ISSN 2256-0394 (online)
ISSN 2256-0386 (print)
2018, *32*, 228–246
doi: 10.2478/eb-2018-0018
https://content.sciendo.com/view/journals/eb/eb-overview.xml

RESOURCE AND INTERNAL PROCESS MANAGEMENT IN THIRD PARTY LOGISTICS

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Abstract. Contemporary third-party logistics (3PL) companies tend to broaden their competences in different fields and apart from traditional logistics services provide various value-added services to their customers. A systematic approach of 3PL resource management, as well as performance and quality indicator measurement are needed to *forecast* development of key performance indicators of a company. The purpose of this study is to discover contemporary tendencies of 3PL with regard to resources, performance and quality related issues, to determine resources, processes and quality indicators of 3PL, and to develop a system dynamics model for optimization of internal resources and processes of a company. The paper provides a systematic review of literature related to management of 3PL resources, quality and performance measurement. A model of management and optimization of 3PL resources and internal processes is developed by applying System Dynamics. The developed model consists of six blocks, namely, commercial activities, operations, procurement, administration, personnel management and quality management, representing different areas of internal activities of 3PL.

Keywords*: Third Party Logistics, System Dynamics, Resource Management.*

JEL Classification: L90; M16; R40; C60

INTRODUCTION

Along with extensive development of manufacturing and emergence of new technologies, the number of companies specializing in cargo transportation and storage services has grown. The level of their integration into management of clients' cargo transportation and storage has also increased. To support continuous optimization of logistics and transportation costs and simultaneously concentrate on the core activities, many international businesses outsource part of their logistics functions to third party logistics (3PL) companies. This has become a widely used practice in international business due to comprehensive experience, knowledge and resources of 3PL companies, which allows providing transportation and logistics services at lower costs. Strong competition in different industries is the main reason for appearance and development of 3PL. Under such circumstances, businesses are forced to continuously develop new products, as well as to utilize the most efficient delivery procedures transporting goods to their clients. Over the time, 3PL companies have expanded the scope of their services, which allows them to cover

large geographical areas and maintain a wide range of transportation and storage services for various types of goods.

According to the resource-based view, the company should determine strategic resources to deliver competitive advantage in the long term. Since 3PL is a light-asset business, personnel, brand and internal processes are the key resources that shall be wisely managed.

Topicality. 3PL companies tend to expand their competences in different fields and provide various value-added services to their customers. A dynamic model is required to plan most efficient allocation of resources, measure current and future quality indicators and forecast development of key performance indicators.

Purpose. The purpose of this paper is, firstly, to discover contemporary tendencies of 3PL with regard to resources, performance and quality related issues, secondly, to determine resources, processes and quality indicators of 3PL, and thirdly, to develop a model using system dynamics method to provide an opportunity to optimize internal resources and processes of 3PL.

Methodology. Includes a systematic literature review and modelling using Vensim PLE software.

The paper is organized as follows. Section 1 presents a review of relevant literature; Section 2 provides a description of the general model and offers a definition of 3PL resources and processes. Subsequently, modelling of 3PL internal processes is described, including the following processes: commercial, operational, procurement, administration, personnel management and financial. Afterwards, three scenarios are simulated to test the developed model. In the end, conclusions are made and the scope for further research is defined.

1. LITERATURE REVIEW

1.1. Resources

The development strategy of a 3PL enterprise depends on the resources that the company manages. Cheng, Hua and Zheng (2009) developed hierarchical interpretive structural models of current and future success factors of 3PL enterprises. Thus, at present, corporate system, customer service and internal integration are considered equally important factors for 3PL success. However, considering the future trends it can be argued that only the corporate system supported by innovation will bring 3PL companies to success.

Conducting content analysis of the leading 3PL data, Yew Wong and Karia (2010) identified different types of 3PL resources and their characteristics. They identified the following types of resources: physical resources, information resources, human resources, knowledge resources, and relational resources. The resource-based view (RBV) asserts that market orientation can help companies enhance performance (Barney, 1991). Hence, market orientation is a valuable asset that provides a competitive advantage to the companies that possess it. Ellinger *et al*. (2008) investigated how market orientation and employee development practices in 3PL companies influence both employee and organizational performance.

1.2. Performance measurement

In the competitive environment, performance measurement has proven to be a successful tool to achieve business objectives. Performance measurement systems are frameworks that integrate various performance information, such as key performance indicators (KPI), in a dynamic and accessible way (Domingues, Reis & Macário, 2015). Performance measurement systems provide companies with the necessary tools to support planning and monitor operational process (Liu & Lyons, 2011). Performance appraisal is also significant in controlling company resources.

An analytical framework is required to assess the performance factors of 3PL companies from the managerial point of view. Kayakutlu and Buyukozkan (2011) developed a model to analyze the effectiveness of different factors that link strategical and operational targets of a 3PL company. This model has four dimensions: performance targets, planning activities, logistics operations and performance attributes.

Zhao, Ding and Liu (2007) proposed a two-dimensional index system of performance appraisal for 3PL companies assessing internal and external environment of a company. The index system of internal performance appraisal includes such first-class indexes as logistics costs, customer service level, productivity, assets and financial affairs, quality and flexibility. The index system of external performance appraisal includes the degree of customer satisfaction: supply time, service level, supply price and information exchange.

The planning related goal of a company is to achieve success in the global competition in the logistics market. Kayakutlu and Buyukozkan (2011) defined three performance targets – alliance network, capital balancing and accredited customers. Planning activities include strategies, resources and information. Each performance target influences planning activities and vice versa. Within the framework of 3PL, logistics operations include transportation management, inventory management, customer relation management and demand coordination. They are based on predefined planning activities. Each logistics operation is measured by its own performance criteria, for instance, customer relation management is assessed considering such factors as order rate, order cycle, complain rate, request trends, and change in portfolio.

Jothimani and Sarmah (2014) proposed to apply a supply chain operations reference (SCOR) model and multi-criteria decision-making methods to identify KPI of 3PL companies and measure supply chain performance of 3PL companies. SCOR considers both effectiveness and efficiency aspects of performance measurement, as well as recognizes internal and customer-related reasons for measuring performance. The model consists of five processes (plan, source, make, deliver, return) and is designed into three levels of process detail. Jothimani and Sarmah (2014) pointed out that performance measurement systems are important tools for assessing success of 3PL companies and identifying corrective actions in case of service failure.

Historically, the main business strategy employed by 3PL companies has involved efforts to gain the largest market share. Thus, it is necessary to understand interrelationships and trade-offs between alternative performance dimensions of a

company. Rajesh *et al*. (2012) suggest applying balanced scorecard (BSC) that employs performance metrics from financial, customer internal processes and growth perspectives. Hence, the concept of BSC includes key strategies for all critical functions and departments of a 3PL company.

Management and operation of 3PL companies are closely linked to marketing, operations, organization structure and human resource management. Leem and Yi (2009) investigated 3PL service production processes and proposed a method to measure management efficiency in 3PL using data envelope analysis (DEA).

1.3. Quality

Nowadays, when the world economy and trade are driven by internalization and globalization, 3PL is playing an increasingly important role for different enterprises in various industries. The role of many aspects of service quality in particular industries has been highlighted by several researchers and experts (Wang *et al*., 2010; Meidutė-Kavaliauskienė, Aranski & Litvinenko, 2013; Shin & Thai, 2016).

Productivity and lean management are among the top aspects based on such criteria as assurance, responsiveness and cost. Since labor productivity of services is lagging far behind industry, it is essential to investigate different contexts of application of lean methodology in logistics and supply chain management in order to understand and eliminate the differences in implementing the lean approach in services as compared to manufacturing. It is also essential to discover the typical ways of adopting this approach (Portioli-Staudacher, 2010; Lagoudis & Shakri, 2015).

2. GENERAL MODEL OF INTERNAL PROCESSES OF 3PL

As the result of literature review on 3PL resources, performance and quality measurement, several methods and approaches have been identified. These methods allow evaluating current condition of the company but they have considerable limitations in forecasting future perspectives. 3PL companies need a tool to allocate and manage resources and forecast future development and to ensure improvement of key performance indicators that directly influence their competitiveness.

Within the scope of this study, it is proposed to develop a model of internal processes of 3PL that would allow answering the question how optimization of 3PL resources influences quality indicators and competitiveness of the company. The following types of resources are defined: personnel, time capacity, suppliers, customers, finances, and brand. These resources drive various processes of the company. The main resource of 3PL considered in this study is personnel.

Similar to time capacity, it is part of the following company processes: commercial, procurement, operational and administrative. This model measures efficiency of personnel and time capacity using a general personnel efficiency indicator. The summary of all resources, processes and indicators is presented in Table 1.

Table 1. Summary of 3PL resources and processes

Resources	Processes	Indicators (measurement)
Personnel and time capacity	Personnel management, commercial activities, procurement, operations, administration	Efficiency of sales and marketing personnel, operational personnel efficiency, administrative personnel efficiency, procurement personnel efficiency, general personnel efficiency
Suppliers	Procurement	Efficiency of suppliers' management
Customers	Commercial activities, administration	Marketing activity efficiency. Commercial process efficiency
Finances	Financial flows	Financial performance
Brand	Commercial activities	Marketing activity efficiency. Customer choice

The scheme presented below (see Fig.1) describes interaction of several internal processes of 3PL. Personnel management of a company directly influences all activities, as it is the main resource of 3PL. Commercial activities have a direct impact on operations and procurement (e.g. quantity of customer orders to be fulfilled and the number of transportation units to be procured). Administration is influenced by operational activities of a company (e.g. invoices to be processed and issued). Procurement performance has a direct impact on operations (e.g. the number of transportation units available to fulfill customer orders). Quality management is linked to all internal processes of 3PL and is meant to measure and regulate activities of each group.

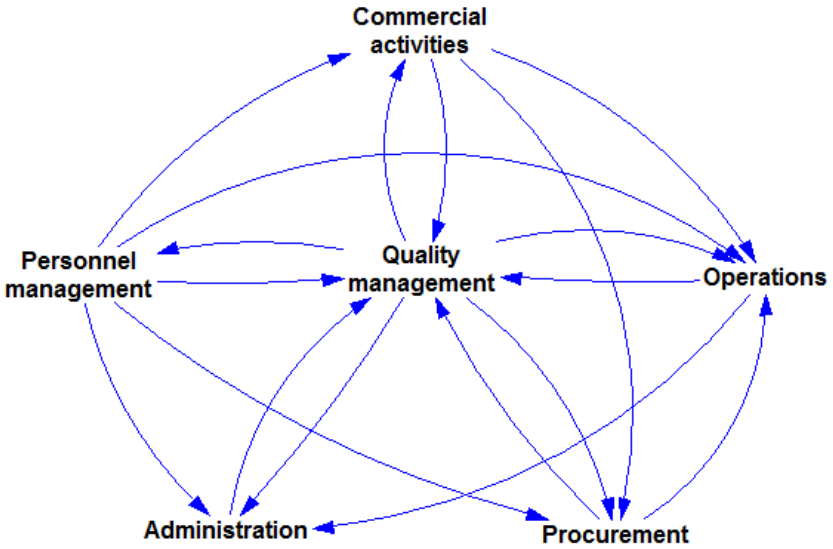

Fig. 1. General model of internal processes of 3PL (developed by the author).

3. INTERNAL PROCESSES OF 3PL

This section of the article consists of four sub-sections describing functionality of separate model blocks. For result simulation, a 60-months period (5 years) was considered as a mid-term planning period of 3PL.

3.1. Commercial, operational and procurement model

One of the main factors that defines financial wealth and long-term development of a 3PL company is its sales. Efficient logistics service design, as well as provision and management of a variety of high quality service to customers are critical success factors in third party logistics (Lin & Pekkarinen, 2011). Normally, sales process of 3PL consists of several steps and, depending on the size of the company, implies assignment of responsibilities. According to international 3PL market practice, this model foresees allocation of sales forces to the following responsibilities: field sales, marketing and indoor sales.

Within the scope of this model, it is assumed that employees are assigned to diverse types of activities. Part of personnel is involved in commercial activities or sales process that in fact is also divided into several stages. Availability of sales forces is defined by 'Sales and marketing capacity' that is measured in man-hours, as shown in Fig.3. Sales process begins with initial 'Contacts with customers'. Ability of field sales personnel is defined by 'Field sales monthly norm per full time employee'. This indicator reflects ability of a single sales person to approach new potential customers on a monthly basis. Contacts with customers are transformed to 'Customer response', the indicator that is normally influenced by the level of 3PL company recognition and reputation in the market. These factors are accumulated into 'Brand equity' indicator shown as 'Brand awareness', 'Customer loyalty' and 'Word of mouth' factors (Crescitelli & Figueiredo, 2009; Leone *et al*., 2006; Tolba & Hassan, 2009). Afterwards 'Customer response' is transformed to 'Customer requests for proposals'. 3PL company's statistical data are used to define this transformation rate and the quantity of single customer orders. In this model, customer orders are measured in "file" units. To transform the requests for proposals into customer orders, such indicator as 'Indoor sales monthly norm per full time employee' is applied, which is similar to 'Field sales monthly norm per full time employee' defined by companies and industry standards. 'Price level' and 'Payment policy' of the company are indicators that are obtained by comparison to market competitors. These two factors play a crucial role in the sales process. 'Incoming new orders from customers' is an inbound flow to 'Pending orders from customers', that is immediately redirected to one of three possible flows. It is considered that normally new received orders are fulfilled as 'Completed orders'. However, it is important to understand that in practice there are numerous factors that may adversely influence completion of customer orders. In this model, these factors are accumulated under 'Order failure indicator' that is compiled of two variables and one fixed factor. Variable factors include 'Capacity related order fulfillment', the factor that identifies the ability of a company to secure the needed capacity (transportation units in case of 3PL) to cover customer demanded volumes.

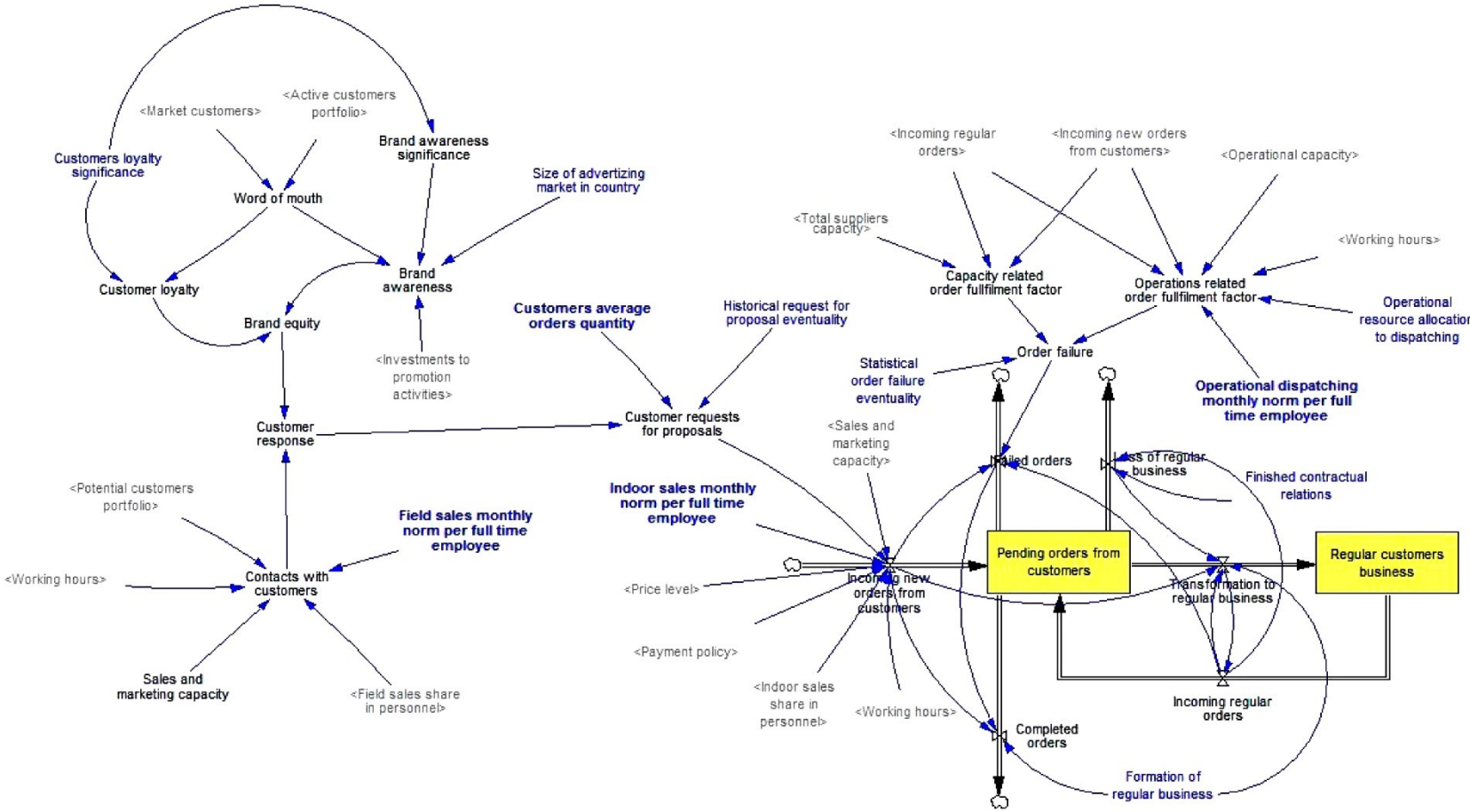

Fig. 2. Commercial process of 3PL (developed by the author).

'Operations related order fulfillment' factor identifies operational capacity to process incoming orders. 'Statistical order failure eventuality' is a fixed factor that is defined considering other (non-capacity and operations related) factors that negatively influence completion of customer orders. 'Incoming new orders' are also transformed to 'Regular customers business' that is accumulated for certain period and regularly redirected to 'Pending orders from customers'. Knowing that regular business is usually contractual business, it is time-limited, hence, in addition to outbound flow of 'Failed orders', it is necessary to implement 'Loss of regular business' that is influenced by 'Finished contractual relations' factor.

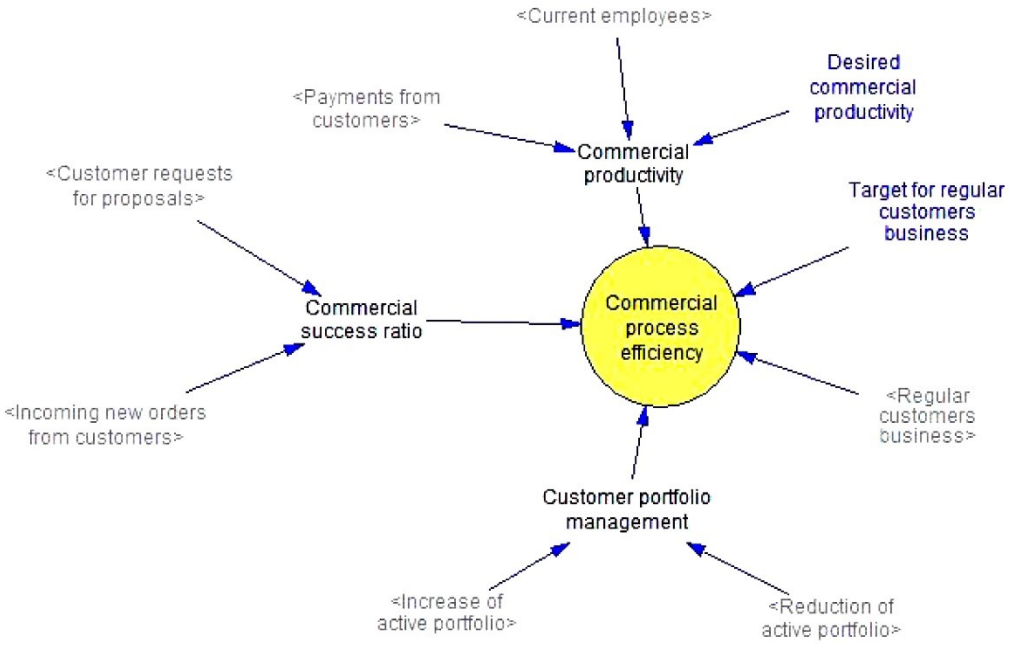

Fig. 3. Measurement of commercial process efficiency (developed by the author).

Commercial process efficiency (see Fig.3.) in an indicator that measures quality and correspondence of commercial processes to the defined company and industry standards. It is made of the following elements: 'Commercial productivity' – turnover generated by a single company employee compared to 'Desired commercial productivity' that is usually a market standard or competition level; 'Correspondence of actual regular business with customers to annual budgeted target'; 'Customer portfolio management' reflects the tendency of increase or reduction of the active portfolio of customers. 'Commercial success ratio' reflects how requests for proposals are transformed to actual new orders.

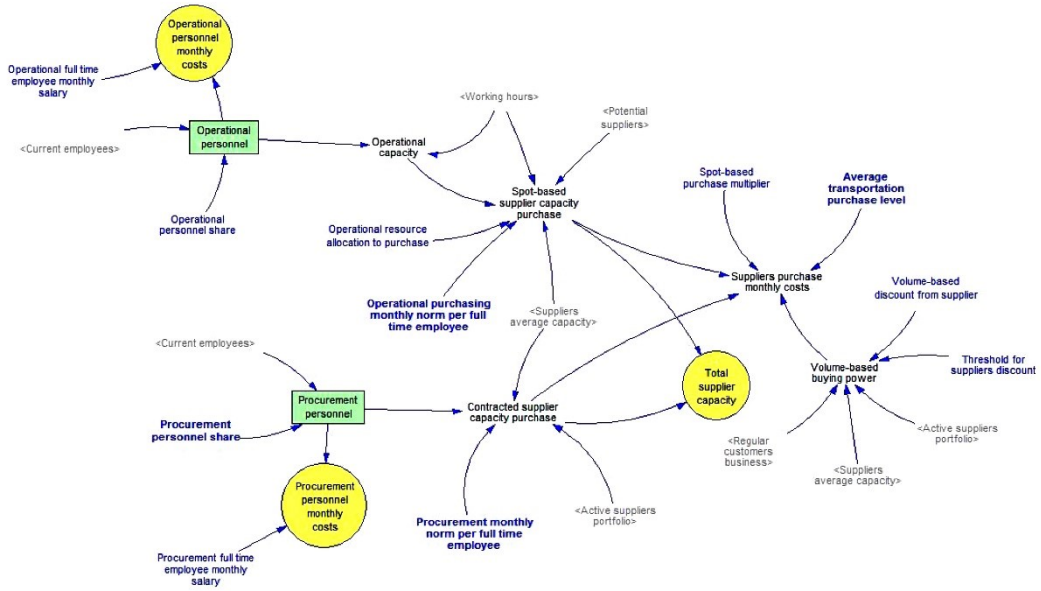

Fig. 4. 3PL procurement process (developed by the author).

A significant part of 3PL company activities involves management of suppliers that grant the needed capacity (transport units) to secure customer demand. As it was shown previously, successful fulfilment of customer orders among all is defined by 'Capacity related order fulfillment' factor that means availability of transportation units. Fig. 4 shows the process of supplier management. In international 3PL practice, this function is mainly allocated to procurement personnel, however, in practice, operational personnel are also regularly involved in supplier management process. As shown in Fig. 5, 'Total supplier capacity' is compiled of 'Spot-based supplier capacity purchase' and 'Contracted supplier capacity purchase'. To calculate supplier purchase monthly costs, the following factors were implemented to distinguish operational and procurement purchase. Spot-based purchase multiplier shows statistical difference of prices between planned procurement activities and urgent procurement made by operational personnel. 'Volume-based buying power' defines suppliers' discount in case of planned procurement activities.

3.2. Administrative model

According to international 3PL practice, administrative activities related to operations and sales stand apart from common processes as they are aimed to form specialization of personnel to consequently raise general personnel efficiency. Two main activities of administrative personnel include administration of suppliers and customers, as shown in Fig. 5.

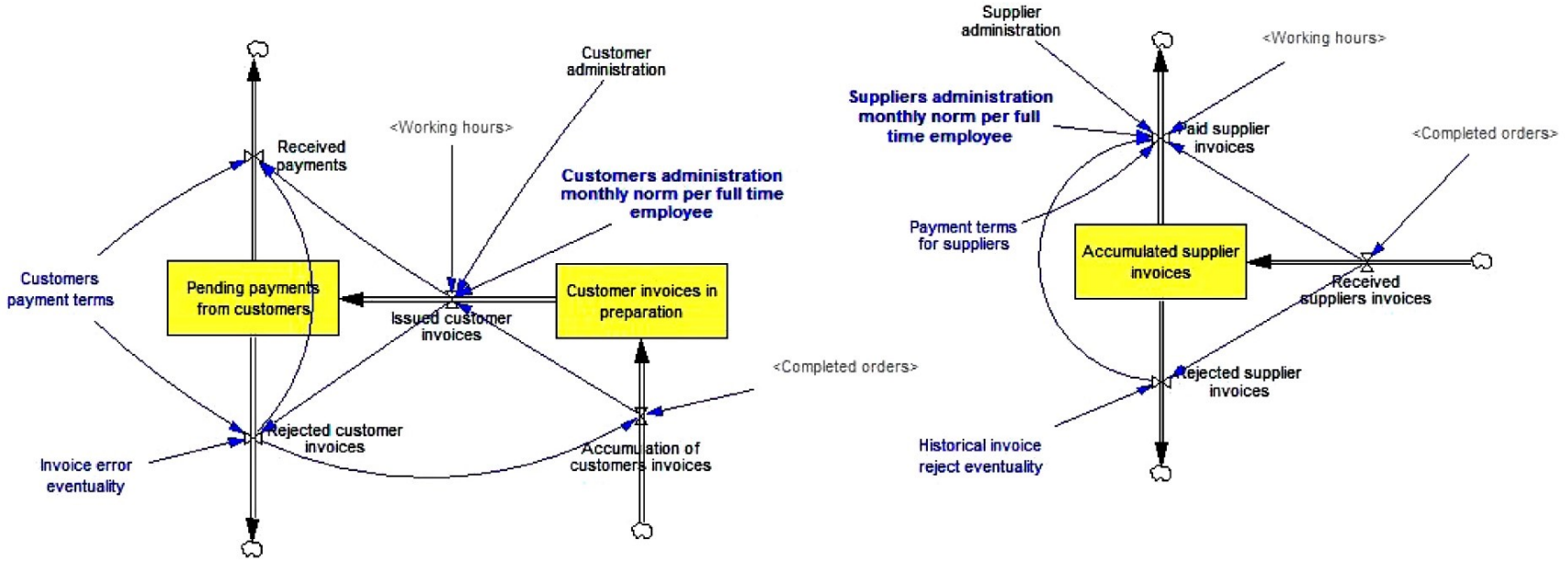

Fig. 5. Administrative processes of 3PL customers and suppliers (developed by the author).

Regarding supplier management, it is reflected as a stock of 'Accumulated supplier invoices' with one inbound and two outbound flows. It is assumed that 'Received suppliers invoices' are equal to 'Completed orders' where transportation units were booked from suppliers. Received invoices are whether paid ('Paid supplier invoices') or rejected ('Rejected supplier invoices'). Concerning customer management, there are two stocks showing 'Customer invoices in preparation', that are not issued yet, hence, the company cannot expect payment for these services. The flow of 'Issued customer invoices' is defined by availability of administrative resources ('Customer administration') in a particular period of time. 'Pending payments from customers' are overdue invoices that the company expects to be paid considering 'Customers payment terms' (defines periods for delay function in 'Received payments' flow).

3.3. Personnel model

The main resource of 3PL that is considered in this study is personnel. As shown in Fig. 6, 'Initial number of employees' defines the starting point of the model. The stock of 'Current employees' is regulated by inbound ('New-coming employees') and outbound ('Leaving employees') flows. In this model, the need for 'General personnel increase' and 'General personnel decrease' is defined by current 'Personnel productivity' that is compared to company and industry standards or 'Desired personnel productivity'.

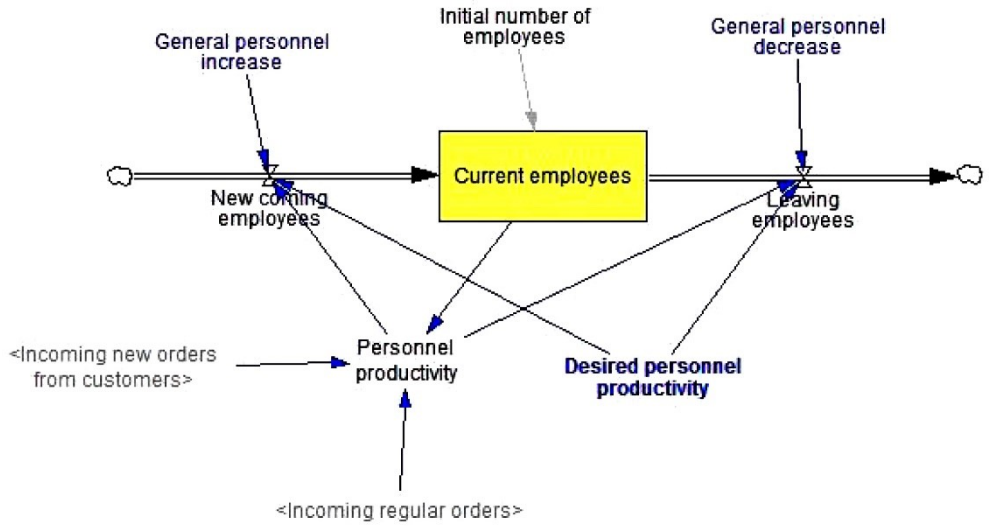

Fig. 6. 3PL personnel model (developed by the author).

General personnel efficiency is measured as shown in Fig. 7. This general indicator is compiled of four separate indicators showing efficiency of specific 3PL activities where respective personnel is allocated. It is needed to evaluate each activity (operations, sales, procurement and administration) separately to discover possible bottlenecks.

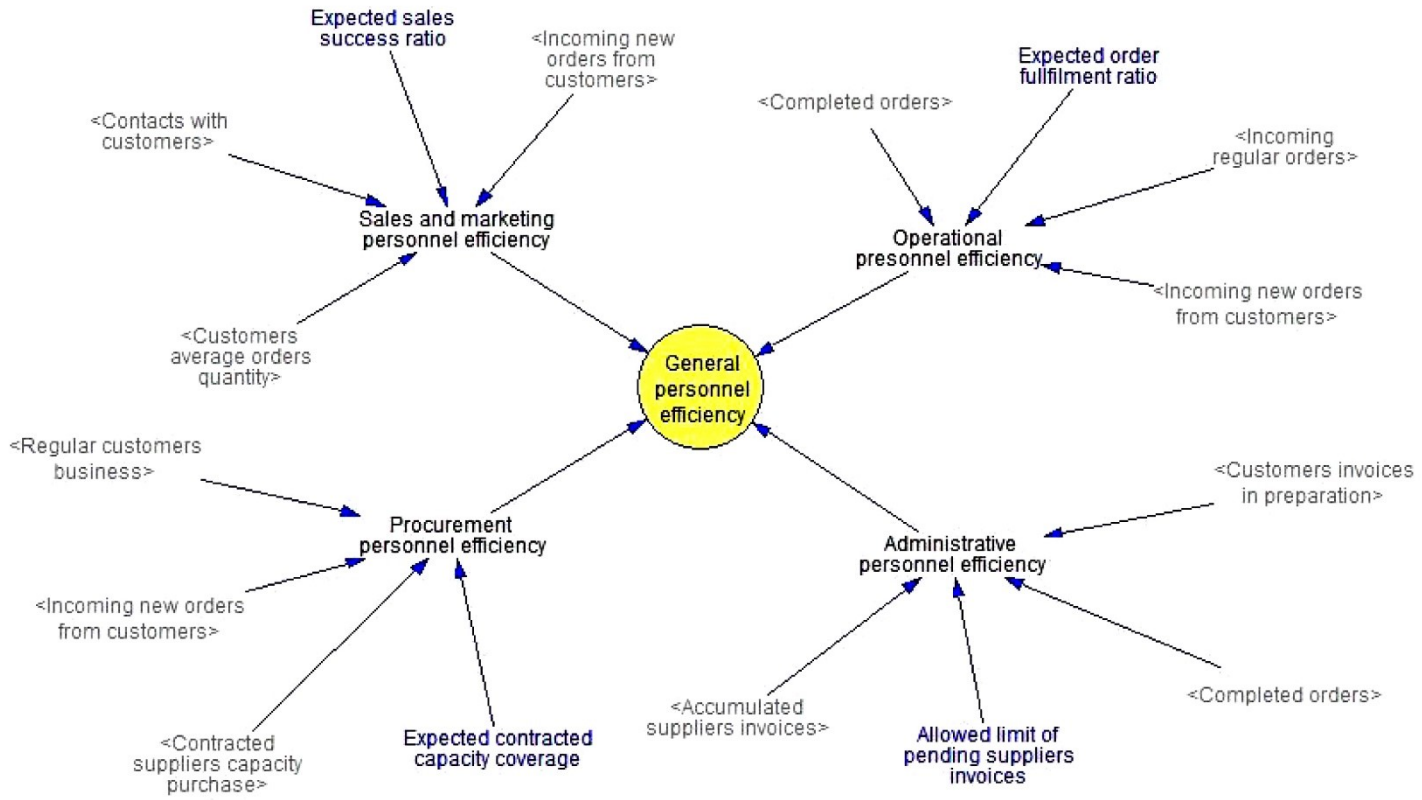

Fig. 7. Measurement of personnel efficiency (developed by the author).

Operational personnel efficiency is defined by comparison of actually completed orders and total incoming orders from customers (sum of 'Incoming regular orders' and 'Incoming new orders from customers'). 'Expected order fulfillment ratio' is defined by the company and competition standards. Administrative personnel efficiency is defined by two factors. Firstly, the company is keen to reduce the number of 'Customer invoices in preparation' to increase cash flow. Secondly, there is need to reduce 'Accumulated supplier invoices' to settle liabilities to suppliers (accounts payable). Securing the capacity of transportation units to cover customer needs is the main function of procurement personnel in 3PL. 'Procurement personnel efficiency' is measured comparing the availability of contractually purchased transportation units with 'Expected contracted capacity coverage'. Knowing that the main responsibility of sales personnel is attraction of new business, 'Sales and marketing personnel efficiency' is measured by 'Sales success ratio'.

3.4. Financial model

Presence of the financial block in the general model allows evaluating the actual impact of optimization of 3PL resources and processes on financial wealth of the company. In this study, the main emphasis was made on the availability of financial resources, as shown in Fig. 8. 'Bank account cash flow' is crucial due to specifics of 3PL business and corporate environment.

As shown in Fig. 8, 'Bank account cash flow' has two inbound and three outbound flows. 'Payments from customers' flow consists of regular payments for 'Completed customer orders' and 'Credits' flow is compiled of 'Bank credit' and 'Shareholder credit'. Basically, these two flows contribute to cash inflow. In case of 3PL business, major part of 'Regular payments' flow is made up by 'Payments to subcontractors'. 'Credit payments' (bank credit and shareholder credit) make the second part of 'Regular payments' flow. 'Labour payments' consist of 'Fixed payments to personnel' (namely, sum of monthly sales, administrative, procurement and operational costs) and 'Variable payments of personnel' that is calculated as percentage of monthly 'Commercial margin'. This approach depends on 3PL organization. The main idea for implementation of this bonus system is motivation of personnel to attract and generate profitable business with the margin that corresponds to budgeted targets of the company. 'Investments to promotion activities' is an essential factor, as it contributes to brand awareness factor that described above. Despite the fact that 3PL is frequently called a light-asset business, there is 'Investments to assets flow' that fulfills 'Fixed assets stock'. Here the company defines 'Asset investment ratio' to sustain the needed stock of equipment and technology.

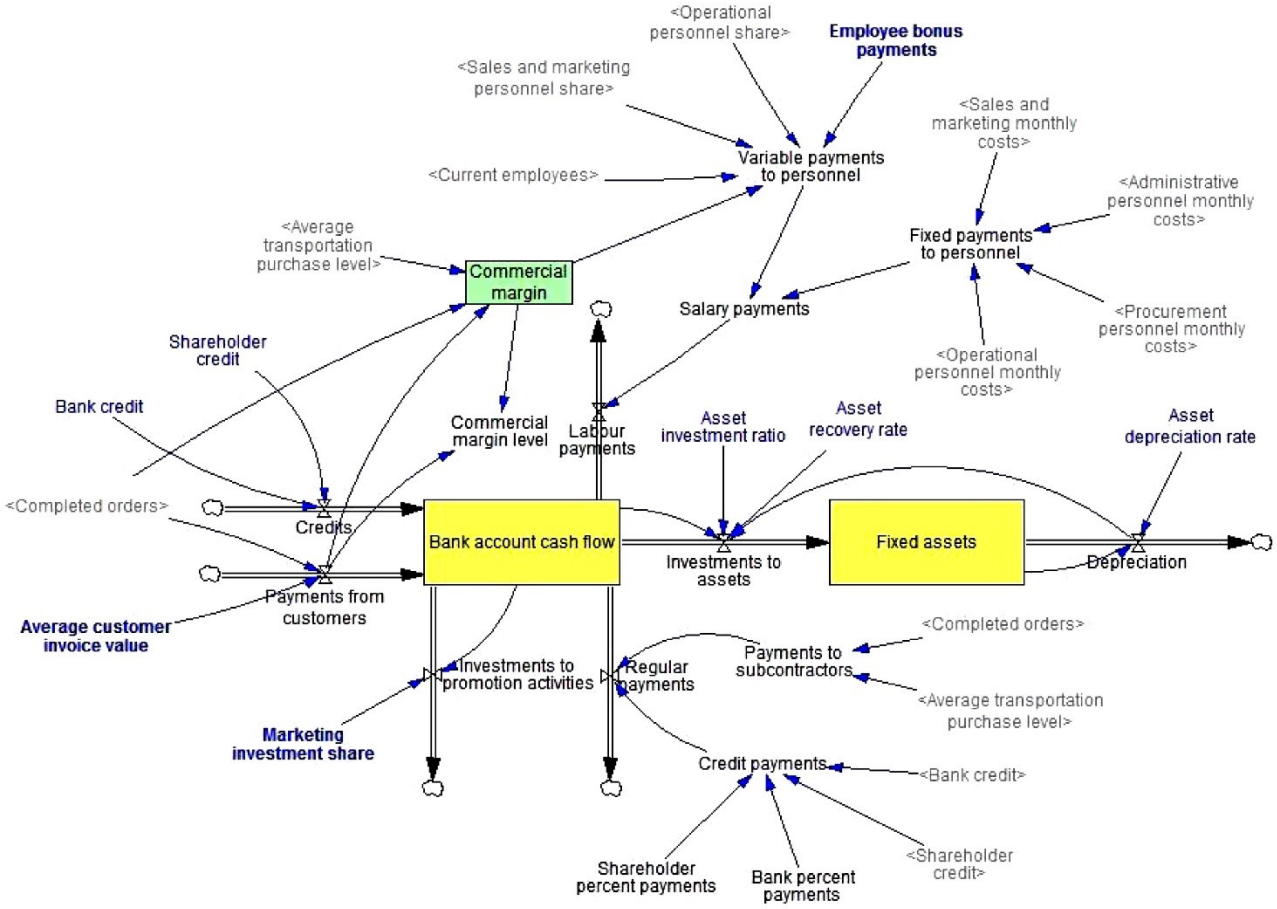

Fig. 8. Financial model of 3PL (developed by the author).

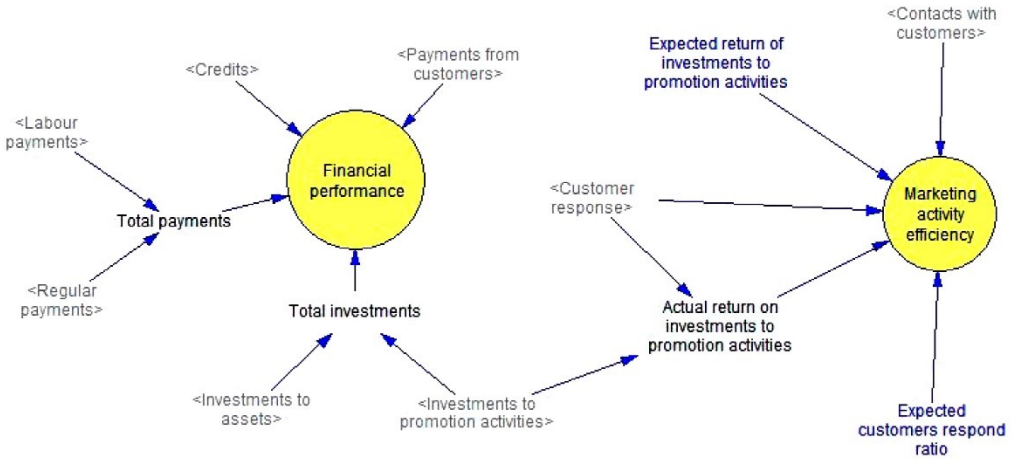

Fig. 9. Measurement of financial and marketing efficiency in 3PL (developed by the author).

Measurement of 'Financial performance' is done by comparing inbound cash flows ('Credits' and 'Payments from customers') and total spending ('Total payments' and 'Total investments'), which allows assessing cash flow of the company during a certain period. Marketing activity efficiency is defined by 'Actual return on investments to promotion activities'.

4. RESULTS

In this model, three scenarios were considered to analyse the proposed model. It is worth mentioning that in this article different personnel allocation variations are considered taking into account significance of this resource in 3PL. Table 2 shows different allocation variations.

Table 2. Scenarios for model analysis

		Scenario 1	**Scenario 2**	**Scenario 3**
Personnel allocation	Sales and Marketing	20%	30%	25%
	Operational	50%	45%	45%
	Procurement	10%	10%	20%
	Administrative	20%	15%	10%

As it was defined in the previous section of this article, the model considers allocation of the total number of 3PL company personnel to four activities: sales and marketing, operational, procurement and administrative. As shown in Table 2, three scenarios are considered. According to 3PL internal policy, management decides on the focused company activities. The first scenario foresees the main emphasis made on operational and administrative activities of 3PL. The second scenario foresees personnel investments into commercial activities to boost sales of

the company. The third scenario foresees balanced allocation between sales and operational activities. Firstly, let us evaluate simulation results of the key indicators within commercial process.

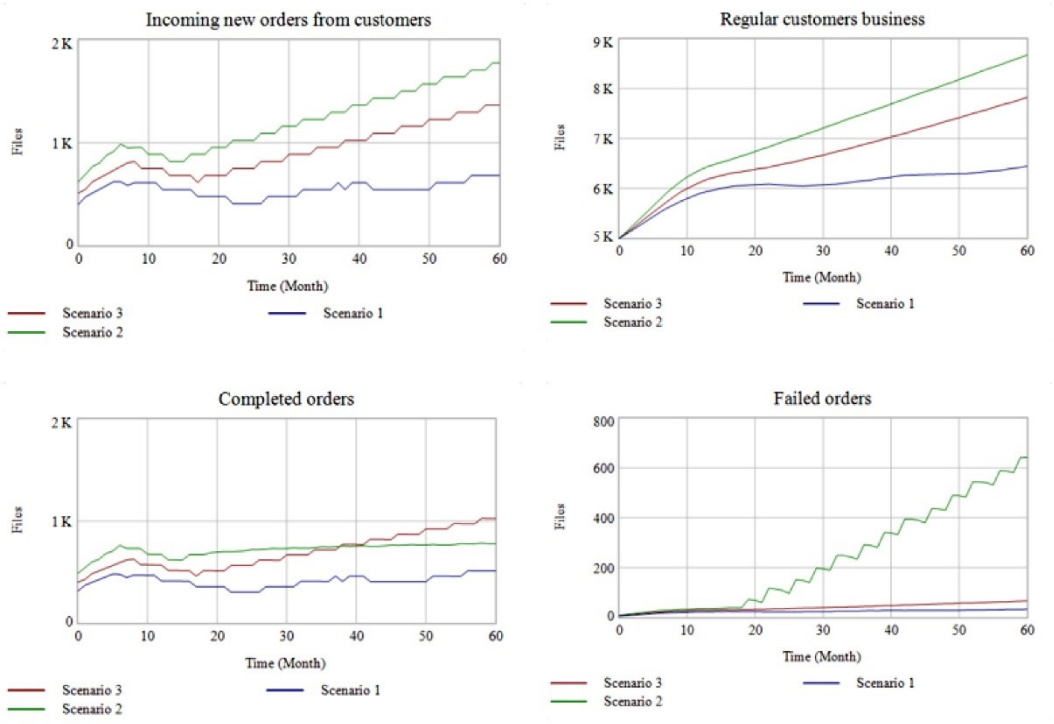

Fig. 10. Simulation of commercial activities (developed by the author).

As shown in Fig. 10, four indicators were chosen in consideration of commercial process. Each of charts displays three considered scenarios. Data are measured in file units that stand for single service orders from customers. As seen in 'Incoming new orders from customers', in case of Scenario 1 a very moderate and volatile growth of new orders is expected, starting from increase during months 1 – 6, subsequent decrease during months 7 – 22 and another growth period during months 23 – 60. Scenario 2 (sales-oriented) and Scenario 3 (balanced) show similar behaviour during months 1 – 6 and months 7 – 22, but during subsequent periods constant growth of new sales is visible. As shown in 'Regular customer business' chart, all three scenarios show enduring accumulation of regular business with some fluctuations in case of Scenario 1. Looking at 'Completed orders' and 'Failed orders', the difference is seen in Scenario 2 (sales-oriented). After 18 months of operations, a very slight decrease of monthly completed orders is visible; at the same time, the number of failed orders drastically increases. It can be explained by the lack of operational capacity, procurement capacity (availability of transport units) and inability to process more incoming new orders and incoming regular orders. In simple words, sales activities overtake operational capacity of a company.

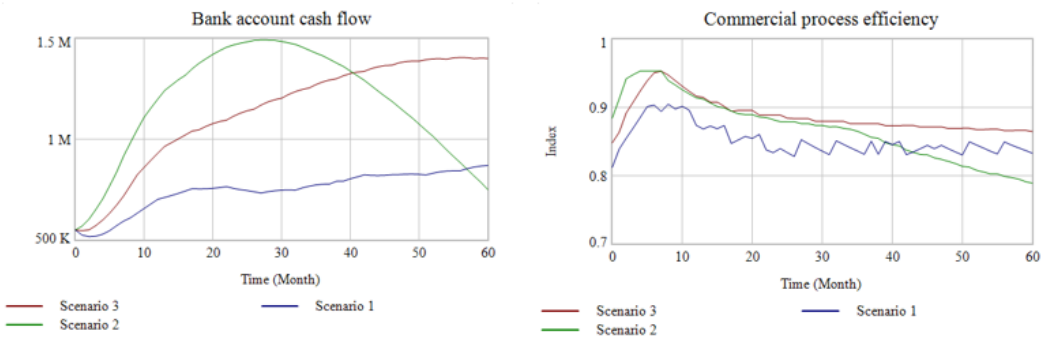

Fig. 11. Commercial process and cash flow efficiency (developed by the author).

Commercial process efficiency is defined by indicator variating from 0 to 1. As it was shown in Fig. 3, in this model, commercial efficiency indicator is compiled of 'Commercial productivity', 'Commercial success ratio', "Regular customer business' and 'Customer portfolio management'. Despite the fact that Scenario 2 is created to boost sales in 3PL, the figure shows that after a short period (months 1 – 5) a rapid decrease is forecasted, mainly due to very low commercial success ratio, as customer requests for proposal will not transform into incoming new orders. As seen in 'Bank account cash flow' chart, this trend will be reflected in the financial standing of a company, but with a certain delay. A rapid decrease of financial resources can be forecasted starting from month 28.

CONCLUSION

General findings related to literature review are the following. Many authors refer to resource-based view theory in their studies, for instance, while evaluating performance of 3PL, considering 3PL resources as the key factor to increase competitiveness. The main emphasis in contemporary research is done on knowledge-based services, thus considering personnel as the key resource of modern 3PL. Many specialists agree that core logistics services tend to be replaced by value-added services. Only by innovating services and improving service level, 3PL providers can enhance customer satisfaction and establish long-term cooperation.

The main contribution of this article is definition of contemporary 3PL resources and core processes within 3PL companies, indication of how resources interact and are transformed into 3PL processes; development of the initial model of 3PL resource and process optimization using system dynamics method. The developed model consists of six blocks, namely commercial activities, operations, procurement, administration, personnel management and quality management, representing different areas of internal activities of 3PL and an additional financial block that allows forecasting cash flow tendencies and financial wealth of the company.

Further research is necessary to enhance the current model. It is hard to imagine a company functioning without the influence of external environment. Hence,

additional blocks shall be implemented into the current model showing the impact of competition (fight for the customers), suppliers and development of industry that would influence 3PL customer portfolio. Also, there are various studies related to decision making (multiple-criteria) and customer choice in 3PL, hence, the current model shall be supplemented by customer decision making and factors influencing this process.

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