired intellectual capital into business benefits⁴²⁰.

The growing importance of human capital as a competitive factor in modern economy comes about as a result of changes taking place in the organization's environment, development of new technologies and new companies in which knowledge is becoming a strategic development factor while progressing internationalization facilitates the movement of employees between job markets. This contributes to risks associated with acquisition and departure of employees, particularly in companies which waste the potential of human resources and utilize management practices typical of the industrial era and unacceptable by the generation of the Internet and smartphone users who constitute an increasing proportion of professionally active people. At the same time, people are becoming more commonly convinced that the ability of companies to compete in these conditions is affected to a far greater extent by the quality of human capital. Modern organizations are trying to maintain their market competitiveness by supporting the development of human capital⁴²¹. Activities undertaken in the field of HRM are supposed to enable acquisition of employees with required skills who can become a part of an integrated team. New employees introduce a specific level of knowledge and skills to the company.

⁴¹⁷ Kianto A., Sáenz J., Aramburu N., *Knowledge-based human resource management practices, intellectual capital and innovation*, Journal of Business Research 81 (2017), p. 12.

⁴¹⁸ Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal*, 48(3), p. 451.

⁴¹⁹ Kianto A., Sáenz J., Aramburu N., *Knowledge-based human resource management practices, intellectual capital and innovation*, Journal of Business Research 81 (2017), p 12.

⁴²⁰ Edvinsson L., Malone M.S., *Kapitał intelektualny*, Fundacja Edukacyjna Przedsiębiorczości, PWN, Warszawa 2001, pp.107-109.

⁴²¹ Kuo Y.K., Kuo T.H., Ho L.A., *Enabling innovative ability: knowledge sharing as a mediator*, *Industrial Management & Data Systems*, Vol. 114 No. 5, 2014 p. 705.

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Subramaniam and Youndt have shown that organizational innovation depends on the effectiveness of recruiting the most talented employees⁴²². Recruitment includes practices and actions taken by the organization with a view to identifying and employing potential workers⁴²³. In contrast, selection refers to identifying which candidate will best meet the requirements for a given job and has the best chance of becoming a part of the team and understanding the culture of the organization employing him or her⁴²⁴.

At the same time, it should be noted that the expectations of entrepreneurs towards their employees are subject to dynamic changes. First of all, it is the effect of shortening product life cycles and technologies used. If an owner of the company decides to change the technology used, employees with new qualifications are needed. Those qualifications may significantly differ from the previously needed ones. In this case, employers either recruit staff with the necessary competences or train currently employed employees. Secondly, progressing globalization forces cooperation with distant suppliers, brokers, subcontractors and recipients. That is why it is important to recruit employees with soft competences based on openness to other cultures. It is important that the employees avoid confrontational behaviors that could be perceived as abusive by business partners from another culture. The increasing globalization and internationalization of business activities translate into an increase in the complexity of logistics processes and, consequently, an increase in the importance of logistics competences. The variety of logistics services offered is growing, and this is becoming one of the sources of competitive advantage⁴²⁵.

It is the knowledge and skills of people engaged in the sphere of logistics that enable to design logistics services at the expected level. Appropriate quality of logistics services is indispensable in order to reduce the risk to logistic processes. Logistics services are a complex process involving the flow of goods, financial resources and information, requiring the involvement of various institutions (e.g. customs offices). Logistics services carried out in a supranational dimension require skills and knowledge about product regulations, features and properties, sources of risk during transport, ways of securing cargo (packaging, cargo science, commodity science). For example, home electronics or appliances damaged

⁴²² Subramaniam, M., & Youndt, M. A. (2005). *The influence of intellectual capital on the types of innovative capabilities*. *Academy of Management Journal*, 48(3), pp. 450–463.

⁴²³ Breaugh J., Starke M., *Research on employee recruitment: So many remaining questions*. *Journal of Management*, 26(3), (2000), p. 45.

⁴²⁴ Torrington D., Hall L., Taylor, S., & Atkinson, C., *Human resource management* (8th ed.). Harlow, Essex, England: Pearson Education, (2014), p. 133.

⁴²⁵ Yazdanparast A., Manuj I., Swartz S.M., *Co-creating logistics value: a service-dominant logic perspective*, *The International Journal of Logistics Management*, Vol. 21 Iss 3, (2010), p. 392.

during transport due to inadequate protection (packaging) will cause customer dissatisfaction. When a customer decides to return the damaged good to the seller, he or she may be forced to wait for a new, functional copy⁴²⁶. As a consequence, mainly the manufacturer and / or the carrier will be charged with additional costs.

Thirdly, new transport trends are gradually changing the way transport is organized. In the US, UPS uses autonomous trucks designed by a start-up called TuSimple. This system is applied to the route between Phoenix and Tucson, Arizona. These vehicles are controlled by people seated in them: the driver and the on-board engineer. The goal of the start-up is, in the beginning, to achieve the fourth level of autonomous driving (where no human assistance is required in standard road situations), and ultimately the highest fifth level of autonomy meaning full automation. Intensive tests are carried out on fully autonomous vehicles, and some are already autonomous, as are connected vehicles or short-range electric delivery vehicles⁴²⁷. Operating them requires a different set of skills than in case of traditional vehicles.

A factor which additionally complicates the tasks of logistics is a progressive increase in specialization and the use of outsourcing in, for example, the area of production. Therefore, even in case of companies that entrust all logistics-related tasks to external logistics operators, it is worth employing employees who have knowledge of the logistics solutions used. Thanks to this, it is possible to significantly reduce the cost of services in this area and the risk of damage to the load during transport and loading or unloading operations.

Fourthly, there is a visible departure from the product-based model as the essence of transactions of trading goods (*goods-dominant logic perspective*) towards a *service-dominant logic perspective (SD)*, when the product being the object of trade is so technologically developed that its transfer is only part of an extensive transaction related to the provision of a knowledge and information package about the capabilities and functions of this product. S-D logic was developed in 2004 by Vargo and Lusch⁴²⁸ and revised in 2008 also by the same authors⁴²⁹. According to this concept, the increase in the value of a product

⁴²⁶ Yazdanparast A., Manuj I., Swartz S.M., *Co-creating logistics value: a service-dominant logic perspective*, The International Journal of Logistics Management, Vol. 21 Iss 3, (2010), p. 392.

⁴²⁷ Speranza M.G., *Trends in transportation and logistics*, European Journal of Operational Research 264 (2018), p. 833.

⁴²⁸ Vargo S.L., Lusch R.F., *Evolving to a new dominant logic for marketing*, Journal of Marketing, Vol. 68, No.1, (2004), pp. 1-17.

⁴²⁹ Vargo S.L., Lusch R.F., *Service-dominant logic: continuing the evolution*, Journal of the Academy of Marketing Science, Vol. 36, No. 1, (2008), pp. 1-10.

requires enriching the offer by adding a service connected to providing knowledge and information about its possibilities.

In the options dominant in recent years, that is *goods-dominant logic (G-D)*, material goods were treated as the most important object of transaction between a producer and a customer buying it⁴³⁰. The manufacturer was, in this case, perceived solely as a supplier of a given product. This product had to meet the quality and quantity expectations specified in the order, be properly packaged, and delivered to the address previously indicated. In *service-dominant logic (S-D)*, the focus is on knowledge as an important factor of value creation. The value above standard is generated when different players from the same supply chain engage in cooperation while designing, manufacturing, shipping, transporting and using the product⁴³¹. As a result of this, a network of connections and relationships is created which requires skills related to spatial thinking, ability to match facts quickly, talent for immediate responses and being resistant to stress. Crucial (virtually indispensable) skills and competences for individuals include those from the area of technology, investment and management (organizational skills) as well as the ability to cooperate, quickly adapt to industry requirements and to implement modern solutions⁴³².

Fifthly, the progressive digitization of business processes translates into a change in business behavior and conduct procedures. An example is the use of extensive data sets called Big Data. They take various forms: news, images, global positioning system (GPS) signals from cell phones, sensor readings. Social networks, smartphones and mobile devices are the source of such collections and provide huge amounts of data related to people, their activities and locations of various enterprises. Big Data constitute extensive, variable and diverse data sets. For their analysis, a set of advanced quantitative tools is necessary, which allows for a multifaceted assessment of various socio-economic phenomena⁴³³. Vehicles servicing freight are equipped with an Internet connection, so traffic data can be collected, processed and analyzed. Because of the ability to access Big Data datasets, managers and business owners can know more and thus make better decisions. Decisions based on the analysis of extensive data sets are frequently more accurate than those made in a traditional

⁴³⁰ Yazdanparast A., Manuj I., Swartz S.M., Co-creating logistics value: a service-dominant logic perspective, *The International Journal of Logistics Management*, Vol. 21 Iss 3, (2010), p. 392.

⁴³¹ Yazdanparast A., Manuj I., Swartz S.M., Co-creating logistics value: a service-dominant logic perspective, *The International Journal of Logistics Management*, Vol. 21 Iss 3, (2010), p. 392.

⁴³² Płaczek E., Wyzwania dla operatorów logistycznych w obszarze logistyki społecznej, *Logistyka* 4/2014, p. 22.

⁴³³ Speranza M.G., Trends in transportation and logistics, *European Journal of Operational Research* 264 (2018), p. 831.

way. Big Data sets create a new wide range of possibilities, in particular in the field of transport and logistics, which can help the management of companies and institutions to make better decisions⁴³⁴. The phenomenon of digitization requires employees to be open to new solutions, flexible and committed to seeking new options (e.g. new ways of communicating with business partners in the supply chain). The derivative of these requirements are the changing expectations that employers have of job candidates.

The recruitment process basically consists of several successive stages: preparation and publication of a job advertisement, initial selection of candidates, the basic process of assessing their competences and direct final interviews, as well as negotiations regarding e.g. financial conditions or additional arrangements such as detailed provisions in the managerial contract⁴³⁵. The selection procedure consists of verifying the qualifications declared by the candidate so as not to employ a worker who exaggerated his or her skills. Nowadays, it is one of the most serious difficulties at this stage due to the fact that candidates wanting to get an interesting and well-paid job frequently embellish the course of their professional career, exaggerate their accomplishments and participation in various projects. The existing EU legislation on the protection of personal data has created certain limitations when contacting previous employers of a given candidate. Such contacts were often used to determine whether the candidate actually carried out the tasks indicated in their resume. Among other things, it is one of the reasons why employers are looking for other options enabling them to verify factual abilities of a given candidate. Emphasis is placed here on proper preparation of verification tests.

Carefully chosen selection procedures have to enable verifying the skills declared by the candidate as well as checking whether he or she really has such competences. This is done through professional competence tests, during which the candidate is asked to solve several hypothetical problems in a specific field or perform several tasks. Practical skills tests allow employers to check the actual skills of the candidate. Other characteristics of the candidates are also checked. Good results achieved by employees are to a large extent influenced by such factors as: talent, abilities, potential, motivation and possibilities, and the combination of these factors ultimately determines the final result, i.e. the results achieved

⁴³⁴ Speranza M.G., *Trends in transportation and logistics*, European Journal of Operational Research 264 (2018), p. 831.

⁴³⁵ David R., Banerjee P., Ponnampalnam A., *Risks perceived regarding recruitment process outsourcing: stakeholder concerns*, Journal of Global Operations and Strategic Sourcing, Vol. 10 No. 1, 2017, p. 113.

by the employee and as a consequence by the entire organization⁴³⁶. In addition to assessing competences, it is the assessment of talent, ability, motivation, potential and opportunity that has been recognized as the basis for the selection process. Talent translates into the speed of acquiring new skills. Abilities form a predisposition to perform a specific profession. Motivation is manifested in making efforts to complete the task. Potential and possibilities mean ease of acquiring new skills. Verifying these parameters is much more difficult than assessing competences.

Developing comprehensive methods and procedures that meet specific organizational requirements for talent acquisition is a challenging task⁴³⁷. So as to ensure that candidates have not only knowledge and skills but also character traits needed to perform work in a given position, multifaceted selection procedures are created. There are many methods for measuring these parameters. Currently, one of the most popular methods include Assessment Center tools, which focus on measuring competences and observing the behavior of participants, while performing specific simulated tasks⁴³⁸.

Assessment Center is a multidimensional assessment process in which participants are observed by a team of objective and trained assessors. During the session, the following are evaluated: behavior related to a specific position, aptitude, and personality. This can generally be thought of as assessing and determining the candidate's development potential. What is also checked in this way, is the candidate's reaction to stressful situations. This method, although effective, is expensive. It is also important whether the evaluated persons (candidates) will identify with the values important in a given organization. The specificity of working on a specific position is also important. In case of accounting, preference is given to accurate and precise people who are able to focus on the task related to sets of numbers and view these sets analytically. In case of sales-people, open, extroverted individuals are often sought after, frequently ones with an attractive appearance who can easily make contact with other people. In the area of logistics, interviewers look for people who can manage stress well and are able to operate under time pressure. On the other hand, when looking for candidates for managerial positions, dynamic and expansive people who are able to impose their point of view on the team are often wanted. It is possible to use personality

⁴³⁶ Ożgo E., Brewster Ch., *Knowledge Flows in MNEs and the Role of HRM*, w: C.Machado (ed.), *International Human Resources Management. Challenges and Changes*, Springer, 2015, p. 26.

⁴³⁷ Sheehan C., Cooper B.K., HRM outsourcing: the impact of organisational size and HRM strategic involvement, *Personnel Review*, Vol. 40 No. 6, 2011, p. 744.

⁴³⁸ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne* Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, pp. 176, 391.

tests for almost all positions. Most often than not, these tests give information whether the candidate can work in a group or has leadership skills. It is possible to assess a person's management style, the way in which they solve problems and determine their level of social skills⁴³⁹.

In most cases, when choosing new employees, their social skills are important, just as much as their ability to work as members of a team. It is often a critical skill. In many cases, employers say that they are able to teach an inexperienced candidate how to work in the profession, provided that the new employee integrates with the team and is able to build positive relationships with the rest of the group. Which means that the person cannot be conflicting, aggressive, malicious, and create tense atmosphere. Teamwork skills, combined with interpersonal skills, increase the likelihood that a person will be able to use the knowledge of other members of the organization. In addition, in dynamically changing conditions, adaptive skills are important due to the fact that they enable individuals to respond effectively to constant change and quickly learn new competences. Such conditions are typical for industries based on the use of technically advanced solutions and extensive, professional knowledge⁴⁴⁰. All of the interpersonal skills described above need to be verified in the selection process. That is why, in some situations, recruiters should select candidates on the basis of their potential, and not based on their current knowledge, skills or experience. This can be attributed to the fact that people with high potential are more inclined to learn new knowledge necessary to create and carry out innovations⁴⁴¹. Since learning takes place primarily in the context of cooperation, knowledge-based recruitment should take into account the candidate's ability to cooperate. In short, knowledge-based recruitment involves a strong and clear focus on selecting candidates with the right knowledge, learning and networking opportunities⁴⁴².

When the selection process takes place inside the company, in the so-called internal recruitment, the selection procedures are slightly less complicated as they are based on the system of internal promotion. In this case, the recruitment team looks for a right candidate for a given job among those currently employed at a given company. After a couple of years

⁴³⁹ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne* Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, p. 394.

⁴⁴⁰ Ożgo E., Brewster Ch., *Knowledge Flows in MNEs and the Role of HRM*, w: C.Machado (ed.), *International Human Resources Management. Challenges and Changes*, Springer, 2015, p. 28.

⁴⁴¹ Kianto A., Sáenz J., Aramburu N., *Knowledge-based human resource management practices, intellectual capital and innovation*, *Journal of Business Research* 81 (2017), p. 12.

⁴⁴² Kianto A., Sáenz J., Aramburu N., *Knowledge-based human resource management practices, intellectual capital and innovation*, *Journal of Business Research* 81 (2017), p. 12.

of cooperation, it is usually not difficult to assess strength and weaknesses of an employee as long as the new position does not involve entirely differing expectations and requirements than hitherto prevailing. Such a situation can take place when the company management decides to enter a new market, launch a production of an entirely new product, or, for the first time, use new technology or organizational solutions. The more ground-breaking the planned innovation is in relation to what has been practiced in the company up to this point, the greater the need to go beyond the previously known cognitive boundaries⁴⁴³. In such a situation, when completely different challenges and conditions for activities arise, many years of experience and knowledge of a specific person can be practically worthless, and the risk associated with the situation is almost identical as when introducing a completely new employee to the team, who in the event of failure is easier to release (in an emotional sense) than a person that somebody has been working with for years (which also makes a very bad impression on other colleagues).

High speed of change, especially in sectors of the knowledge-based economy means that knowledge and skills become obsolete much faster⁴⁴⁴. Experienced employees may not know the latest technological solutions (e.g. ICT) and managerial practices without being trained in such an area. Such employees will be in a significantly worse position compared to those who are just graduating from prestigious and well-respected universities or coming from such research institutions⁴⁴⁵. Experienced employees may have difficulties with getting rid of old habits resulting from many years of experience, which may make it difficult for them to switch to new knowledge or acquire it. Robbins, Judge and Campbell emphasize that competent employees do not remain competent forever⁴⁴⁶. Skills are getting worse and may become outdated. Employees of the organization, within its internal structures and relationships, create a certain model - a pattern of attitudes and behavior that is supposed to promote the creation of new solutions. If these models are not gradually replaced (updated), they become outdated and the company may lose its competitiveness⁴⁴⁷. It is interesting to

⁴⁴³ Santiago F., Alcorta L., Human resource management for learning through knowledge exploitation and knowledge exploration: Pharmaceuticals in Mexico, *Structural Change and Economic Dynamics* 23 (2012), p. 532.

⁴⁴⁴ Vinding A.L., Human resources; absorptive capacity and innovative performance, w: Product innovation, interactive learning and economic performance, red. J.L.Christensen, B.Å.Lundvall, Elsevier, 2004, p. 168.

⁴⁴⁵ Vinding A.L., Human resources; absorptive capacity and innovative performance, w: Product innovation, interactive learning and economic performance, red. J.L.Christensen, B.Å.Lundvall, Elsevier, 2004, p. 168.

⁴⁴⁶ Robbins S. P., Judge T. A., Campbell T. T., *Organizational behaviour*. Harlow, Essex, England: Pearson Education (2010).

⁴⁴⁷ Cambra-Fierro J., Florin J., Perez L., Whitelock J., Inter-firm market orientation as antecedent of knowledge transfer, innovation and value creation in networks, *Management Decision*, Vol. 49 No. 3, 2011, p. 448.

note that sporadically such solutions are used as employing ex employees as trainers, or using their help in crisis situations⁴⁴⁸. This confirms certain restrictions of internal selection and resistance towards involving former employees.

The second particularly important area of human resources development is related to continuous improvement of competences of the employees. Companies create possibilities of broadening and creating knowledge through access to its sources in the form of trainings, conferences, sharing professional publications, meetings with experts, creating teams consisting of employees of different departments of the company⁴⁴⁹. Trainings are intended to continuously broaden the knowledge of employees and develop the skills of entire teams, their parts or individual workers. The most typical division includes a distinction between internal trainings (performed by the company staff) and external trainings (conducted by specialists from the outside of a company). The scope of trainings can cover virtually all areas of the activity performed within a given organization. This can include such topics as: training in new sales techniques, new forms of communication with the environment, e.g. with customers or suppliers, changes in regulations, building a sense of teamwork, coaching, or building resistance to stress. In addition to acquiring new skills or improving existing skills, trainings help creating positive relationships between employees, strengthen and deepen knowledge of organizational values, applicable standards and patterns of action, and facilitate further assimilation of employees⁴⁵⁰. However, traditional training, which is about passing on ready-to-use knowledge or developing a narrow set of skills, may turn out not be enough for more complex areas. Training practices that increase the ability to respond to dynamic changes in the environment, as well as promote learning from others, can support the processes implemented in a given company more strongly⁴⁵¹. Such training practices make it easier to build the skills required in the area of research and development. In some areas, such as biotechnology, external trainings ensure understanding of advanced methods

⁴⁴⁸ Godziszewski B., Stan zarządania wiedzą w polskich przedsiębiorstwach – próba oceny, w: Zarządzanie wiedzą w warunkach globalnej współpracy przedsiębiorstw, red. J.Bogdanienko, M.Kuzel, I.Sobczak, Wydawnictwo Adam Marszałek, Toruń 2007, p. 38.

⁴⁴⁹ Gierszewska G., *Zarządzanie wiedzą w przedsiębiorstwie – modele, podejścia, praktyka*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011, p. 152.

⁴⁵⁰ Ożgo E., Brewster Ch., *Knowledge Flows in MNEs and the Role of HRM*, w: C.Machado (ed.), *International Human Resources Management. Challenges and Changes*, Springer, 2015, p. 28.

⁴⁵¹ Ożgo E., Brewster Ch., *Knowledge Flows in MNEs and the Role of HRM*, w: C.Machado (ed.), *International Human Resources Management. Challenges and Changes*, Springer, 2015, p. 28.

and research techniques, as well as the way in which the results can be potentially applied⁴⁵². Acquiring new knowledge is necessary in case of using previously unknown technologies, creating new products or services when employees need to face impossible or at least unpredictable supply⁴⁵³. This requires a new perspective on a number of implemented processes and organizational patterns already being in force in many organizations. When designing and carrying out training and development activities, organizations can optimize the relationship between the current skills and knowledge of the employees and their required state and in this way contribute to creating knowledge and enhancing the quality of human capital⁴⁵⁴. Training can also improve the creativity of the workforce.

In summary, each employee constitutes a potential source of expert knowledge. The best way to obtain this source is by recruiting appropriately selected employees and by building their loyalty and commitment in such a way that they can further develop it for the benefit of the company⁴⁵⁵. Activities related to HRM rely increasingly on motivating employees by building grounds for positive attitudes and behaviors⁴⁵⁶. Human resource management is supposed to positively influence attitudes of employees. It is connected to designing workplaces in such a way so as to ensure best conditions for the employees to perform their jobs in. It is particularly visible in case of companies from the high-tech sector, such as Google, where workplaces are very friendly, created in accordance with the rules of ensuring favorable workplace ergonomics. Special rooms devoted to unwinding and relaxing are also prepared (they are called ‘chill-out rooms’).

Open and noisy office spaces organized in the style of "open space", which were very popular 10-15 years ago, are becoming obsolete. Open spaces can be characterized by the lack of walls between work stations. As a result, dozens of people work in one spacious room. They hear each other's conversations and see each other. The goal behind using open

⁴⁵² Santiago F., Alcorta L., *Human resource management for learning through knowledge exploitation and knowledge exploration: Pharmaceuticals in Mexico*, *Structural Change and Economic Dynamics* 23 (2012), p. 542.

⁴⁵³ Santiago F., Alcorta L., *Human resource management for learning through knowledge exploitation and knowledge exploration: Pharmaceuticals in Mexico*, *Structural Change and Economic Dynamics* 23 (2012), p. 532.

⁴⁵⁴ Cabello-Medina C., López-Cabrales A., Valle-Cabrera R., *Leveraging the innovative performance of human capital through HRM and social capital in Spanish firms*. *International Journal of Human Resource Management*, 22(4), (2011), pp. 807–828.

⁴⁵⁵ Gierszewska G., *Zarządzanie wiedzą w przedsiębiorstwie – modele, podejścia, praktyka*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011, p. 153.

⁴⁵⁶ Szierbowski-Seibel K., Kabst R., *The impact of HR outsourcing and strategic HR integration on the HR-to-employee ratio. An empirical evaluation of the HR function over the last decade*, *International Journal of Manpower*, Vol. 39 No. 2, 2018, p. 283.

spaces was to encourage all employees to be very active throughout the working day (the manager usually occupies a central place in the middle of the room so that he or she can observe the activity of employees from that place). It is possible to easily notice who goes out for a cigarette and how often, how much time the employee devotes to a meal, how much to gossip, how much to work and how many coffee breaks they have during the day. The goal was also to reduce the psychological barrier associated with the closed door syndrome, behind which an employee reluctant to cooperate with others hides. This solution was supposed to eliminate some kind of an artificial interpersonal barrier. This approach, however, was quite controversial, because by fighting against those individuals who avoided work, the work of those people who were devoting much attention to it was hindered. It was a very tiring, stressful solution and in the end (in the long term) reducing work efficiency. Such an environment causes long-term and overloading stress in which one functions worse, in terms of cognitive skills, problem-solving capabilities, general well-being, and cooperation. Employees in such conditions also tend to be more conflicting⁴⁵⁷.

Another advanced form of activity in the HRM area include various types of activities that integrate staff. Various events such as integration trips and meetings outside working hours are organized in order to build positive relationships inside the workplace. It is believed that the level of job satisfaction (and as a result of the quality of work) depends on interpersonal relationships and working conditions, work organization, management methods and atmosphere prevailing in the company. Having analyzed various concepts, it can be concluded that job satisfaction is becoming an increasingly important issue for businesses and employees. Positive emotions are conducive to creative thinking. Satisfied employees have a strong internal motivation to work, thanks to which they build and participate in the success of the organization in which they work⁴⁵⁸. The appropriate attitude and behavior of employees has huge influence upon the functioning of an organization. Nowadays, employees want to know what is happening in their companies. They want important decisions to be consulted with them and the effects of their work to represent value to their organizations. This gives satisfaction to the employees. It has been proven that factors related to interpersonal relationships (good relations with coworkers, with the

⁴⁵⁷ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne*”, Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, p. 28.

⁴⁵⁸ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne*” Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, p. 293.

supervisors, communication with the management, other groups and being recognized by the superiors) and stability of employment have the greatest importance⁴⁵⁹.

6.3. Outsourcing of recruitment and training processes

Human resources outsourcing (HRO) can be defined as transferring processes and activities of HRM to be executed by an outside provider of personnel services⁴⁶⁰. It is generally believed that outsourcing of HRM activities in the area of management is a trend adopted by European organizations from American corporations⁴⁶¹. Kakabadse and Kakabadse researched 747 organizations operating in Europe and came to the conclusion that among other services such as catering, cleaning, IT servicing, HRM is one of the functions transferred in outsourcing⁴⁶². In other surveys, it has been proven that only in case of 10.8% of companies no outsourcing is used in the area of HRM, while the majority of companies transfer even a couple of different functions associated with this area⁴⁶³. Studies conducted since 2000 enabled to confirm growing interest in HRO in practically all aspects ascribed traditionally to HRM⁴⁶⁴. Yet another study comprising 3964 organizations operating in 15 European countries (with each of them employing more than 200 employees), indicated that in 97 per cent of cases, companies outsource at least part of their HRM activities to outside agencies. According to this research, in almost a half of organizations surveyed and over the last couple of years, a sharp increase was noticeable in the usage of this option⁴⁶⁵.

Owing to the diversity of functions and tasks executed within the scope of HRM, an outside provider of personnel services (depending on the kind of contract), performs all

⁴⁵⁹ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne*” Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, p. 292.

⁴⁶⁰ Szierbowski-Seibel K., Kabst R., *The impact of HR outsourcing and strategic HR integration on the HR-to-employee ratio. An empirical evaluation of the HR function over the last decade*, *International Journal of Manpower*, Vol. 39 No. 2, 2018, p. 284.

⁴⁶¹ Kakabadse A., Kakabadse N., *Trends in outsourcing: contrasting USA and Europe*, *European Management Journal*, Vol. 20, No. 2, (2002), pp. 189-98.

⁴⁶² Kakabadse A., Kakabadse N., *Trends in outsourcing: contrasting USA and Europe*, *European Management Journal*, Vol. 20, No. 2, (2002), pp. 189-98.

⁴⁶³ Delmotte J., Sels L., *HR outsourcing: threat or opportunity?*, *Personnel Review* Vol. 37 No. 5, 2008, p. 553.

⁴⁶⁴ Szierbowski-Seibel K., Kabst R., *The impact of HR outsourcing and strategic HR integration on the HR-to-employee ratio. An empirical evaluation of the HR function over the last decade*, *International Journal of Manpower*, Vol. 39 No. 2, 2018, p. 284.

⁴⁶⁵ Delmotte J., Sels L., *HR outsourcing: threat or opportunity?*, *Personnel Review* Vol. 37 No. 5, 2008, p. 544.

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functions related to it or just the selected ones⁴⁶⁶. In case of all HR functions being outsourced, the organization resigns from performing them on its own⁴⁶⁷. The most frequently outsourced HRM functions are presented in the table below.

Table 6.1. HRM related most often outsourced functions

HR activity	Percentage of organizations using this option
Payroll	71,8
Training	60,5
Temporary agency work	52,6
Recruitment and selection of operational and support staff	20,0
Advice on personnel policy	18,4
Recruitment and selection of managerial staff	15,1
Drawing up of job or wage classification	7,6
Outplacement	4,7
Appraisal	4,5
Career guidance	2,0

Source: J. Delmotte, L. Sels, *HR outsourcing: threat or opportunity?*, Personnel Review Vol. 37 No. 5, 2008, p. 552.

Other studies carried out in Europe and the US found that the activities most often outsourced were outplacement, pre-employment testing, training, payroll administration, employee assistance, counseling and pension plans⁴⁶⁸. In subsequent studies, it was shown

⁴⁶⁶ David R., Banerjee P., Ponnampalani A., *Risks perceived regarding recruitment process outsourcing: stakeholder concerns*, Journal of Global Operations and Strategic Sourcing, Vol. 10 No. 1, 2017, p. 113.

⁴⁶⁷ David R., Banerjee P., Ponnampalani A., *Risks perceived regarding recruitment process outsourcing: stakeholder concerns*, Journal of Global Operations and Strategic Sourcing, Vol. 10 No. 1, 2017, p. 114.

⁴⁶⁸ Dickman, M. and Tyson, S., *Outsourcing payroll: beyond transaction cost economics*, Personnel Review, Vol. 34 No. 4, (2005), pp. 451-67.

that the most frequently outsourced HRM functions were: training and employee development, followed by the recruitment and selection of candidates⁴⁶⁹.

HRM outsourcing is not limited to administrative activities such as payroll preparation or employee data management. Outsourcing also provides more strategic activities⁴⁷⁰ (e.g. organization of substantively advanced training courses, recruitment and selection of candidates employed as specialists in key positions, planning future employment). An external personnel service provider (employment agency)⁴⁷¹ is responsible for placing a job ad in newspapers, magazines, radio and / or websites. The advertisement usually contains the expectations of the employer (client), a description of requirements related to work in a given position, as well as contact details of the agency.

In most cases (according to the guidelines of the customer) the name of the prospective employer is undisclosed. Employees recruiting from the HRO sector use one of two strategies. The first (more often used) involves recruiting candidates based on industry-specific schemes. Alternatively, personnel agencies can undertake the recruitment process, regardless of the schemes, operating under a new model designed exclusively for the needs of one specific client⁴⁷².

Organizations use the HRO option to focus employee resources on strategic issues, gain access to HRM knowledge, as well as keep up with regulations on work organization and safety on individual positions⁴⁷³. One can also point to three main reasons why organizations are involved in HRO⁴⁷⁴. This includes: a strategic dimension, cost savings, and the possibility of obtaining better quality of HR services. Delmotte and Sels also pointed to three basic motives for outsourcing in the HRM area⁴⁷⁵. The first one is related to the release of resources and the creation of time for strategic activities in the sphere of HRM. Outsourcing side and administrative functions related to HRM allows greater focus on the

⁴⁶⁹ Sheehan C., *Outsourcing HRM activities in Australian organisations*, Asia Pacific Journal of Human Resources, Vol. 47 No 2, (2009), pp. 236-253.

⁴⁷⁰ Gainey T.W., Klaas B.S., *The outsourcing of training and development: factors impacting client satisfaction*, Journal of Management, Vol. 29 No. 2, (2003), pp. 207-29.

⁴⁷¹ Delmotte J., Sels L., *HR outsourcing: threat or opportunity?*, Personnel Review Vol. 37 No. 5, 2008, p. 544.

⁴⁷² David R., Banerjee P., Ponnampalam A., *Risks perceived regarding recruitment process outsourcing: stakeholder concerns*, Journal of Global Operations and Strategic Sourcing, Vol. 10 No. 1, 2017, p. 119.

⁴⁷³ Woodall J., Scott-Jackson W., Newham T., Gurney M., *Making the decision to outsource human resources*, Personnel Review, Vol. 38 No. 3, 2009, p. 238.

⁴⁷⁴ Shen J., *Human resource outsourcing: 1990-2004*, Journal of Organisational Transformation & Social Change, Vol. 2 No. 3, 2005, pp. 275-296.

⁴⁷⁵ Delmotte J., Sels L., *HR outsourcing: threat or opportunity?*, Personnel Review Vol. 37 No. 5, 2008, p. 544.

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most important tasks of the HR department. Outsourcing creates the opportunity to perform key tasks in this area. By outsourcing operational human resources tasks (such as creating a payroll), more time can be allocated to the strategic dimension of HRM-related works⁴⁷⁶. The implementation of the functions of HRM on the basis of external resources is the result of not only the growing variety of tasks in this field, but also the expectations of increasing the value of tasks that are becoming more and more complex and problematic⁴⁷⁷. This is in line with the general assumption that outsourcing is supposed to help focus on activities that generate a competitive advantage thanks to ordering other entities to perform low-value peripheral activities⁴⁷⁸. A positive relationship was found between the strategic approach to HRM and the level of HRM outsourcing⁴⁷⁹. So in companies where HRM is of strategic importance, external support in this area is more often used. This has been confirmed by other researchers^{480, 481}.

The second motive concerns the use of outsourcing as a tool of reducing the spendings related to HRM activities. Outsourcing is an instrument used to reduce costs and time needed by individuals to familiarize themselves with hundreds or thousands of applications and resumes sent by candidates for a vacancy⁴⁸². In this case, the external HR service provider, for example, performs a pre-selection of candidates, using guidelines received from the client. Most often, however, cost reduction is associated with a reduction in staff employed in the human resources department⁴⁸³. This happens when the use of outsourcing is highly cost-oriented. Smaller companies when using an external personnel service provider achieve proportionally greater cost reduction than large companies⁴⁸⁴. However, research results indicate that organizations that focus on reducing HRM costs do not outsource more tasks

⁴⁷⁶ Lawler E., Mohrman S., *Creating a Strategic Human Resources Organization: An Assessment of Trends and New Directions*, Stanford University Press, Stanford, CA 2003.

⁴⁷⁷ Sheehan C., Cooper B.K., *HRM outsourcing: the impact of organisational size and HRM strategic involvement*, Personnel Review, Vol. 40, No. 6, 2011, p. 745.

⁴⁷⁸ Conklin D.W., *Risks and rewards in HR business process outsourcing*, Long Range Planning, Vol. 38 No. 6, 2005, pp. 579-98.

⁴⁷⁹ Delmotte J., Sels L., *HR outsourcing: threat or opportunity?*, Personnel Review Vol. 37 No. 5, 2008, pp. 553, 557.

⁴⁸⁰ Klaas B.S., McClendon J., Gainey T.W., *Outsourcing HR: the impact of organizational characteristics*, Human Resource Management, Vol. 40 No. 2, 2001, pp. 125-38.

⁴⁸¹ Sheehan C., Cooper B.K., *HRM outsourcing: the impact of organisational size and HRM strategic involvement*, Personnel Review, Vol. 40, No. 6, 2011, p. 745.

⁴⁸² David R., Banerjee P., Ponnampalani A., *Risks perceived regarding recruitment process outsourcing: stakeholder concerns*, Journal of Global Operations and Strategic Sourcing, Vol. 10 No. 1, 2017, p. 115.

⁴⁸³ Delmotte J., Sels L., *HR outsourcing: threat or opportunity?*, Personnel Review Vol. 37 No. 5, 2008, p. 544.

⁴⁸⁴ Gilley K.M., Greer C.R., Rasheed A.A., *Human resource outsourcing and organizational performance in manufacturing firms*, Journal of Business Research, Vol. 57, No. 3, 2004, pp. 232-40.

in this field than organizations that focus less on reducing HRM costs⁴⁸⁵. This is understandably related to the low level of cost reduction that is possible to achieve in this field. Even in global corporations, HR departments do not typically consist of hundreds of members. Owing to this reason, savings related to outsourcing HRM activities may be small. However, there are also such issues to consider as: saving time, transferring painstaking, time-consuming, mechanically performed operations that do not bring any added value to the organization.

While short-term savings of costs are usually seen as the main reason for outsourcing, it has been shown in many cases that they are not the only motivation⁴⁸⁶. Therefore, it is often pointed out that cost reduction should not be the only factor taken into account when deciding on the outsourcing of HRM functions^{487 488}. For example, the Beaman study shows that the actual benefits of HRM outsourcing are not due to cost reductions but to better quality⁴⁸⁹.

This can be considered as the third motivation for outsourcing in the HRM area. It assumes increasing access to advanced solutions, obtaining benefits resulting from the use of advanced specialist knowledge in this field and, as a result, reducing the risk of choosing the wrong employee^{490 491}. Innovations in the area of HRM are motivated by the need to gain more knowledge from external companies in order to compete more effectively by improving work efficiency in the organization⁴⁹². The desire to operate in accordance with the best practices, improve the quality of operations in this area, focus on the core competencies of the organization and the use of new solutions are also important reasons when using external personnel agencies⁴⁹³. Due to the fact that new employees have to face a growing level of expectations, more and more often companies use specialized

⁴⁸⁵ Delmotte J., Sels L., *HR outsourcing: threat or opportunity?*, Personnel Review Vol. 37 No. 5, 2008, p. 557.

⁴⁸⁶ Woodall J., Scott-Jackson W., Newham T., Gurney M., *Making the decision to outsource human resources*, Personnel Review, Vol. 38 No. 3, 2009, p. 238.

⁴⁸⁷ Shelgren D., *Why HR outsourcing continues to expand*, Employment Relations Today, Vol. 31 No. 2, (2004), pp. 47-53.

⁴⁸⁸ Stroh L.D., Trechuboff D., *Outsourcing HR functions: when and when not to go outside?*, Journal of Leadership and Organizational Studies, Vol. 10 No. 1, 2003), pp. 19-28.

⁴⁸⁹ Beaman, K.V., *Out of Site: An Inside Look at HR Outsourcing*, IHRIM Press, Austin, TX 2004.

⁴⁹⁰ Belcourt M., *Outsourcing: the benefits and the risks*, Human Resource Management Review, Vol. 16 No. 2, 2006, pp. 269-79.

⁴⁹¹ Scott-Jackson W., Newham T., Gurney M., *HR Outsourcing: the Key Decisions*, Chartered Institute of Personnel and Development, London 2005.

⁴⁹² Sheehan C., Cooper B.K., HRM outsourcing: the impact of organisational size and HRM strategic involvement, Personnel Review, Vol. 40, No. 6, 2011, p. 746.

⁴⁹³ Woodall J., Scott-Jackson W., Newham T., Gurney M., *Making the decision to outsource human resources*, Personnel Review, Vol. 38 No. 3, 2009, p. 238.

employment agencies to find a specialist with both practical knowledge, professional skills and the right set of characterological features. This is because those agencies employ, for example, psychology specialists with extensive experience in the area of recognizing candidates' life attitudes, ambitions, character traits, etc.

The outsourcing of HRM functions may also involve the development of human capital. In case of trainings conducted by external specialists, this solution is used in the event of the company having insufficient own resources. This may be related to the implementation of a new (purchased from an external entity) production technology, a new IT system, changes in legislation that the company must adapt to, as well as in case of testing new forms of sales radically different from those previously used (e.g. launching a new e-commerce distribution channel).

It should be noted at this point that the HRO concept also raises some reservations. Lawler and Mohrman's research⁴⁹⁴ has shown that HR outsourcing can lead to problems resulting from the low level of specialist knowledge on the part of personnel service providers. This can be related to insufficient knowledge about the specificity of the client's business and higher costs than initially assumed. In the latter case, it is often associated with a long-term search for an employee with high qualifications, and also an expensive one. When it turns out that the standard procedure fails, companies need to reach for more extensive and expensive methods. Many failures have been identified due to outsourcing of the HR function, including loss of control over the recruitment process, loss of strategic flexibility, lower level of candidates than expected and loss of promising candidates⁴⁹⁵.

The risk increases especially in the event of absence of workforce. In this case, discouraging interesting candidates almost disqualifies employment agencies. As for the selection of candidates, in this area some reservations can also be made as to the lack of efficiency. External personnel agencies are often not familiar with the client who is ordering to find a new employee, the specificity of the company, its organizational strategy and culture⁴⁹⁶. The risk exists that poor self-presentation during the first contact can take place. According to the theory of critical contact, during direct interviews both candidates and employers want to make a good impression on the other side for various reasons: candidates

⁴⁹⁴ Lawler E.E., Mohrman S.A., *Creating a Strategic Human Resources Organisation*, Stanford University Press, Palo Alto, CA, 2003.

⁴⁹⁵ Susomrith P., Brown A., *The core processes adopted for outsourcing HRM in Australia and its outcomes*, *Management Decision*, Vol. 55 No. 7, 2017, p. 1521.

⁴⁹⁶ Woodall J., Scott-Jackson W., Newham T., Gurney M., *Making the decision to outsource human resources*, *Personnel Review*, Vol. 38 No. 3, 2009, p. 239.

hope to get a well-paid, interesting and attractive job offer, employers want to attract employees with the highest qualifications⁴⁹⁷.

Outsourcing of functions related to recruitment also translates into the fact that the first contact takes place between a candidate and a recruitment agency (personnel service provider), and not a potential employer. A candidate ascribes possible negative experiences from the recruitment process to the company in which he or she was supposed to be eventually employed (the ordering party is identified with the agency representing it)⁴⁹⁸.

It is possible to come up with many examples of unprofessional approach to job interviews. Examples include such situations when a meeting (the first stage) took place in such a small office, or even in some dingy cabin so that the candidate seriously considered resigning from further stages of the recruitment process⁴⁹⁹. The first impression of the company was not a very pleasant one. In another case, a representative of an employment agency conducted an interview, and after a few days she informed the person that the candidate will get some job offer, but it is not yet known exactly which one. She said she would call back, but she didn't do it for eight or nine months. After this period of time, the candidate was called and said that he was selected for a direct interview with the representative of the company that ordered the search for the employee⁵⁰⁰. The candidate went to an interview and found out that the job offer profile differed significantly from the one he was informed about at earlier stages. Interestingly, the final employer turned out to be a well-organized company capable of honestly treating its employees. In this case, it can be guessed that the reason for such chaos can be attributed to communication errors and probably little experience of the employees of the external recruitment agency.

The fact that recruitment agencies frequently lack understanding of the organizational culture of the company ordering the service, can cause multiple problems like a mismatch between the organizational culture of the client and the personnel service provider who finds it difficult to understand the basic assumptions and beliefs shared by the majority of employees employed in the client's organization. Reservations regarding the use of outsourcing in the sphere of HRM relate to the limited ability of external personnel service

⁴⁹⁷ Behling O., Labovitz, G., Gainer M., *College recruiting: a theoretical base*, *Personnel Journal*, Vol. 47 No. 1, (1968), pp. 13-19.

⁴⁹⁸ Byham W.C., Riddle S., *Outsourcing: a strategic tool for a more strategic HR*, *Employment Relations Today*, Vol. 26 No. 1, (1999), pp. 37-55.

⁴⁹⁹ David R., Banerjee P., Ponnampalam A., *Risks perceived regarding recruitment process outsourcing: stakeholder concerns*, *Journal of Global Operations and Strategic Sourcing*, Vol. 10 No. 1, 2017, p. 119.

⁵⁰⁰ David R., Banerjee P., Ponnampalam A., *Risks perceived regarding recruitment process outsourcing: stakeholder concerns*, *Journal of Global Operations and Strategic Sourcing*, Vol. 10 No. 1, 2017, p. 119.

providers (employment agencies) to identify and develop key competences of employees that are crucial for the employer (for example, in the form of a training)⁵⁰¹.

It is difficult to clearly indicate the immediate causes of this state. A possible reason is the long-term nature of such activities, which is difficult to obtain if a company only signs a contract for a relatively short period of time. Outsourcing can lead to a lower level of staff involvement by changing the nature of work, especially among internal HR specialists who lose motivation to work, develop and engage when their role begins to focus merely on monitoring the results of someone else's work and mechanically creating uncomplicated reports⁵⁰².

In case of trainings carried out by external companies, the actual experience of the employees of a given organization when cooperating with an external entity can differ significantly. Training references may relate to one specific person (trainer) who, in the event of termination of cooperation with an external training company or only one-time training, may be difficult to replace. References in this case to the training organizer and not to the specific trainer can be misleading. However, in case of selecting employees, on the other hand, the know-how that a given company looking for proper candidates has at its disposal is decisive. In this case, what counts is the experience of the entire external organization team in finding job candidates with specific character traits and skills.

Building human capital is a long-term process that requires deliberate policy. It is much easier to rely on outsourcing of relatively simple operations, for example, data administration, because in this case it is easier to convey information about what is important for the ordering party.

6.4. Benefits obtainable thanks to efficient human resource management

In principle, all activities related to human resource management such as recruitment, training, gathering information on the results and effects obtained by the employees, analyzing the results of measurements of work efficiency, planning career paths are supposed to translate into positive effects. In case of companies taking HRM seriously, numerous examples of positive effects can be mentioned. Employees can serve as a source

⁵⁰¹ Woodall J., Scott-Jackson W., Newham T., Gurney M., *Making the decision to outsource human resources*, Personnel Review, Vol. 38 No. 3, 2009, p. 239.

⁵⁰² Grugulis I., Vincent S., Hebson G., *The rise of the network organisation and the decline of discretion*, Human Resource Management Journal, Vol. 13 No. 2, 2003, pp. 45-59.

of lasting competitive advantage, while effective HRM practices can even further strengthen this competitive advantage by through strategic work management⁵⁰³. Effective human resource management is a potential source of competitive advantage because it is rare, difficult to follow, it helps to differentiate a company from the competition and generate a sustainable competitive advantage. Dahl and Klepper have proven that companies that are unable to gain access to key skills at the recruitment stage show lower levels of performance and are less likely to survive in a competitive market⁵⁰⁴. Of course, a lot here depends on the specifics of the industry. The effectiveness and significance of HRM activities may vary depending on the pace and scale of changes taking place within the technology used in a given industry⁵⁰⁵.

It can be expected that the importance of the effectiveness of the activities undertaken in the area of HRM will grow even bigger in industries, in which new technological solutions emerge regularly. In turn, in industries which have been based on the same industries for many years, the influence of activities from the area of HRM can be slightly smaller, and the main objective will be limiting staff turnover and relying on experienced employees, which is particularly important in the situation of a deficit of professionals on the labor market. In this case, personnel management leading to the attachment of employees to the company can be treated as the basis for company operation. The impact of human capital on success should be particularly important in advanced technology industries, where complex solutions are typically require extensive knowledge and skills to function in a dynamic and changing environment. However, research shows that the impact of human capital is equally strong in both high and low technology industries⁵⁰⁶. However, another pattern was noted. Positive effects of human capital were higher in young companies than in older ones⁵⁰⁷.

There is no doubt that this phenomenon is closely related to the specificity of young companies, frequently based on knowledge. Higher level of knowledge, qualifications and skills lead to improved efficiency in advanced economies in which competition is based on

⁵⁰³ Martin-Rios C., Why do firms seek to share human resource management knowledge? The importance of inter-firm networks, *Journal of Business Research* 67 (2014), p. 192.

⁵⁰⁴ Dahl M., Klepper S., Whom do new firms hire? *Ind. Corp. Change* 24 (4), 2015, pp. 819–836.

⁵⁰⁵ Santiago F., Alcorta L., Human resource management for learning through knowledge exploitation and knowledge exploration: Pharmaceuticals in Mexico, *Structural Change and Economic Dynamics* 23 (2012), p. 532.

⁵⁰⁶ Unger J.M., Rauch A., Frese M., Rosenbusch N., Human capital and entrepreneurial success: A meta-analytical review, *Journal of Business Venturing* 26 (2011), pp. 345, 352.

⁵⁰⁷ Unger J.M., Rauch A., Frese M., Rosenbusch N., Human capital and entrepreneurial success: A meta-analytical review, *Journal of Business Venturing* 26 (2011), p. 352.

knowledge and companies compete by producing innovative goods relying on modern technologies and advanced production processes⁵⁰⁸.

Positive effects of changes in human capital translated into significant increase in the efficiency of industry operating in Taiwan. The situation there was analyzed in major agglomerations. Increasing the percentage of employees with higher education by 1 percent translated into an increase in the efficiency of production plants operating in this area by about 1.15 percent⁵⁰⁹. In Taiwan, the increase in the employment rate of employees with higher education translated into an increase in productivity, as a result of which the value added per enterprise increased by approximately USD 15 940 per year, and the total profit for the entire manufacturing industry by USD 1.27 billion⁵¹⁰.

The results of other studies indicate that the presence of universities in given towns or cities plays a greater role in the creation of technologically advanced plants from the high-tech sector than the presence of other production plants (based on outdated technology)⁵¹¹. As far as companies based on new technologies are concerned, a higher level of human capital translates into greater opportunities to create alliances in the field of R&D⁵¹². The team's advanced technological knowledge can be an important factor in applying for a grant (funding from the ministry, government subsidies, research grants), i.e. funds allocated to finance the further development of the company⁵¹³.

Also a lot depends on the size of the company. HRM contributes, among others, to developing and improving management in big corporations, also including global companies. Nonetheless, HRM has incomparably lower influence on the quality and efficiency of management in small and medium enterprises⁵¹⁴. It turns out that smaller companies have more informal approach to human resource management than bigger

⁵⁰⁸ Onkelinx J., Manolova T.S., Edelman L.F., *The human factor: Investments in employee human capital, productivity, and SME internationalization*, *Journal of International Management* 22 (2016), p. 353.

⁵⁰⁹ Chang Ch.-F., Wang P., Liu J.-T., *Knowledge spillovers, human capital and productivity*, *Journal of Macroeconomics* 47 (2016), p. 229.

⁵¹⁰ Chang Ch.-F., Wang P., Liu J.-T., *Knowledge spillovers, human capital and productivity*, *Journal of Macroeconomics* 47 (2016), p. 229.

⁵¹¹ Chang Ch.-F., Wang P., Liu J.-T., *Knowledge spillovers, human capital and productivity*, *Journal of Macroeconomics* 47 (2016), p. 229.

⁵¹² Grilli L., Murtinu S., *Selective subsidies, entrepreneurial founders' human capital, and access to R&D alliances*, *Research Policy* 47 (2018), p. 1948.

⁵¹³ Grilli L., Murtinu S., *Selective subsidies, entrepreneurial founders' human capital, and access to R&D alliances*, Samuele Murtinu, *Research Policy* 47 (2018), p. 1948.

⁵¹⁴ Oleksyn T., Sypniewska B.A., *Zarządzanie zasobami ludzkimi. Refleksje teoretyczne, kwestie praktyczne*, Wyższa Szkoła Finansów i Zarządzania, Warszawa 2016, p. 26.

companies⁵¹⁵. This can be attributed to the fact that, to begin with, such companies simply have smaller possibilities. On the other hand, their specific character dictates the situation in just as much as the owners who frequently want to decide about everything by themselves and independently select their teams. To some, it may seem as unprofessional (especially when comparing it to extensive corporate recruitment procedures). However, it can also be seen as a simple method of building a team in which positive relationships prevail between its members. People who do not correspond in terms of character traits to the rest of the staff, will either give up themselves or will be asked to resign. However, if managers of small companies get more seriously involved in HRM, they can also count on favorable results. The level of human capital has a positive effect on the results of companies, both small and large⁵¹⁶. Research in the field of human resource management has shown that the use of best practices in this area can lead to positive financial results, ensuring the profitability of business operations⁵¹⁷.

Research has confirmed the positive impact of human resource management systems on greater organizational efficiency⁵¹⁸. Also the impact of developed human capital on efficiency of plants was analyzed. The results clearly indicate that industrial plants employing better-educated employees are more resistant to technological shocks caused, e.g. by a radical change in industry-leading technology (which previously brought the largest benefits to companies in this industry)⁵¹⁹. Human capital is positively related to productivity, and investing in human capital leads to increased efficiency⁵²⁰. Companies that invest in their employees through payroll or training are more likely to increase work efficiency. Human capital increases the possibilities of owners to discover and use business opportunities. Human capital helps owners to acquire other usable resources, such as financial and physical capital, as well as helps to accumulate new knowledge and skills. A higher level of knowledge, qualifications and skills allows employees to engage in complex

⁵¹⁵ Sheehan C., Cooper B.K., *HRM outsourcing: the impact of organisational size and HRM strategic involvement*, Personnel Review, Vol. 40 No. 6, 2011, p. 744.

⁵¹⁶ William C. McDowell, Whitney O. Peake, LeAnne Coder, Michael L. Harris, *Building small firm performance through intellectual capital development: Exploring innovation as the "black box"*, Journal of Business Research 88 (2018), p. 322.

⁵¹⁷ Sheehan C., Cooper B.K., *HRM outsourcing: the impact of organisational size and HRM strategic involvement*, Personnel Review, Vol. 40 No. 6, 2011, p. 745.

⁵¹⁸ Özgo E., Brewster Ch., *Knowledge Flows in MNEs and the Role of HRM*, w: C.Machado (ed.), International Human Resources Management. Challenges and Changes, Springer, 2015, p. 27.

⁵¹⁹ Chang Ch.-F., Wang P., Liu J.-T., *Knowledge spillovers, human capital and productivity*, Journal of Macroeconomics 47 (2016), p. 229.

⁵²⁰ Onkelinx J., Manolova T.S., Edelman L.F., *The human factor: Investments in employee human capital, productivity, and SME internationalization*, Journal of International Management 22 (2016), p. 358.

and non-routine tasks and perform them effectively, meeting high quality standards, thereby increasing the company's added value⁵²¹. Brilliant employees with extensive knowledge bring new ideas to the organization, and thanks to excellent skills enabling them identification of emerging possibilities, they help to create an advantage over competitors⁵²².

The literature on entrepreneurship provides many arguments about how human capital can increase success in this sphere. First, human capital increases the ability to discover and use business opportunities⁵²³. For example, prior knowledge increases the chances of getting ready to discover specific opportunities that others are unable to perceive. This contributes to increasing the likelihood of seizing the arising opportunities. Secondly, human capital is a prerequisite for further learning and helps to accumulate new knowledge and skills⁵²⁴. In a model suggested by A. Brooking⁵²⁵, human capital affects the ability to think creatively, the ability to solve problems, as well as leadership and managerial skills. Entrepreneurs whose human capital consists of unique or confidential knowledge, achieve greater entrepreneurial success, higher revenues and income productivity⁵²⁶.

Examples of beneficial influence of human resource management on the simplicity with which innovations can be implemented, can further translate into company's competitiveness in the long run. One can find them when going through relevant literature⁵²⁷. Human resource management practices influence the level of intellectual capital of the company. This reflects intangible properties that generate value to the company, including skills and motivation of employees, external relations and knowledge contained in information systems, documents and databases⁵²⁸. These elements of intellectual capital, in turn, affect the innovation of companies. Generally speaking, human resource management

⁵²¹ Onkelinx J., Manolova T.S., Edelman L.F., *The human factor: Investments in employee human capital, productivity, and SME internationalization*, Journal of International Management 22 (2016), p. 353.

⁵²² McDowell W.C., Peake W.O., Coder L.A., Harris M.L., Building small firm performance through intellectual capital development: Exploring innovation as the "black box", Journal of Business Research 88 (2018), p. 322.

⁵²³ Unger J.M., Rauch A., Frese M., Rosenbusch N., Human capital and entrepreneurial success: A meta-analytical review, Journal of Business Venturing 26 (2011), p. 343.

⁵²⁴ Unger J.M., Rauch A., Frese M., Rosenbusch N., Human capital and entrepreneurial success: A meta-analytical review, Journal of Business Venturing 26 (2011), p. 343.

⁵²⁵ Brooking A., *Intellectual Capital – Core Asset for the Third Millennium Enterprise*, International Thomson Business Press, London, 1996, nr 12–13, vol. 8, p. 13.

⁵²⁶ McDowell W.C., Peake W.O., Coder L.A., Harris M.L., Building small firm performance through intellectual capital development: Exploring innovation as the "black box", Journal of Business Research 88 (2018), p. 322.

⁵²⁷ Santiago F., Alcorta L., Human resource management for learning through knowledge exploitation and knowledge exploration: Pharmaceuticals in Mexico, Structural Change and Economic Dynamics 23 (2012), p. 530.

⁵²⁸ Kianto A., Sáenz J., Aramburu N., Knowledge-based human resource management practices, intellectual capital and innovation, Journal of Business Research 81 (2017), p. 11.

contributes to innovation by increasing organizational knowledge base and stimulating knowledge creation⁵²⁹. Human capital has been identified as a factor increasing the openness towards technological innovations⁵³⁰. It can be assumed that human capital management is oriented towards increasing a innovativeness in a broad sense, in comparison to previously preferred increase in efficiency⁵³¹. Human capital is a factor conducive to innovation⁵³², and because most of the innovations at the company level are incremental (rather than fluctuating or associated with breakthrough innovations). This also indicates the role which human capital plays in generating, adapting and disseminating technical and organizational changes⁵³³. By creating teams consisting of employees with higher level of technical education, companies increase their chances of establishing cooperation with universities and other public research organizations in terms of research and development. Higher level of technical education (for example, achieved by employing people with PhD in sciences and technology), allows to engage in activities related to research and development, and this should, in turn, increase the possibilities of establishing cooperation in this area with external research centers, laboratories and universities⁵³⁴. As a result, HRM can ensure greater strategic innovation⁵³⁵.

There are numerous examples illustrating beneficial impact of human resource management on the ease with which companies implement innovations. This includes the improvement and development of products manufactured and services offered. Well-designed human resource management systems contribute to improving the quality of operations, especially in the service sector⁵³⁶. This is related to the impact of employment of qualified employees on the level of quality of the services offered, e.g. in logistics. An employee with professional knowledge can advise customers on the best solution. On the

⁵²⁹ Kianto A., Sáenz J., Aramburu N., Knowledge-based human resource management practices, intellectual capital and innovation, *Journal of Business Research* 81 (2017), p. 11.

⁵³⁰ McGuirk H., Lenihan H., Hart M., Measuring the impact of innovative human capital on small firms' propensity to innovate, *Research Policy* 44 (2015), p. 967.

⁵³¹ Morawski M., *Zarządzanie wiedzą. Organizacja – system – pracownik*, Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław 2006, p. 47.

⁵³² Leiponen, A., *Skills and innovation*. *International Journal of Industrial Organization* 23, 2005, pp. 303–323.

⁵³³ McGuirk H., Lenihan H., Hart M., *Measuring the impact of innovative human capital on small firms' propensity to innovate*, *Research Policy* 44 (2015), p. 967.

⁵³⁴ Grilli L., Murtinu S., *Selective subsidies, entrepreneurial founders' human capital, and access to R&D alliances*, *Research Policy* 47 (2018), p. 1948.

⁵³⁵ Sheehan C., Cooper B.K., *HRM outsourcing: the impact of organisational size and HRM strategic involvement*, *Personnel Review*, Vol. 40 No. 6, 2011, p. 745.

⁵³⁶ Ozgo E., Brewster Ch., *Knowledge Flows in MNEs and the Role of HRM*, w: C.Machado (ed.), *International Human Resources Management. Challenges and Changes*, Springer, 2015, p. 27.

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one hand, the general level of employee knowledge is important here (this facilitates the process of employees easily adapting themselves to new realities). On the other hand, the so-called soft competences are just as crucial. This includes, for example, the ability to talk to the client, proper understanding of his expectations, ease of communication, predisposition to articulate ones opinions and suggestions in an understandable way, as well as persuasion skills which enable to persuade the client to choose a specific solution recommended by the worker (who also happens to know that it is going to be the most beneficial one because of his experience).

Providing logistics services includes activities related to transport, reloading, storage, completion and transfer of goods, freight forwarding and co-packing. It requires extensive knowledge and experience. The role of logistics employees is e.g. the proper selection of means of transport and supervision over implemented transport and storage processes. Employees with a high level of skill will efficiently perform activities related to:

- transport, storage and warehousing of loads,
- risk reduction in the implementation of transport and logistics operations,
- settlement of orders, transport and logistics operations,
- estimating future logistics costs,
- storage and warehousing services,
- controlling inventory levels,
- helping in choosing the optimal transport option,
- providing access to information,
- using the real-time tracking option of the current shipment location,
- organizing supplies of raw materials and semi-finished products, supplying spare parts, replacement parts and other consumables,
- coordinating supply processes,
- completing documents,
- completing batches of products for shipment,
- packaging,
- organizing the shipment of finished products to the destination,
- handling returns,
- waste management and reverse logistics.

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All of these activities require professional knowledge and competences and their acquisition usually takes years. In some cases, it is necessary to design a new supply chain and plan flows in this chain. In such a situation, the suppliers are re-selected, verified and assessed. Then comes the issue of using relational capital both in dealings with suppliers, subcontractors and companies that perform selected outsourcing tasks. This can apply to both production functions and operations performed by the logistics operator. The emergence of services provided by logistics operators can be seen as a step forward compared to earlier solutions, when the interested companies, based on their own resources, independently organized the majority of logistics tasks, using at most the offer of carriers for transports organized over longer routes.

Thanks to high qualifications of employees, it is possible to develop the architecture of the process and to find the best logistics operators who will be responsible for activities at individual stages of the supply chain. Their selection in terms of quality, specifics and price of services provided is the task of the employees of logistics departments. It also makes it possible to:

- develop a design for a new supply chain organization and new transaction rules,
- propose a new shape of relations and relationships between partners in the supply chain,
- create a new formula for action,
- design a new approach to activities related to acquiring suppliers and carrying out the purchasing process,
- acquire know-how and knowledge about the latest logistics and IT solutions,
- create and enable the sharing of knowledge on innovation in logistics,
- improve communication through the integration of IT systems,
- identify IT solutions that will increase the efficiency of logistics activities,
- provide access to knowledge about the market and trends, as well as ways to optimize costs and methods of improving the efficiency of logistics operations,
- share data, information and knowledge,
- transform data into information and information into knowledge,
- use of decision support systems and analytical tools,
- coordination of logistics and transport processes (diversified in terms of operations carried out, means of transport used and size of shipments) covering flows in vast areas (in a geographical sense) forming a complex network of connections.

SUPPLY CHAIN PROJECT MANAGEMENT
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Knowledge about the possibilities of information technology, disadvantages and advantages of various solutions, including IT systems, translates into measurable effects. For example, the effectiveness of monitoring operations in real-time is becoming more and more dependent on the technology applied. IT systems ensure smooth real-time communication and a continuous flow of information between service contractors and the client. They are intended to ensure the ability to coordinate activities in all chains of the created network of connections. Efficient staff makes it possible to increase the flexibility of activities within such a structure, which results in an overall positive influence upon the functioning of the entire supply chain.

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