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MODEL OF INSTRUMENTS FOR MEASURING THE QUALITY OF LOGISTICS SERVICES IN THE COOPETITION OF ENTERPRISES

Józef FRĄŚ

Poznan University of Technology, Faculty of Engineering Management, Institute of Logistics;
jozef.fras@put.poznan.pl, ORCID: 0000-0002-7263-7006

Aim: The idea, and at the same time the aim of the paper, was to develop a model of instruments dedicated to the assessment and improvement of the quality of logistics services in coopetition and this goal was achieved. The presented article features, against the background of the coopetition of enterprises in a network, essential instruments for measuring the quality of logistics services both from the point of view of its essence as well as an innovative form of relationship, i.e. in the coopetition of enterprises in which logistics services, especially their quality, are of fundamental importance.
Design/methodology/approach: Literature critical analysis. Analysis of international literature from databases as well as exploratory own research work and expert analyses.
Results: The article presents the results of conceptual research on the use of an original model of instruments for measuring and improving the quality of logistics services in the coopetition of enterprises in the Deming Cycle standard and the ISO 9001 quality management system.
Originality/value: Model of instruments for measuring, evaluating and improving the quality of services in competitive cooperation. The obtained results attest to the cognitive and practical value of the developed model of instruments.

Keywords: coopetition, logistics services, quality of logistic services, logistics services measurement instruments, TFL sector.

Category of paper: research work.

1. Introduction

Logistics operators (enterprises operating in the supply chain between the supplier of goods - the principal of logistics services and its end customers), creating a comprehensive logistics service and operating supply networks, have generated a need for a change in the paradigm of the transport-forwarding-logistics sector, the so-called TFL sector (Rydzkowski, 2011). A crucial element here has been the transition of the economy from the marketing orientation of a seller's market to a buyer's market. Logistics services are an integrated area related to the flow of goods and information. The liberalization of rail, air and mail transport has led to the

emergence of new businesses in the logistics services market. New players in the logistics services sector are, for example, national postal services. The face of the market has also been changed by numerous strategic alliances, mergers and acquisitions as well as the intensifying phenomenon of competitive cooperation (in the literature referred to as coopetition) of not only logistics enterprises (Aluchna, 2013; Bengtsson, Kock, 1999; Czakon, 2021; Frąś, 2020; Zakrzewska-Bielawska, 2014).

One of the essential ways of measuring, evaluating and improving the quality management system of logistics services in enterprises is the use of various methods, tools and techniques of quality management. Since a significant number of such instruments can be found in the source literature, enterprises cannot use all of them at once (Wolniak, 2013, 2016, 2017; Wolniak, Skotnicka, 2011; Skotnicka-Zasadzień et al., 2017, 2018; Wolniak et al., 2017; Zendla, Wolniak, 2015; Sułkowski, Woźniak 2018).

Therefore, a crucial problem addressed by business managers in competitive cooperation is made up of issues concerning the selection of proper instruments for measuring, evaluating and managing the quality of services in the TFL sector. Therefore, it is useful to know instruments for measuring, evaluating and improving the quality of logistics services. Hence, the aim of this publication is model development of instruments, i.e. methods, tools and techniques used to measure the quality of services in the coopetition of enterprises in the TFL sector and filling the research gap in this area.

2. Quality of logistics services

There is no unequivocal definition of a logistics service in the source literature, due to its characteristics. The scope of activities carried out by logistics operators indicates (Biesok, 2013; Harrison, Hoek, 2010; Zamkowska, Zagodżon, 2011) that it may include activities related to relocation, forwarding, storage, picking, refining (e.g. labelling, repackaging, shrink-wrapping, creating promotional packages), inventory management, consulting, etc.

In a basic sense, a logistics service is an activity aimed at satisfying logistics needs of enterprises and people (Zamkowska, Zagodżon, 2011). Characteristics distinguishing services from other objects of market exchange include:

- intangibility,
- inseparability of the production and consumption process,
- diversity,
- nondurability,
- inability to acquire ownership (Rydzkowski, 2011).

A service feature, from among those mentioned above, which is the most frequently addressed and characterized by authors is intangibility. This feature allows to distinguish services from other objects of market exchange (Dyr, 2009). Service operations do not have

a material form. They are intangible and it is not possible to check a service before its purchase (on a trust basis). It is not possible to provide services in advance or store them - a service is experienced (Chojnacka, 2011). Services are sold - provided and then consumed in contrast to goods that are first produced, then sold and consumed (Rydzkowski, 2011).

A logistics service is the performance, on the basis of a contract, of activities consisting in the execution by a contractor of one or more logistics functions for an ordering party (Rydzkowski, 2011). Logistics services combine both transport services, storage and replenishment of stocks, transshipment as well as many other services that were previously in the sphere of activities performed by manufacturing and trading enterprises. As part of logistics services, a customer can purchase storage services, stock handling, transport, cargo handling, market research, creating a marketing information system, financing transactions and insurance banking services. The logistics services sector is developing and changing dynamically under the influence of many factors. In a market transaction not only a product itself or its price are important, but also its delivery, a logistics service, and above all its quality.

Currently, there are three groups of logistics service operators on the market which provide transport-forwarding-logistics services along with additional services, e.g. informing an ordering party about the state of the performance of a contract. They provide the following services:

- *transport* - consisting only in the performance of transport tasks against payment, the result of which is the shipment of people and materials with a limited scope of consultation provided contributing to the efficient and effective operation of all sectors of the state economy,
- *forwarding* - in its basic form, consisting in organizing the shipment of goods, insurance, issuing necessary documentation, and customs service when dealing with Polish conditions,
- *logistics* – including the performance of transport and forwarding activities, terminal services (from cross-docking, through storage to picking and packaging), and refinement activities (labelling, shrink-wrapping, adding documents to goods, creating promotional sets, repackaging, collecting receivables and others).

The area of activities covered by a logistics service can be very diverse (Rydzkowski, 2011). For each of the logistics functions performed, there are a number of detailed activities that make up the scope of a logistics service (Zamkowska, Zagodżon, 2011). The sphere of logistics services and enterprises that provide them are referred to as the TFL sector. This term seems imprecise because it suggests that transport and forwarding are separate from logistics. In fact, they are a part of it. Transport is a part of logistics related to the movement of goods, and forwarding is a more extensive service, within which there is not only transport but also its supplementation with necessary transport documentation, cargo insurance, preparation for transport through appropriate packaging, etc. Forwarding activities also consist in obtaining and combining goods for economic transport (use of the cargo space of a given means of transport, distance, costs).

The task of transport and forwarding is to ensure the declared level of service in such a way that goods are delivered to an indicated place at a specified time and in an undamaged state. In a logistics service, a customer is to receive the ordered goods in appropriate quantity and quality, and the preceding activities related to the process of picking, storing and packaging are to be carried out at the lowest cost possible (Fig. 1).

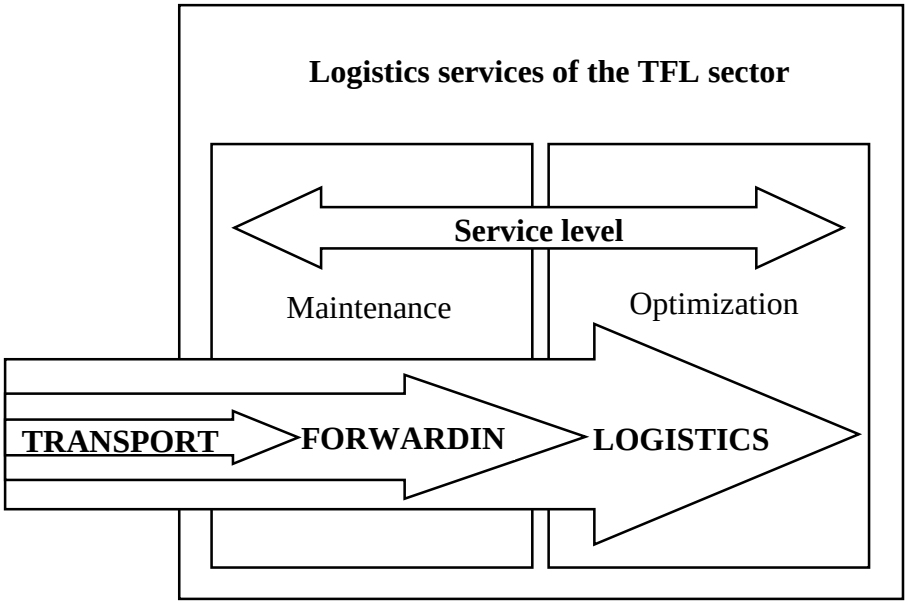

Figure 1. Relationship between the type of a logistics service of the TFL sector and the level of service. Source: Rydzkowski, 2011; Fajczak- Kowalska, Kowalska, 2017.

Quality assessment of logistics services is related to quality determinants, which are understood as the most important properties that a logistics service has or should have. In view of the above, a logistics service should meet the following requirements in accordance with the 7R concept:

- the right product,
- the right quantity,
- the right time,
- the right condition,
- the right place,
- the right customer,
- the right price (Biesok, 2013).

The 7R principle is a basic axiom used in logistics. It can be said that this principle is a kind of shortened and simplified definition of logistics, and at the same time is a set of determinants of the quality of a logistics service. It puts forward 7 conditions that each logistics enterprise must meet in order to exist and compete on the market.

According to A. Harrison and R. Hoek (Harrison, Hoek, 2010), the quality of a logistics service is fundamental to achieving long-term market success. This is due to the fact that the quality of a service is difficult to measure and counterfeit by competing enterprises. The most

important determinants of efficiency and effectiveness, and thus the quality of the provision of logistics services, include:

- convenience of customer service,
- order processing time,
- flexibility of deliveries,
- flexibility and comprehensiveness of a service,
- reliability of deliveries,
- handling of returned goods (Frąś, 2015; Zimon, 2013).

In order to achieve the above determinants in the provision of logistics services by enterprises in the coopetition processes, the concept of a model of instruments for shaping and improving the quality of services presented in point 4 of this paper was developed.

3. Coopetition as a contemporary direction in shaping the quality of services in the TFL sector

The beginnings of coopetition can be found in the theory of strategic alliances, game theory, resource concept of strategic management, network approach, competition theory, transaction costs theory and others (Mierzejewska, 2018). However, the number, intensity and variability of this type of relationships made it necessary to deepen this subject and single it out as an independent theory (Bengtsson, Kock, 1999; Zakrzewska-Bielawska, 2014; Czakon, 2010; Jankowska, 2009; Zakrzewska-Bielawska, 2014; Aluchna, 2013). Currently, coopetition as a strategic phenomenon has a strong theoretical basis. One even talks about a theory of coopetition, thus distinguishing it from other relationships that may occur between competitors (Aluchna, 2013).

Coopetition is interdependence, dynamism and complexity of relationships, but also opportunism and asymmetry (Dal-Soto, Monticelli, 2017). Coopetitive relationships occur between enterprises that have convergent cooperative goals and divergent competitive goals (Hamel et al., 1989). Enterprises connected by this relationship cooperate in some parts of the value chain, and in others they compete (Cygler, 2009). It is therefore an extremely complex phenomenon, meaning the occurrence of two opposing streams of relationships: competition and cooperation, and is characterized by significant variability in intensity during a period of time (Rogalski, 2011; Czakon, 2017).

Coopetition is not a homogeneous phenomenon. The richness of coopetitive relationships and their heterogeneity is evidenced by numerous classifications appearing in the source literature (Bengtsson et al., 2010,;Dagnino, Padula, 2002; Luo, 2007; Nalebuff, Brandenburger, 1997; Czakon, 2010). Coopetitive relationships can be dominated by cooperation, balanced or dominated by competition. The type of a coopetitive relationship depends on many factors, including market requirements, customer expectations, institutional environment, entities'

resource autonomy, pressure to integrate the global value chain and others (Bengtsson, Kock, 2000; Stańczyk-Hugiet, 2011).

Some researchers distinguish coopetitive relationships in parts of the value chain located close to a customer (sales, marketing) as well as in those located far from a customer (logistics, research and development, production) (Lindström, Polsa, 2016). In modern, turbulent times, it often turns out that enterprises are forced to implement both the strategy of competition and the strategy of cooperation (Lado et al., 1997). Coopetition may be a strategy for achieving a competitive advantage by individual participants of a competitive cooperation network, but it may also be generated at the level and in relation to other entire competitive networks. There are a number of benefits that entering into coopetitive relationships brings. The most frequently mentioned are:

- cost reduction,
- risk and knowledge sharing,
- synergy, increased market share,
- increase in efficiency indicators,
- development of new technologies,
- acquisition of resources (Gnyawali, Park, 2009; Czakon, 2007; Zakrzewska-Bielawska, 2014).

Unfortunately, coopetition can also encourage the emergence of various pathologies and creation of new types of risk. This can be a limitation of the flexibility and independence of an enterprise, opportunism, emerging conflicts of interest and difficulties in coordinating coopetitive activities. All these negative effects can contribute to the reduction of efficiency and competitiveness of coopetitors (Baumard, 2009; Bonel, Rocco, 2007). Therefore, it is worth looking at the factors that determine the success of coopetition, identified with the generated positive above-average effects.

Referring to the logistics services market as an organized structure and logistics service providers operating on it, they can also generate various types of indirect interactions that have the hallmarks of both competition and cooperation. Aside from extreme forms of competition-cooperation relationships, it is possible, in efforts made by logistics services providers, to designate such an area of cooperation that would allow to partially develop the existing resources and set common goals in such a way as to enable each party to ensure:

- creation of specific added value,
- provision of mutual benefits,
- sharing a partial convergence of interests, e.g. courier services market, mobile telephony operators, etc.

An important problem is, therefore, to find such an optimum that, on the scale of intensity of processes of both competition and cooperation, would allow, on the one hand, to better use the resources, and, on the other hand, to achieve a higher level of benefits that is possible on a given market of logistics services. Competition processes can be developed either independently or jointly with other enterprises. Independent development of competition

processes is the simplest way, but at the same time it is only recommended for two types of enterprises: small ones – operating only locally and/or in the niche sector, and large ones, which can use the effects of economies of scale. However, in the era of increasing globalization and environment turbulence, even these large enterprises are forced to develop their competitiveness in conjunction with other enterprises. It can be assumed that the second option is more pro-developmental.

The symbiosis of competition and cooperation may lead to the emergence of a new way of regulating the behaviour of enterprises, i.e. coopetition. The structure of coopetitive relationships between logistics service providers is presented in Fig. 2.

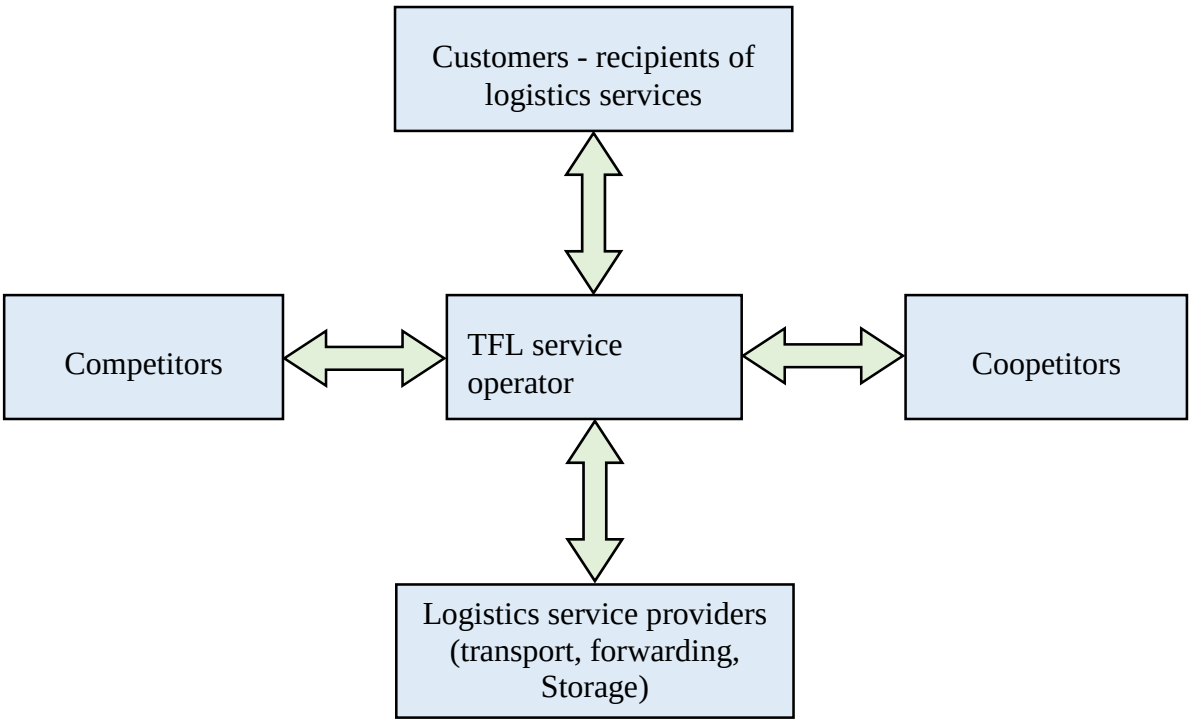

Figure 2. Structure of coopetitive relationships of logistics services.

Source: Brandenburger, Nalebuff, 1996; Jankowska, 2009; Frąś, 2020.

Coopetition is an attempt to look for a "third way" that would be an alternative to competition and cooperation leading to one type of coopetitive relationships between entities on the logistics services market. The essence of coopetition is expressed in the fact that logistics service providers, striving to gain a competitive advantage thanks to specific resources, competences and a specific market position, try to integrate their strengths with current rivals, suppliers, customers and other partners in the process of providing logistics services. Coopetition is, on the one hand, a joint use of their competitive potential by logistics operators (coopetitors), and on the other – constant competition for cost leadership, share in the logistics services market and stimulation of technological changes in the TFL sector.

4. Instruments and model for measuring and improving the quality of logistics services in competitive cooperation

In many publications related to the subject of quality management (Wolniak, Skotnicka, 2011; Wolniak, 2013, 2016; Sułkowski, Wolniak, 2018; Frąś, 2011, 2020, 2021; Zakrzewska-Bielawska, 2014; Rydzkowski, 2011; Hamrol, Mantura, 2005; Detyna, 2011), one can find an approach which states that tools, techniques and methods, referred to in the literature as instruments, implemented for quality management are extremely important in supporting the development and improvement of the quality of products purchased by customers. The spectrum of tools and methods as well as the principles of measuring, evaluating and improving the quality of logistics services, which is contained in the source literature, is broad (Wolniak, 2017; Hamrol, Mantura, 2005; Zimon, 2013, Frąś, 2013, 2021 and others). The attempt to define quality assessment instruments by various authors makes it difficult for the reader to understand unambiguously their essence allowing to assess the quality of services, including logistics.

Quality management instruments are used to monitor the entire production cycle, from the design stage, through production, to the control of the finished product or the service purchased. All tools and methods are characterised by a planned, repeatable and scientifically based approach to their use.

Based on the above-mentioned research (Wolniak, 2017; Hamrol, Mantura, 2005; Zimon, 2013; Frąś, 2013, 2020), the following typology can be presented:

- *quality management principles* (QMP) – define the attitude of an enterprise and its employees to generally understood quality problems, do not give operational guidelines, and the results of their application are difficult to assess on an ongoing basis, but constitute canons of conduct in shaping the quality of products, services and processes.
- *quality management methods* (QMM) – are characterized by a planned, repeatable and scientifically based way of proceeding in the execution of quality management tasks, they are more complex than quality tools, they use data collected through them, they allow to shape the design quality and the quality of workmanship, both of products and services.
- *quality management tools (QMT*) – are used to collect and process data related to various aspects of quality management, they are distinguished by simplicity and they are used to collect and process data related to various aspects of quality management, their impact is limited in time, their effective use usually requires connection with methods.

Various classifications of quality management instruments can be found in many source literature publications (Wolniak, 2017; Wolniak, Skotnicka, 2008; Zimon, 2013; Frąś, 2013,

2015 and others). One of the universal classifications, due to the complexity and use of quality measurement instruments, is presented in Table 1.

Table 1.
Key instruments of quality management in logistics

	Characteristics and manner of impact on the quality of services	**Examples**
Quality management principles	Long-term impact – define the strategy of enterprise development. They go beyond the framework of an enterprise. They do not give operational guidelines. The results of the application are difficult to assess on an ongoing basis.	Deming, Juran and Crosby principles. "Zero defects" principle. Teamwork principle. Kaizen – the principle of continuous improvement, enhancement and perfection.
Quality management methods	Medium-term impact. They allow to shape the design quality and the quality of workmanship. They are based on generally accepted algorithms of conduct.	QFD – quality control by the customer. Value analysis. SPC – statistical process control. FMEA – of a process, product. Servqual – measuring the quality of services. CSI – customer satisfaction index. DOE – design of experiments.
Quality management tools	Short-term (operational). The results of the application are visible "almost" immediately, but effective use requires a combination with methods.	Traditional tools: Flowchart, Ishikawa diagram, Pareto chart, Histogram, Control sheets, Correlation graphs, Control chart. New quality management tools: Affinity diagram, Relationship diagram, Systematic diagram, Matrix diagram, Matrix data analysis, PDPC chart, Arrow diagram.

Source: Frąś, 2013, 2021; Hamrol, Mantura, 2005; Wolniak, Skotnicka, 2008.

Instruments used to solve quality problems in enterprises in coopetition in the area of analysis and evaluation and improvement of the quality of logistics services in the Deming Cycle standard and the ISO 9001 quality management system are shown in Fig. 3. It is an original model of instruments, developed on the basis of the analysis of bibliographic sources, own reflections and many years of experience in this area. This model is related to the extent of the impact of these instruments in enterprises in the coopetition network.

The instruments are characterised by short, medium and long-term impact. Their effective use is noticed in combination. Then the results of activities are visible almost from the very beginning of their application and have a synergistic effect.

The principles, tools and methods for analyzing, evaluating and improving the quality of services in the TFL sector presented in the model are widely known in the source literature and will not be discussed separately due to the volume limitations of this paper (Hamrol, Mantura, 2005; Wolniak, 2013; Wolniak, Skotnicka, 2011; Frąś, 2015; Zimon, 2013).

In the conceptual research of the model creation, the priority in the selection of tools and methods was a risk occurring in coopetition. Hence, among the methods for solving quality problems of services (Frąś, 2011, 2015), the key method of analyzing failure modes and effects - FMEA was indicated, which takes into account risk estimation using the point method.

Risk estimation using the FMEA method has several aspects, allows to assess the level of risk of coopetition, manage the risk of this cooperation and is a strategic determinant of the development of competitive cooperation in a network of enterprises. Solving quality problems using this method is supported in the ISO 9001 quality management system (requirement 6.1 - activities aimed at determining risks and possibilities) (Frąś, 2020).

It is also important to use the Ishikawa diagram in the model to solve quality problems of services, in which, in addition to the main causes of inconsistency, i.e. man, machine, material, management, method, environment, the assessment of a risk occurring in competitive cooperation is also important (Frąś, 2011).

This will constitute a synergy or antagonism of both methods – FMEA and the Ishikawa diagram, and thus confirm or exclude a risk and its level as a positive or negative phenomenon in the coopetition of enterprises.

The final part of the paper presents the idea of continuous improvement of the quality of logistics service processes in coopetition between enterprises using the Deming cycle (Fig. 4).

The above-presented approach to continuous improvement of processes and products and the PDCA method used for this purpose, have their roots in focusing on customer needs, striving for quality, continuous improvement of processes and services, efficiency, cooperation and mutual respect, using *internal motivation* as a natural force for development (Hamrol, Mantura, 2005). All of them break the paradigm of management of the 19th and mid-20th centuries (Taylor, 1911, scientific management, use of *external motivation*) and introduce the paradigm of learning organizations (Deming, Senge, 1990). They have their place in **empiricism**, i.e. experiencing, observing and collecting the necessary data, and on their basis, the existing qualitative activities of production and service processes are improved (Frąś, 2013). Such an activity improving the quality of logistics services in the coopetition of enterprises is presented below in Figure 4 and is based on the PDCA Deming Cycle. This is a basic pattern in the implementation of Lean and Agile or Toyota Kata methodologies.

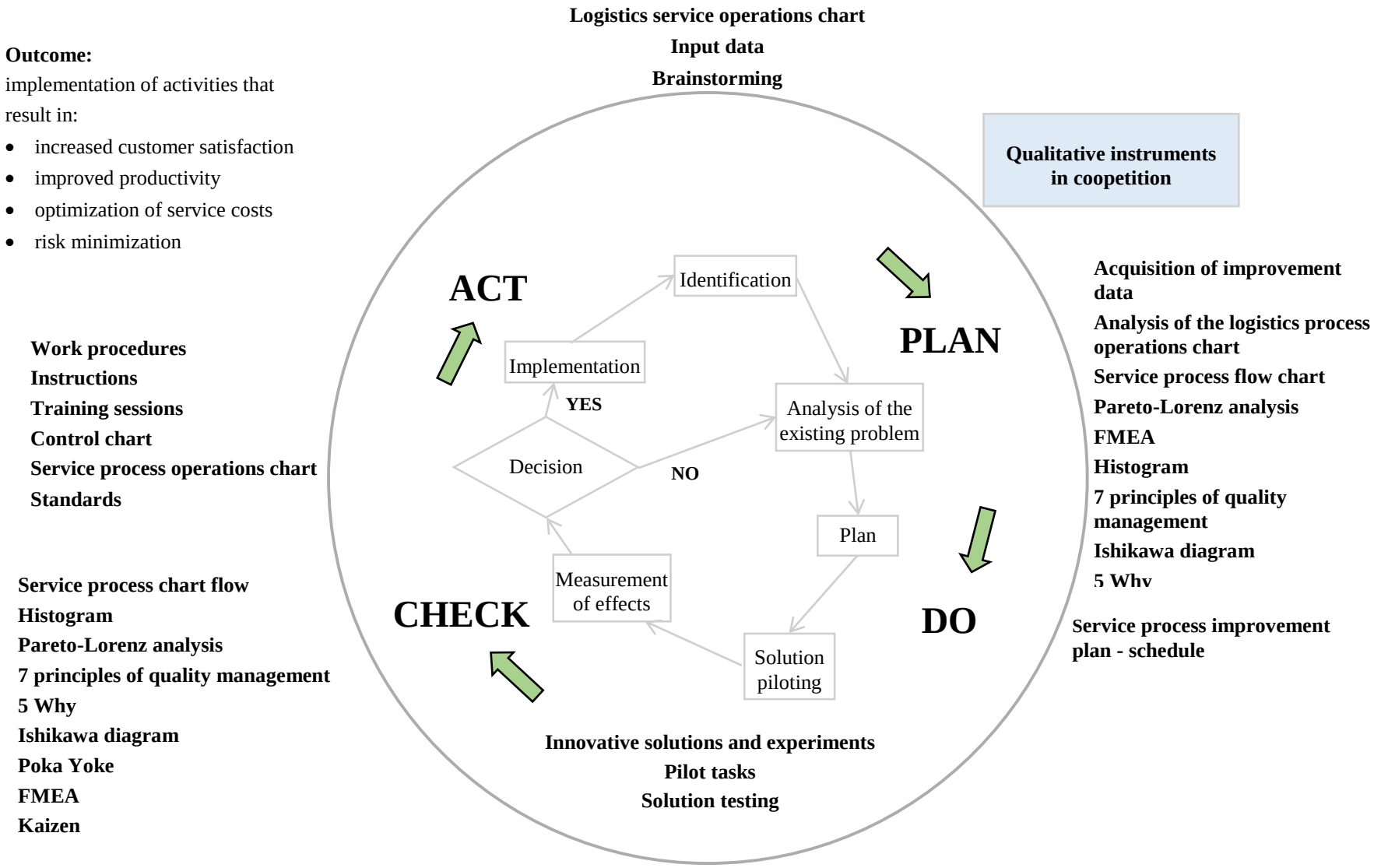

Figure 3. Model of instruments for solving quality problems of logistics services in the coopetition of enterprises in the Deming Cycle and ISO 9000 standards.

Source: author's own development.

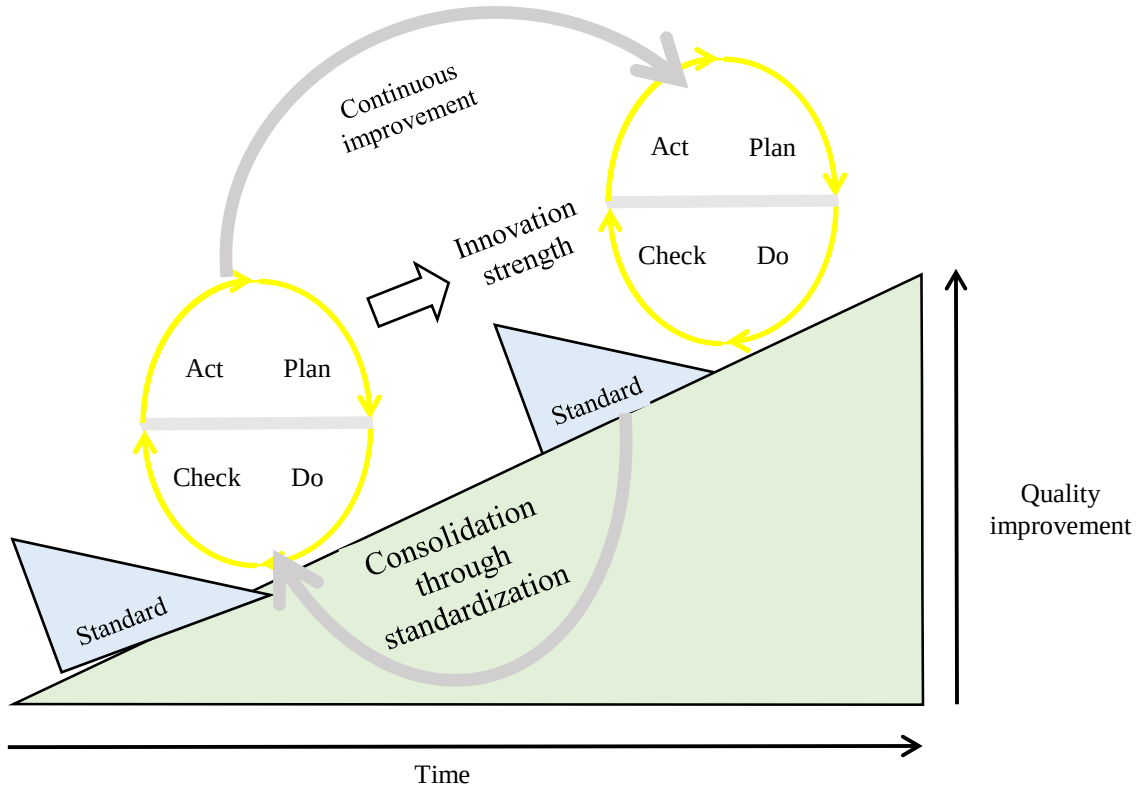

Figure 4. Continuous improvement of the quality of processes in logistics services in the coopetition of enterprises.

Source: own development.

Summary

Using the presented model of instruments in shaping and improving the quality of logistics services in the conditions of the competitive cooperation of enterprises will effectively solve the problems of quality logistics services in competitive cooperation in the Deming Cycle and ISO 9000 standards.

The model of instruments, due to the extensive possibilities of its use at many stages of the product or process life cycle, can be very useful and constitute a convenient tool for shaping the quality of logistics services in enterprises involved in coopetition, however, it requires further empirical research.

References

1. Aluchna, M. (2013). Kooperencja w grupach kapitałowych. In: *Kooperencja przedsiębiorstw w dobie globalizacji. Wyzwania strategiczne, uwarunkowania prawne*. Warszawa: Wolters Kluwer.
2. Bengtsson, M., Kock, S. (1999). Cooperation and Competition in Relationships between Competitors in Business Network. *Journal of Business and Industrial Marketing, vol. 14, no. 3*.
3. Biesok, G. (ed.) (2013). *Logistyka usług*. Warszawa: CeDeWu.
4. Brandenburger, M., Nalebuff, B.J. (1996). *Co-opetition*. New York: Doubleday.
5. Chojnacka, A. (2011). Usługa logistyczna jako przedmiot rynku. *Autobusy, nr 12.*
6. Coyle, J.J., Bardi, E.J., Langley, C.J.Jr (2013). *Zarządzanie logistyczne.* Warszawa: PWE.
7. Czakon, W. (2010). Emerging coopetition: an empirical investigation of coopetition as interorganizational relationship instability. In: S. Yami, S. Castaldo, G.B. Dagnino, F. le Roy (eds.), *Coopetition: Winning strategies for the 21st century*. Cheltenham, UK; Northampton, USA.
8. de Resende, L.M.M., Volski, I., Betim, L.M., de Carvalho, G.D.G., de Barros, R., Senger, F.P. (2018). Critical success factors in coopetition: Evidence on a business network. *Industrial Marketing Management, Vol. 68*.
9. Detyna, B. (2011). *Zarządzanie jakością w logistyce*. Wałbrzych: Wydawnictwo Państwowej Szkoły Zawodowej im. Angelusa Silesiusa.
10. Dyr, T. (2009). *Czynniki rozwoju rynku regionalnych przewozów pasażerskich*. Radom: Wydawnictwo Politechniki Radomskiej.
11. Fajczak-Kowalska, A., Kowalska, M. (2017). Jakość usług logistycznych – rozwiązania wykorzystywane w ostatniej mili przez firmy kurierskie. *Logistyka, nr 2.*
12. Frąś, J. (2021). *Zarządzanie i logistyka w eksploatacji maszyn*. Poznań: Wydawnictwo Naukowe Politechniki Poznańskiej.
13. Frąś, J. (2013). *Kompleksowe zarządzanie jakością w logistyce*. Poznań-Radom: Wydawnictwo Naukowe Wyższej Szkoły Logistyki w Poznaniu przy współudziale Instytutu Eksploatacji Technologii – Państwowego Instytutu Badawczego w Radomiu.
14. Frąś, J. (2011). Metody i techniki zarządzania jakością. *Zeszyty naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia, nr 46.*
15. Frąś, J. (2015). *Normalizacja i zarządzanie jakością w logistyce*. Poznań: Wydawnictwo Naukowe Politechniki Poznańskiej.
16. Frąś, T. (2020). *Metodyka zarządzania ryzykiem w procesie kooperencji przedsiębiorstw.* Praca doktorska. Wydział Inżynierii Zarządzania, Politechnika Poznańska.

17. Gawlik, J., Kiełbas, A. (2003). *Metody i narzędzia w analizie jakości wyrobów*. Kraków: Wyd. Politechniki Krakowskiej.
18. Hamrol, A., Mantura, W. (2005). *Zarządzanie jakością – teoria i praktyka*. Warszawa: PWN.
19. Harrison, A., Hoek, R. (2010). *Zarządzanie logistyką*. Warszawa: PWE.
20. Jankowska, B. (2009). *Konkurencja czy kooperacja?* Warszawa: Ekonomista, Keytext.
21. Luo, Y. (2007). A coopetition perspective of global competition. *Journal of World Business, Vol. 42, No. 2*.
22. Mierzejewska, W. (2018). Czynniki sukcesu koopetycji. *Journal of Management and Finance, Vol. 16, No. 1/1*.
23. Nalebuff, B., Brandenburger, A. (1997). Co-opetition: Competitive and cooperative business strategies for the digital economy. *Strategy & Leadership, Nov/Dec*.
24. Rydzkowski, W. (ed.) (2011). *Usługi logistyczne. Teoria i praktyka.* Poznań: ILiM.
25. Skotnicka-Zasadzień, B., Wolniak, R., Gembalska-Kwiecień, A. (2018). Improving the efficiency of the Production process using SMED. *MATEC Web of Conferences QPI, 183, 01002*.
26. Skotnicka-Zasadzień, B., Wolniak, R., Zasadzień, M. (2017). Use of quality engineering tools and methods for the analysis of production processes – case study. *Advances in Economic, Business and Management Research, 33*. Second International Conference on Economic and Business Management, FEBM, Shanghai, 240-245.
27. Sułkowski, M., Wolniak, R. (2018). *Poziom wdrożenia instrumentów zarządzania jakością w przedsiębiorstwach branży obróbki metali*. Częstochowa: Oficyna Wydawnicza Stowarzyszenia Menedżerów Produkcji i Jakości.
28. Wolniak, R. (2013). Metody i narzędzia Lean Production i ich rola w kształtowaniu innowacji w przemyśle. In: R. Knosala (ed.), *Innowacje w zarządzaniu i inżynierii produkcji* (pp. 524-553). Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją.
29. Wolniak, R. (2016). *Metoda QFD w zarządzaniu jakością. Teoria i praktyka*. Gliwice: Wydawnictwo Politechniki Śląskiej.
30. Wolniak, R. (2017). Koncepcja wykorzystania analizy Kano w metodzie QFD. In: R. Knosala (ed.), *Innowacje w Zarządzaniu i Inżynierii Produkcji, 2* (pp. 400-409). Opole: Oficyna Wydawnicza PTZP.
31. Wolniak, R., Skotnicka, B. (2011). *Metody i narzędzia zarządzania jakością – Teoria i praktyka, cz. 1*. Gliwice: Wydawnictwo Naukowe Politechniki Śląskiej.
32. Zakrzewska-Bielawska, A. (2014). Strategia koopetycji w praktyce firm high-tech. In: *Koopetycja w rozwoju firm high-tech. Determinanty i dynamika.* Warszawa: Placet.

33. Zamkowska, S., Zagożdżon, B. (2011). *Systemy logistyczne w obsłudze przedsiębiorstw.* Radom: Wydawnictwo Politechniki Radomskiej.
34. Zendla, S., Wolniak, R. (2015). Wyeliminowanie obszarów niezadowolenia klienta za pomocą metod i narzędzi zarządzania jakością oraz wprowadzenie udoskonaleń w międzynarodowym porcie lotniczym. *Zeszyty Naukowe Politechniki Śląskiej. Seria Organizacji i Zarządzanie, nr 82*.
35. Zimon, D. (2013). *Zarządzanie jakością w logistyce*. Warszawa: CeDeWu.