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TRANSPORTATION PROCESSES – THEORETICAL AND PRACTICAL ASPECTS

The article presents an overview of the concept of process definition which is widely used in various fields of life and, depending on the area, it is definitions adopt slightly different meanings. The analysis of the definitions allowed the authors arrive at a conclusion that processes are of a dynamic nature which is indispensable for the operation of every enterprise. The study also considered the issue of the processes in transportation and logistics. On the example of Public Transport Company in Rokietnica (ZUK Rokbus Sp. z o.o.) a classification of the processes in passenger transportation taking into account different components and processes was considered. The classification of processes allows adequate management of the company.

The purpose of this article is to present the essence of the classification of processes occurring in a transport company. The considerations commence with an attempt to define the concept of process in which the dynamic nature of the processes occurring in transport and logistics will be shown.

Keywords: logistics and transport processes, classification of processes

1. INTRODUCTION

The process is a universal term commonly used both in the science and other fields. Even though much has been said about the processes the term remains ambiguous, and the definition depends on the contextual considerations. In recent years, process approach has been distinctly disseminated. Processes occur in each company and they remain in close synergy. The relationships between them influence the quality of the company's operation. The effective management of the company's operations is directly refered to its increasing attractiveness on the market. A higher level of customer service makes an organization more competitive, thus the company must

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constantly evolve in order to maintain its high standards. This development involves constant improvement of the processes. A necessary step in proper management and process improvement is the process identification, which is a first step for better understanding of the operation's principles as well as a value created in the process. An essential element of the identification process is to establish the rules of separation of criteria of processes.

The purpose of this paper is to present a wide spectrum of the process definition and the proposal for process classification framework for generic passenger transport company. The considerations commence with an attempt to define the concept of process, which has dynamic nature in transport and logistics.

2. DEFINING THE PROCESS

A lack of clear definition of the process contributed, among others, to the creation of such synonyms as 'business process' and 'economic process'. The most general definition of the process provided by Polish Language Dictionary [43] is the course of successive, causally linked changes which constitute successive steps, phases, stages of development of something; the course of something, the development, a transformation of something. A similar definition is given in Oxford English Dictionary [27] where the process is a series of actions or steps taken in order to achieve a particular aim.

The foundations of process science were formulated by M. E. Porter in the 1980s. as a part of the basics of marketing. Porter [33] introduced the concept of the value chain, in which all operations carried out in the company are divided into two types: principle and supportive operations. At the same time, Pall [28] said the process is a logical organisation of people, materials, energy, equipment and procedures into work activities designed to produce a specified end result. In turn, Hammer and Champy, called as creators of reengineering era, considered the process as a collection of activities that takes one or more kinds of inputs and creates an output that is of value to the customer. A business process has a goal and is affected by the events occurring in the external world or in other processes [12]. According to this definition, processes should consist only of actions that result in creating a value for the customer or, in the case of manufacturing processes, in creating a product or service. Similarly to Hammer and Champy's definition, the aspect of input and output to/from the process has been included in the definition given by the qualitative standard terminology [32]. The process is a set of interrelated or interactive activities that transform inputs into outputs. This standard stresses the implementation of the measures using various resources, e.g. technical ones.

Based on the definition by Oxford English Dictionary [27], Peppard and Rowland [29] interpret the process as a continuous and regular action or succession of actions, taking place or carried out in a definite manner and leading to the accomplishment of

some result; it is a continuous operation or a series of operations. Also according to the Davenport [6], the final aim of process, defined as the chain of activities, is the production of a specific output for a particular customer or market. The author particularly emphasizes the aspect of measurability of processes and, similar to Hammer and Champy, satisfying the customer's needs.

The work of Stabryła puts the process definition in a slightly different, qualitative, context [39]. Author believes that process is a sequence of actions or specific functions arranged in a certain order, which express a cause-effect phenomenon acting on an object. A collection of the most important process definitions, in order of their publication dates, is presented in Table 1.

Table 1

The spectrum of process definition – the static process nature

Reference (author, year, number)	Process definition
Polish Language Dictionary, 1978 [43]	A series of connected actions and changes which constitute subsequent stages of development; the course, development and transformation of something.
Pall, 1987 [228]	Logical organisation of people, materials, energy, equipment and procedures into work activities; it is designed to produce a specified result
Stabryła, 1991 [40]	A sequence of actions that are specific functions arranged in a certain order, expressing cause-effect phenomena acting on an object
Johansson *et al.* 1993 [16]	A set of linked activities that transform input values into an output values.
Hammer & Champy, 1993 [11]	Only those activities that create an output that is of value to the customer or in the context of manufacturing, a product or service is created.
Davenport, 1993 [6]	Defined as the chain of activities whose final aim is the production of a specific output for a particular customer or market.
Jacobson, 1995 [14]	A set of internal activities performer to serve a customer.
Rummler, Brache, 1995 [34]	A series of steps designed to produce a product or service.
Peppard, Rowland, 1997 [29]	A continuous and regular action or succession of actions, taking place or carried out in a definite manner and leading to the accomplishment of some result; a continuous operation or series of operations.
Soliman, 1998 [38]	It may be considered as a complex interconnected activities

By reference: own work

Table 1

The spectrum of process definition – the static process nature (cont.)

Reference (author, year, number)	Process definition
Agerfalk, 1999 [1]	Consists of activities ordered in a structured way with the purpose of providing valuable results to the customer.
Boszko, 1999 [4]	Transformation of input materials in the product, the material may include information or raw materials; the product might be understood as goods or decisions.
Eriksson, Pencke, 2000 [7]	It has an explicit goal, a set of input objects and a set of output objects. The input objects are resources that are transformed or consumed as part of the process, such as raw material in a manufacturing process.
PN-EN ISO 9000:2000, 2000 [29]	A set of interrelated or interactive activities that transform inputs into outputs. The implementation of the activities is carried out by means of various resources.
Volkner, Werners, 2000 [44]	Defined as a sequence of states, which result from the execution of activities within an organisations carried out in order to reach a certain objective
Fan, 2001 [8]	A set of one or more linked procedures or activities that collectively realise a business objective or a policy goal, normally within the context of an organisational structure defining functional roles and relationships.
Stohr, Zhao, 2001 [42]	Consists of a sequence of activities. It has distinct inputs and outputs and serves a meaningful purpose within an organisation or between organisations.
Gunasekaran, Kobu, 2002 [10]	A group of related tasks that in combination create value for a customer known as business process.
Becker, Kugeler, 2003 [3]	Finite, logically structured and time matched set of activities necessary to be realized in a business object.
Shen et al., 2004 [37]	A set of one or more linked procedures or activities that collectively realise a business objective or policy goal, normally within the context of an organisational structure defining functional roles and relationships.
Wang, Wang, 2005 [44]	Defined as a set of business rules that control tasks through explicit representation of process knowledge.
Oxford English Dictionary, 2010 [27]	A series of actions or steps taken in order to achieve a particular end; a natural series of changes.
Weske, 2012 [45]	Consists of a set of activities that are performed in coordination in an organizational and technical environment. These activities jointly realize a business goal.

By reference: own work

Table 2

The spectrum of process definition – the dynamic process nature (cont.)

Reference (author, year, number)	Process definition
Stock, Lambert, 2001 [41]	Can be viewed as a structure of activities designed for action with focus on the end customer and the dynamic management of flows involving products, information, cash, knowledge and ideas.
Irani *et al.* 2002 [13]	A dynamically ordered set of activities carried out at a certain time and place, with a beginning and an end, and clearly identified inputs and outputs.
Grajewski, 2007 [9]	Any action or set of actions can be presented as the process where a certain value of the initial is transformed in result of the process.
Sawicki, 2013 [36]	A structured set of activities, which are implemented using the necessary resources, processing input elements in the expected results. The process is determined both by interaction between the internal environment (e.g. other processes) and the outside environment (e.g. the market and customers).

By reference: own work

Only four of the presented definitions stress the dynamic nature of the process. According to Grajewski an essential role in the organization and its streamlining, has a process, which is dynamic element representing the essence of activities of the company [9]. The dynamics of the process is influenced by such factors as market and customer behaviour, i.e. the external environment and other processes within the organization, i.e. the internal environment [36]. Another key feature included in the process are human behaviours and the use of resources which make it possible to achieve the result desired by the client. These considerations point to the conclusion that the most complete definition of the process is the definition provided by Sawicki [36]. It consists of the elements included in the definitions of the process presented by other authors. A schematic diagram of the process based on the above definition is shown in Fig. 1.

In practice, what shows the Fig. 1, the process consists of clearly defined actions performed in the right order and time using appropriate resources such as: people, information, equipment, materials, energy, etc. The process commences with a goal to be pursued by appropriate combination of all components. The course of the process is influenced by clients, the changing market conditions, the economy as well as other processes within an organization. The result constitutes a value which is directly addressed to the customer and it provides a basis for other processes.

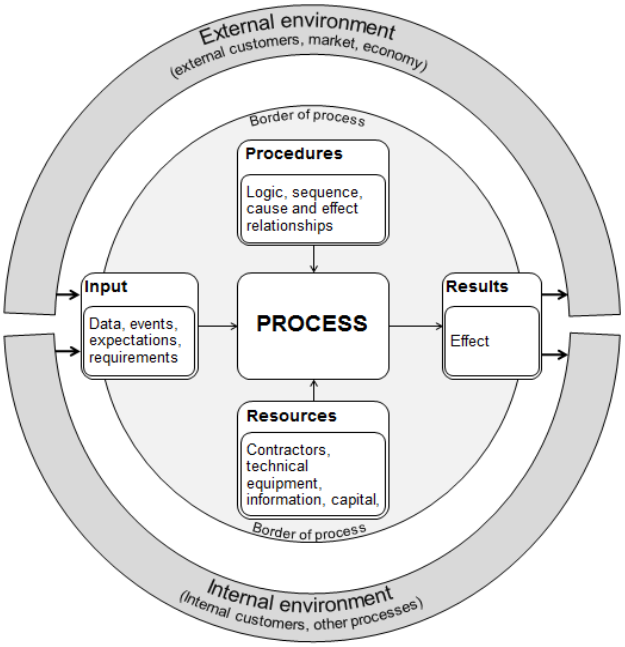

Fig. 1. Diagram of the key process components [36]

3. PROCESS CLASSIFICATION

3.1. A framework for general process classification

Processes can be identified once the classification criteria are defined and organized specific sets of processes. As in the case of process definition, in the literature many different classification criteria can be found. According to the aforementioned concept of Porter's value chain, there are two types of processes: main (operational) processes leading to the implementation of the value added by the company and supportive (auxiliary) processes [33]. The primary processes include:

– input logistics, including the activities necessary to the prepare the production or deliver the service,
– product manufacturing or the provision of services,
– output logistics, including sales of products or services,
– marketing,
– after-sales services (customer service).

The auxiliary processes include such elements as:

– managing the entire organization,
– human resources management,

– supply management,

– managing the development of products, processes and services.

In turn, the Process Classification Framework [2] prepared by the APQC (American Productivity Quality Centre) distinguishes two categories of processes because of the scope of the actions:

– operating (key) category which consists of five main groups of processes, namely [36]: creating and developing a vision and strategy, creating and developing products and services, selling products and services, manufacturing goods and services, customer service management,

– managerial and auxiliary category consisting of seven main process groups, i.e. [36]: developing and managing human resources, financial resource management, acquiring and maintaining technical resources, risk management, compliance and reliability management, external relations management, development and potential management.

From the viewpoint of product life cycle Kaplan & Cooper [17, 18] identified three categories of processes, i.e.:

– innovative – dealing with the market and the preparation of product or service offers,

– operating – related to the product or service and its distribution to the client,

– after-sales service – pertaining to customer service after delivery of the product or the completion of service.

On the other hand, Miller & Vollman [24] divided processes into four groups according to the performance criterion:

– logistic processes – including directing material jets from the purchase of raw material to the sales of finished product,

– regulatory processes – adapting production to demand,

– control processes – related to the assurance of product quality, production processes and execution of orders,

– information processes (change management) – for updating data and all changes.

M. Waske [45], in contrast to Miller [24] and Vollmann, pointed to five criteria according to which processes may be divided i.e.:

– the level of location of the process - organizational and operational,

– the process area – inside the organization and amongst organizations,

– the degree of automation of processes – manually operated, fully automated and mixed,

– the degree of repeatability of processes – regular and occasional,

– the degree of formalization of process – formal and general.

S. Nowosielski [26] as well as M. Waske suggest a larger group of classification criteria. The proposals of both authors are similar; Nowosielski divided processes in view of [26]:

– the importance of tasks in the process (primary and secondary processes),

– the importance of positions involved in decision-making (management and implementation processes)

– the importance of decisions for the organization (strategic and operational processes)

– the creation of added value (value adding processes and non-value adding processes)

– the spatial and organizational process flow (intra-functional processes and inter-functional processes)

– their place in the chain value (innovative processes, operational processes, after-sales service)

– superiority and subordination (major and minor processes, i.e. sub process).

The criteria of processes classification do not relate to the architecture of processes, and therefore a hierarchical structure of processes should be considered. In the literature only a three level division may be found, i.e. the division into mega process, process and sub-process [9]. Sawicki [36] suggested a five level process structure which consists of:

– the parent process, which is the highest in the hierarchy,

– the process,

– sub process, which is a set of interdependent actions in the process which are involved in the transformation of input elements into output results,

– procedures, actions related to the activities lead to achieving a result,

– step – the basic ingredient of action.

3.2. Processes in transport

A transportation process belongs to the category of logistic processes. According to the Polish standard, a transport process involves [28] a number of interrelated transport operations performed sequentially in a certain order on a specified route and at certain times.

In literature [5, 22, 23,35] meets different criteria for the classification of transport. Transportation can be divided into vertical and horizontal. On account of transportation environment, vertical transportation is divided into:

– land transport (road / car, rail, transmission / pipeline)

– air transport (aviation, cosmic),

– water transport (see, inland).

Division horizontal transport takes into account the following aspects:

– object movement (goods transport and passenger),

– legal and organization form (industry, economic),

– methods of transport use (individual transport, group transport (eg. taxis, car pooling), and collective transport),

– form of accessibility (private and public),

– the distance (range) or the movement area (short, medium and long-range transport or local (municipal), regional, national, international),

– functionality (transport regular / scheduled and irregular),

– the organization of movement (transport direct, indirect and combined).

According to Jeszka [15], the transport process is associated with the movement of goods and execution of successive actions in a timely manner and order, the effect of which is to deliver goods to the consignee.

Similarly, Płaczek [30] treats the transport process as a set of coordinated actions related to the movement of goods, services and information, or as a process involving the time-space transformation of goods, services and information, in accordance with the terms of the contract.

In the literature, there is hardly any definition of processes in transport. According to Sawicki [36], the transportation process, as each process consists of primary and supporting processes involving organizational, operational and commercial activities. In his work, the author focused on four main levels of the process, the fifth one, i.e. steps, is not mentioned. The primary and supporting processes in transport of freight and passengers are slightly different. There are no studies in the field of classification processes in passengers transport which encouraged the authors to make an attempt at organizing these processes. This was done on the example of one of the public transportation companies, and the work of Sawicki [36] and experience of the author were the basis for the development of the study.

3.3. The structure of processes passenger transport

In order to illustrate the principles of construction of the structure of processes occurring in the transport undertaking, the author has developed the structure of processes occurring in the enterprise passenger transport.

The company for which carried out the analyze, it is Public Transport Company in Rokietnica (in Polish: Zakład Usług Komunikacyjnych Rokbus Sp. z o.o.) which provides services related to public collective transport in Rokietnica's municipality and neighboring municipalities, and additionally provides services related to commercial public transport for longer trips. The fleet consists of ten buses of buses providing regular services as well as five coaches. Part of the processes taking place in the public transport is different than the occurring in commercial public transport. The difference occurs among others in processes related to planning transportation routes which are designed by the organizer, which in this case is Management of Urban Transport in Poznan (in Polish – Zarząd Transportu Miejskiego w Poznaniu – ZTM Poznań). However, in commercial public transport all the processes related to tickets and ticket inspection were left out. The auxiliary processes in both cases remained the same. Tables 3 and 4 show the universal sequence of primary and sup-

porting processes in the passenger transport. Figures 2, 3 and 4 show relationships between the processes presented in tables 3 and 4.

Table 3

The structure of the primary processes in the passenger transport

The parent process	Process	Sub-process	Procedure
Performing passenger transport services	Transport planing	Planning of public transport	Analysing historical data of passenger flow Forecasting passenger flows Design of transport network Bus stops planning Planning timetables Pricing policy making Setting up the service standards
		Planning of commercial transport	Design of transport network Determining the location of bus stops Defining a route policy Planning transport routes Bus stops planning
		Contracting commercial transport	Acquisition of general contracts with public operator Acquisition of transport orders Negotiating contracts
	Carriage	Providing passenger transport	Dispatching transport means Transportation of passengers Regular rest Making trip documentation Trip ending
		The carriage of passenger baggage	Luggage accepting and labelling Loading the luggage Verification of luggage Issuing luggage
		Accounting for services rendered	Settlement of tickets and transport documents Completion of transport documents
	Service monitoring and control	Inspection of public transport services rendered	Analysing the availability of ticket points of sale Monitoring the status of ticket validating devices Ticket inspection

By reference: own work based on [36]

Table 3

The structure of the primary processes in the passenger transport (cont.)

The parent process	Process	Sub-process	Procedure
		Inspecting the rendered services of commercial transport	Inspection of drivers Inspection of transport documentations Network monitoring Inspection of vehicles

By reference: own work based on [36]

Table 4

The structure of the supporting processes in the transport of persons

The parent process	Process	Sub-process	Procedure
Technical resource management	Management of technical resources	Creating the concept of resources	Identification of resource development options Decision-making – purchasing, leasing, rental
		Equipment planning	Defining the necessary equipment Selecting equipment
Technical resource management	Management of technical resources	Creating the concept of resources	Identification of resource development options Decision-making – purchasing, leasing, rental
		Equipment planning	Defining the necessary equipment Selecting equipment Identifying the available budget Equipment management
	Forming facilities	Maintenance of facilities	Determining the number of facilities Acquisition of the equipment
		Replacement of vehicles	Development of vehicle replacement policy Updating the documentation and records
		Withdrawing vehicles from service	Planning of vehicle removal form service Withdrawing the vehicle Updating of documentation and records

By reference: own work based on [36]

Table 4

The structure of the supporting processes in the transport of persons (cont.)

The parent process	Process	Sub-process	Procedure
	Additional service management and repair	Conducting daily service	Maintenance Maintaining vehicle cleanliness Recording defects
		Conducting periodic maintenance and repairs	Planning exclusion from service Planning the availability of spare parts and materials Handling Vehicles
		Planning and purchasing spare parts and consumables	Purchase planning (spare parts) Planning the purchase of consumables Acquisition of spare parts and consumables Storing spare parts and consumables
	Acquisition and commissioning the vehicles	Planning of management vehicles policy	Assessing the usability of vehicles Determining the number of vehicles Selecting new vehicles
		Acquiring new vehicles and commissioning them	Determining the policy of vehice replacement Identifying the source of vehicles Acquiring the vehicles Updating the vehicle register
	Vehicle insurance	Acquiring insurance	Defining the scope of the insurance policy Analysing and choosing the type of insurance and the insurance agency
		Updating insurance documentation	Monitoring termination dates of insurance policies Updating vehicle insurance documentation
Human resource managment	Human resources management	Planning the work	Determining the demand for labour Determining the number of employees Scheduling work Preparing individual work plans

By reference: own work based on [36]

Table 4

The structure of the supporting processes in the transport of persons (cont.)

The parent process	Process	Sub-process	Procedure
		Staff management	Allocation of tasks Inspecting the quality of tasks completion Working time management with respect to drivers and the supporting personnel Updating employee documentation
		Planning and purchasing spare parts and consumables	Purchase planning (spare parts) Planning the purchase of consumables Acquisition of spare parts and consumables Storing spare parts and consumables

By reference: own work based on [36]

4. CONCLUSION

The fact is definitions of the process were rather ambiguous called for a detailed analysis of commonly used terms. The most definitions assumes the static character of occurrences which have influence on the final process. Only three of the presented definition shows dynamic nature of this process. According to authors, the final form of the process determined by factors such as: changes in time, ranked, interconnection activities and internal environment which are other ongoing processes and the external environment understood as the behaviour of customers and the market [36]. The dynamic nature of the process is important in the organization; it makes it possible to quickly adapt to continuously changing environmental conditions. Each process consists of input, output, the external and internal environment and several other elements such as the resources. The aim of the process is to develop a specific outcome, mostly for the sake of the customer.

Because processes play a large role in the organization, it is important to their understanding. For this purpose it is necessary to identify the processes constituting a crucial phase in the reconstruction process. Consequently, it is created a set of processes - the structure of the processes. Regardless of the organization type, one of the processes classification divides them into main- and support process, and among them separate structural levels: the parent process, the process, sub-process and the step.

Set of the processes also applies to processes in transport. Due to the type of transportation, these processes differ from each other. Some of them, especially the supporting processes remain unchanged, while the main processes are characteristic for each type of transport.

Process identification is key when it comes to reconstructing processes, or optimizing them. Moreover, it facilitates a better understanding of transport processes. This approach allows for a rational satisfaction of customer needs

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PROCESY TRANSPORTOWE – ASPEKTY TEORETYCZNE I PRAKTYCZNE

Streszczenie

W artykule przedstawiono przegląd koncepcji definicji procesu. Pojęcie procesu jest szeroko stosowane w różnych dziedzinach życia i w zależności od obszaru przyjmuje nieco odmienne znaczeniowo definicje. Przeprowadzona w pracy analiza definicji pozwoliła na sformułowanie wniosku o dynamicznym charakterze procesów, który jest nieodzwonym zjawiskiem funkcjonowania przedsiębiorstwa.

W pracy rozważono również zagadnienie procesów w transporcie i logistyce. Na podstawie Zakładu Usług Komunikacyjnych Rokbus Sp. z o.o. zaproponowano klasyfikację procesów w transporcie osób, uwzględniając istotne elementy składowe i przebieg procesów. Klasyfikacja procesów pozwala na odpowiednie zarządzanie nimi w przedsiębiorstwie, co jest kolejnym krokiem w osiągnieciu zamierzonego celu.

Celem artykułu jest przedstawienie istoty klasyfikacji procesów w przedsiębiorstwie transportowym. Rozważania rozpoczynie próba jednoznacznego zdefiniowania pojęcia procesu, w którym ukazany zostanie dynamiczny charakter procesów zachodzących w transporcie i logistyce.

Słowa kluczowe: procesy transportowe i logistyczne, klasyfikacja procesów