Original Research Article

Methodology for assessing a logistics chain capability based on a value-based approach

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Abstract: The logistics chain creates value for the end user by competing with other logistics chains, therefore it is necessary to more accurately measure, calculate and evaluate its potential depending on the specific management situation. The solution of these objectives requires qualitative methods of research of logistics chains based on the use of classification attributes and dichotomies of management objects, the combination of which allows us to justify clear criteria for assessing the potential of a logistics chain of two types. The article substantiates the content of the terms "potential of a logistics chain" and "logistics potential", offers options for the potential of a logistics chain focused on creating values for end consumers of products and services; based on the set of relevant qualitative attributes, the structure of the potential of a logistics chain, including four groups of criteria, is substantiated; a methodology for calculating the potential of a logistics chain is developed. The obtained results will allow us to assess the compliance of the potential of logistics chain with the demands and content of the value of end consumers of products and services; to determine its strengths and weaknesses; to develop measures to adapt the potential of the logistics chain to a specific management situation and create methodological prerequisites for digitalization of the methodology for calculating the potential of a logistics chain.

Keywords: Capability, Logistics, Chain, Value, Factor, Environment.

1. Introduction

Theory and practice confirm that supply chains including enterprises (Coyle et al., 2013), processes (Wisner et al., 2012), relationships (Christopher, 2011), flows (Blackhurst et al., 2012), etc., is a more effective form of entrepreneurial organization than managing these objects separately (Oliver and Weber, 1982). If you use flows, not inventory, as the basis of chains (Goldsby and Martichenko, 2005) and additionally consider value chains (Ramsey, 2005) and demands chains (Rainbird, 2004), then we can talk not only about supply chains, but about logistics chains (Bowersox et al., 2002), since logistics is "the function responsible for the flow materials" (Waters, 2009).

Like almost any management object, the logistics chain has capability (Karagöz and Akgün, 2015) or "the ability or power to do something", which, on the one hand, is predetermined by its ability to create values for end consumers of products and/or services (e.g. Loanne and Webster, 2014) and, on the other hand, these abilities may be limited by environmental factors (e.g. Frolich and Westbrook, 2001), and these factors influence logistics chain links with varying degrees of complexity, speed, and uncertainty.

Measurement, calculation, assessment and development of logistics chain capability are complex challenges as currently:

(1) there is no unified and generally recognized definition of the terms "logistics chain capability" and "logistics capability", including because there is no consensus on the substance and content of the term "logistics" (e.g., Rushton et al., 2010; Straka, 2019);

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(2) a significant number of options have been developed for the structure of the capability of enterprises (Matwiejczuk, 2011), as well as logistics chains (Liu and Xiong, 2013), which significantly complicates its measurement, calculation, assessment and development. At the same time, issues of studying the capabilities of value chains and demand chains remain out of the field of view of specialists;

(3) no consideration is given to factors and trends affecting the behavior of end consumers of products and/or services focused on creating and perceiving value that is "always intangible, heterogeneous, co-created and potentially perishable" (Vargo and Lusch, 2008);

(4) a systematic approach to solving the problem based on accounting for the objects of the logistics chain: enterprises, relationships, processes and flows, as well as the specifics of their measurement, calculation and assessment, primarily those that depend on joint solutions of two or more links of the logistics chain, is ignored; and

(5) does not take into account the need to differentiate between the subject (who manages?) and the objects of management (who or what is managed?), although the low or high capability of the subject of management can lead to degradation or strengthening of the capabilities of the objects of the logistics chain and vice versa.

This article presents a decision to the above problem aspects of measuring, calculating, assessing and developing the logistics chain capability, which should not be confused with the logistics capability (Cho et al., 2008).

2. Literature review

It is impossible to clarify the essence and content of the term "logistics chain capability" without standardizing the term "logistics chain" and its main options, which ensure the transformation of this object into another object on the principle of "from simple to complex" and vice versa. If you share such qualitative attributes and dichotomies of an object as "type of movement of resource flows": sequential and parallel, as well as "stability of parameters and characteristics of resource flows": stable and unstable, then you can justify the following options for logistics systems: channel, chain, front and echelon (Tyapukhin, 2012). In this case, the logistics chain means "a set of links and/or processes of the logistics system that sequentially have a direct or indirect effect on the resource flow in order to change its parameters and characteristics, from the source of origin to the source of absorption". This definition allows us to draw the following conclusions:

(1) the simplest version of the logistics chain is a three-link chain, the intermediate link of which is a focus enterprise (Lambert et al., 1998), establishing and maintaining relationships with the consumer and supplier, as well as creating prerequisites for the formation of an "n"-link chain;

(2) a three-link logistics chain consists of two channels: "consumer - focus enterprise" and "focus enterprise supplier" and is the basis for creating a logistics echelon or network (Lazzarini et al., 2001); and

(3) the logistic chain can be represented in two main forms: a chain in static, including enterprises (Chopra and Meindl, 2007) and relationships between them, and a chain in dynamics, which includes processes (Ayers, 2001) and the resource flows connecting them (Georgi and Kaiser, 2009).

Since the capability extends to a logistics chain entity such as an enterprise, the content of the term "enterprise capability" should be examined. Common characteristics of this term are: focus on achieving efficiency and effectiveness (Barney and Clark, 2007); environmental accounting (Eisenhardt and Martin, 2000); using resources to solve a problem or activity (Hafeez et al., 2002); dependence on "skills and accumulated knowledge realized within organizational processes" (Day, 1994; Olavarrieta and Ellinger, 1997); studying the capability of the enterprise in dynamics (Hayes and Pisano, 1994; Teece, 2007), et al.

In turn, the logistics capability, including logistics chains, has the following attributes: customer satisfaction (GLRT at Michigan State University, 1995; Zhang et al., 2005), improving their quality of service (Lai et al., 2004) and loyalty (Flint et al., 2005); a focus on supply and demand (Morash et al., 1996) as well as information support (Zhao et al., 2001); creating prerequisites for the use of logistics providers (Lai et al., 2004;

Coyle et al., 2013); attributes such as added value, rarity and complexity of imitation (Olavarrieta and Ellinger, 1997); creating prerequisites for integration (Mentzer et al., 2004); the possibility of eliminating uncertainty and risk (Wang et al., 2018); ensuring the sustainability of logistics chains (Ponomarov and Holcomb, 2009) and their flexibility (Naim et al., 2010); dependence on the geographical location of the enterprise (Sharma and Gupta, 2012); as well as a link to innovation (Soosay et al., 2008; Hellström and Nilsson, 2011).

The researchers pay special attention to the study of the structure of logistics capability and logistics chain capability. Saad and Bahadori (2020) have developed a conceptual framework for logistical opportunities in the fractal supply network. Sandberg and Abrahamsson (2011) identified five dynamic components of capability: management knowledge and presence, cross-functional collaboration, control, training, and supply chain relationships. In turn, Zawawi et al. (2017) proposed to consider capability components such as maintenance (timely delivery, product damage and tracking protection system) and flexibility (meeting non-standard special customer requests, handling unforeseen events, flexible operational procedures, and performing reverse logistics operations). Hayes and Pisano (1994) identified five logistical opportunities as drivers for delivering superior value to customers: cost, quality, flexibility, delivery, and innovation. Fawcett and Fawcett (1995) stated that the following capabilities are necessary to achieve optimal operating performance on a global level: delivery speed, quality of service, flexibility, cost, and innovation. According to Ponomarov and Holcomb (2009), opportunities consist of those features, abilities, organizational processes, knowledge and skills that allow the enterprise to achieve superior work. Christopher and Peck (2004) identified four main opportunities for developing supply chain sustainability: (re) design, collaboration, flexibility, and risk awareness. Sabry (2015) proposed to divide the supply chain capability into three groups: external, internal, flyby capabilities and clarified the content of these groups. Liu and Xiong (2013) studied capabilities such as supply, production, logistic sales opportunities and organization, management and their indicators, etc.

To measure and assess the capability of the logistics chain, the authors developed several methods (Li and Cheng, 2007; USAID, 2008; Liu and Xiong, 2013; Lin and Lai, 2017; Logistics clusters, 2019; Aziz et al., 2020; Arabelen and Kaya, 2021, etc.). The purpose of this study is not to refine and supplement the methodology for measuring, calculating and assessing of the capability of the logistics chain, although the qualitative characteristics used in them are further taken into account. Note that in the simplest version, the authors usually identify groups that characterize certain aspects of a this capability, as well as their main indicators. Further, based on expert assessments, each indicator is assigned a weight coefficient and a quantitative parameter, which allows giving an integral assessment not only of the capability of each group of objects, but also of the capability of the logistics chain as a whole.

The study made it possible to formulate the following questions, the answers to which characterize its scientific novelty:

RQ1: What is the essence and content of the logistics chain capability based on supply chains, demand and value?

RQ2: How to identify options for the capability of a logistics chain focused on value creation for end consumers of products and/or services?

RQ3: How to shape the capability structure of the logistics chain taking into account its main objects?

RQ4: How to identify options and create a sequence for calculating the capability of the main objects and the logistics chain as a whole?

3. Methodology

The capability of the logistics chain and its main objects: enterprises, relationships, processes and flows are described mainly by qualitative characteristics, the measurement of which is associated with significant difficulties due to the wide variety of these characteristics, on the one hand, and the lack of a scale and tools for measuring them, on the other hand. This aspect significantly limits the ability to measure, calculate, assess and

develop the capability of the logistics chain. Therefore, the following methods of study were chosen:

(1) a descriptor method based on the analysis of literary sources and/or the results of sociological surveys of specialists in the field of logistics and chain management, allowing to identify and substantiate a set of relevant qualitative characteristics of objects of the logistics chain, as well as their dichotomy; and

(2) a faceted method that objects structuring and formalization of these objects, the tools of which are binary matrices that allow obtaining "2^x" versions of the objects under study (e.g., Bailey, 1994), where the number "2" reflects the number of dichotomies, and x is the number of qualitative characteristics of the object under study. Binary matrices allow you to develop a classification of variants of objects, components and elements within the framework of a research method such as analysis. Using these options, more complex combinations of research objects based on synthesis can be formed. Any binary matrix-derived combination of object variants is processed using deduction and induction methods.

The main advantage of the above methods is the possibility of full use of a systematic approach to the formation of a logistics chain capability structure, as a result of which the components and elements of the studied objects have common qualitative attributes and dichotomies, which allows not only to digitize them, but also to trace the transformation of one component or element into another component or element depending on the specific management situation.

4. Results

4.1 The essence and variants of the logistics chain capability

Summarizing the various points of view on the essence and content of the term "logistics", it can be concluded that logistics can be perceived either as a concept of managing the flow of material, information, financial and human resources (Ayers, 2001), or as a type of enterprise activity, including operations such as transportation, storage, consolidation, disaggregation, sorting, labeling, packaging, etc. (Tyapukhin, 2012). In accordance with this point of view, the terms "logistics chain capability" and "logistics capability" should be distinguished. Taking into account the previously identified characteristic features of these capabilities and theoretical prerequisites of the study, the following definitions are proposed:

The logistics chain capability is the ability of objects, as well as management objects: enterprises, relationships, processes and flows to create values for end consumers of products and/or services and ensure sustainable development of the chain taking into account environmental factors; Logistics capability is the ability of objects and management objects to concentrate, distribute, store and move material, information, financial and human resources in accordance with the requirements of consumers of products and/or services.

The peculiarities of these definitions are: the possibility of isolating logistics capability from the capability of the logistics chain, as well as any other types of capability: marketing, technological financial, human, etc.; delimitation of objects with responsibility and authority and management objects that contribute not only to the creation of values, as one of the options for customer service, but also to the fulfillment of consumer demands in the links of value chains, demands and supplies; orientation of the chain to create value not only for end consumers of products and/or services, but also for each of its links; impact of the efficiency of logistics operations on the parameters and characteristics of management objects, etc.

Among the main features of the logistics chain capability is its focus on creating value for end consumers of products and/or services. It should be noted that the term "meaning" is also ambiguously understood. However, most experts agree that value characterizes "the amount that buyers are willing to pay for what the firm provides" (Porter, 1985). In other words, the consumer estimates the difference between what they expected to receive (the desired value) and what they received (the perceived value) and what they received (the perceived value) and what they spent on it. In addition, the term "value" refers to product and process attributes (Lancaster, 1975; Browning, 2003), experience (Pawar et al., 2009), consumer perception of product and process (Woodruff, 1997), etc. It can be hypothesized that these types of value and the difference between them can be predetermined by

consumer preferences, which in turn are formed by components of the 4P marketing complex (McCarthy, 1964), such as “product” and “price”, with the product differing in quantity and quality, and the price depending on the cost or time to create the product. This aspect of the studies is presented in Figure 1.

	The component of the marketing complex “Price” Costs Z (0)	Time T (1)
Quantity N (0)	The difference between the price Ps products and/or services, and the costs Zc, «Z – N» (00)	The difference between the Tc and Ts execution times of the same consumer order, «T – N» (01)
The component of the marketing complex “Product” Quality Q (1)	The difference between specialized Ac and basic As attributes of products and/or services, «Z – Q» (10)	The difference between the attributes of innovative Asi and traditional As types of products and/or services, «T – Q» (11)

Figure 1 Classification of consumer value components of products and/or services

As it follows from Figure 1, at least four components of consumer value of products and/or services can be distinguished: economic, code “00”, marketing, code “10”, logistic, code “01”, and innovative, code “11” values. This conclusion allows to establish the interrelations between components and types of consumer value of products and/or services (Figure 2).

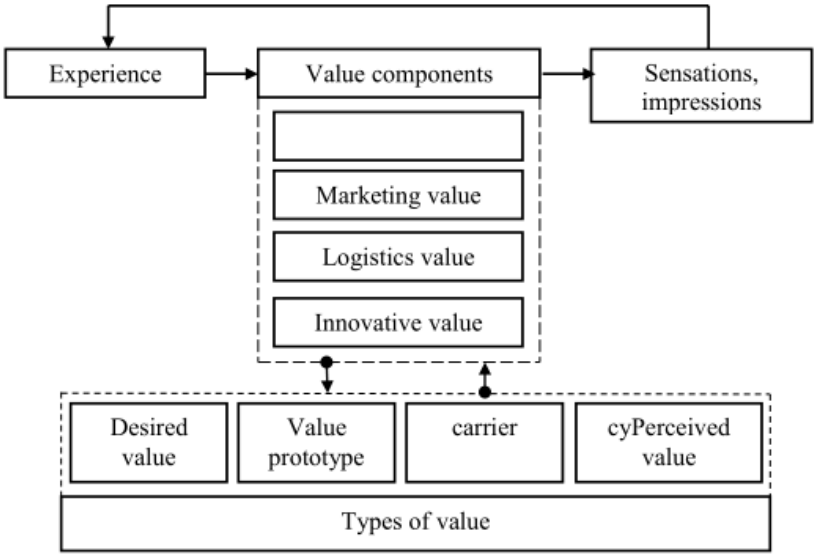

Figure 2 Interrelations between components and types of consumer value

Figure 2 shows that the consumer’s experience of products and/or services allows them to receive four components of value individually or jointly through sensations and experiences that in turn change or replace their previous experience. At the same time, each value component can undergo changes from desired to perceived value, which also affect the experience of the consumer of products and/or services.

The information in Figure 2 allows you to develop methods for developing the capability of the logistics chain (Table 1), such as reducing costs and lost profits, differentiating products and/or services, reducing the customer’s order time, and creating and implementing innovations.

Each of these methods is implemented in a typical management situation, respectively, when the supplier price or consumer costs exceed the price that the consumer is willing to pay (PC < PS); when the product attributes and/or services offered by the supplier do not correspond to the attributes required by the consumer (AC > AS); when the supplier’s order execution time exceeds the customer’s order waiting time (TC < TS), and when the innovation attributes do not make a proper impression on their possible customer (ACi > AC).

Table 1 Components, situations and methods of developing the logistics chain capability

Components and ciphers of value	Situation	Methods
Economic value (00)	PC < PS	Reducing costs and lost profits
Marketing value (10)	AC> AS	Differentiating products and/or services
Logistics value (01)	TC< TS	Reducing customer order fulfillment time
Innovative value (11)	AC> ASI	Creating and implementing innovations

If we take as a basis the main objects of the logistics chain: enterprises, relationships, processes, flows and combine them with the components of consumer value of products and/or services (Figure 2), then we can justify the options for the basic capabilities of the logistics chain (Figure 1, Table 2).

Table 2 Variants of basic logistics chain capabilities

Value components, Fig. 2	Logistics chain objects			
	The chain is static (E – R)		The chain is dynamics (P – F)	
	Enterprise E	Relationships R	Process P	Flow F
Economic value	E:(Z – N)	R:(Z – N)	P:(Z – N)	F:(Z – N)
Marketing value	E:(Z – Q)	R:(Z – Q)	P:(Z – Q)	F:(Z – Q)
Logistics value	E:(T – N)	R:(T – N)	P:(T – N)	F:(T – N)
Innovative value	E:(T – Q)	R:(T – Q)	P:(T – Q)	F:(T – Q)

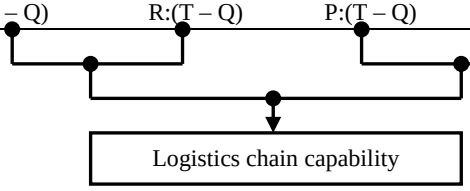

Table 2 shows that a full-scale assessment of the capability of the logistics chain involves the measurement, calculation and assessment of 16 options for its basic capabilities. To solve this problem, it is advisable to measure and assess the capability of each object with its orientation to a specific component of the value of the consumer of products and/or services, for example, E: (Z - N), etc. Next, it is possible to measure, calculate and assess either the component of value as a whole, for example, economic value, or the capability of a logistics chain object, for example, an enterprise. As follows from Table 2, it is then possible to measure the capabilities of the logistic chain in static and dynamic and finally measure and estimate the capability of the chain as a whole. Obviously, the solution to this problem is laborious, therefore it is subject to digitalization with the further creation of a digital twin not only of logistics chains, but also of managing these chains, that is, a non-physical object.

An important aspect of the study is the rationale for the logistics chain capability structure and its components. Since Table 2 presents 4 value components, one of the four variants of these components in relation to the innovative value of the consumer of products and/or services is shown as an example.

The basis for solving this problem is the approach presented in Table 2, which, among other things, allows you to assess the capability of the enterprise, which is a logistics chain consisting of business units, relationships between them, processes and flows within the enterprise. In some cases, it is advisable to select a resource flow as the main object by measuring and assessment of the logistics capability of the chain, since the flow has start, intermediate and end points (enterprises or its subdivisions), and the processes that are consistent when creating relationships between flow point enterprises are used to manage this flow.

In order to justify the components of the “enterprise” object, variant E: (T - Q), it is advisable to divide it into a subject and a management object. The allocation of the management object should create the prerequisites for measuring, calculating and assessing of the capability of other objects presented in Table 2, including logistics capability, as well as relationship and process management capabilities in logistics chains, if it is necessary. Important aspects of solving this problem are the justification of the components of the supply chain management

system, which is achieved using the following qualitative attributes and dichotomies: "components that characterize the person making the management decision": beliefs (professional and moral principles) and behavior, as well as "factors for obtaining the desired result": technology (what to get and how?) and resources (what is needed and where can you get the desired result?). The joint use of these attributes and dichotomies makes it possible to justify such components of the management system as values, goals, powers and structure (Figure 3), and the value of the consumer is the result, the goals form the criteria for creating and perceived value, the powers are aimed at obtaining the result using the functions corresponding to these powers.

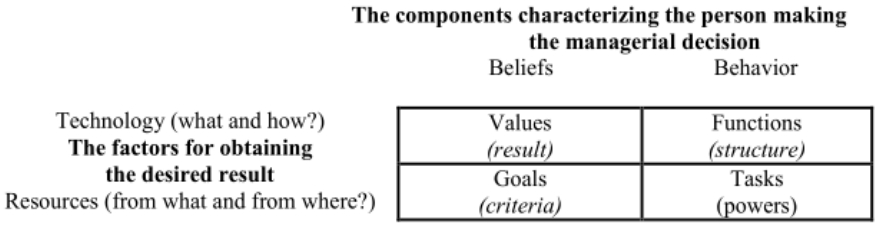

Figure 3 Classification of management system components

The components of the management system presented in Figure 3 can positively affect the capability of an enterprise or logistics chain if its components such as knowledge, skills, abilities and competencies are involved in this (Figure 4).

These components are typical not only for the management subject or managers, but also for the performers, in addition to which it is possible to distinguish such components of the management object as technologies, resources (including performers), infrastructure and property (Figure 5).

In accordance with the components of the object "enterprise", it is possible to distinguish the components of the logistics chain capability that are adequate to them: sustainability, effectiveness, efficiency and availability. Recall that the list of these components may be different depending on the type of consumer value of products and/or services (Figure 2).

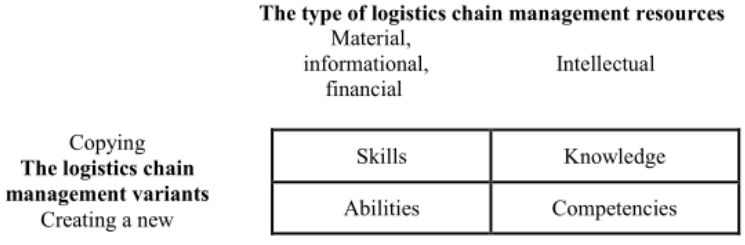

Figure 4 Classification of the components of the capability of the logistics chain management subject

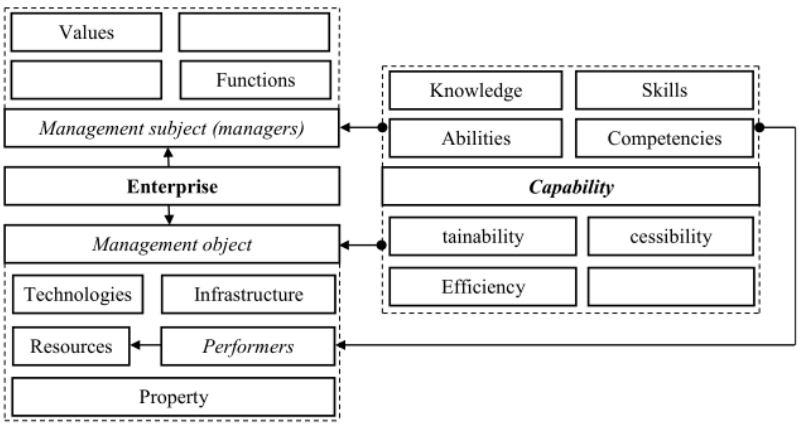

Figure 5 Components of the enterprise's capability as an object of the logistics chain (variant E: (T-Q), Table 2)

The justification of the components of the object "relationship" should be started with the separation of two phases of its use:the establishment and development of relations between the links of the logistics chain(Figure6).

The first phase of the use of the "relationship" management object includes the stages of communication, discussion, coordination and, finally, the organization of interaction. As shown in Figure 6, the following components of the logistics chain capability fully correspond to these phases: responsiveness, relevance, correctness and responsibility.

In turn, the "development" phase includes the following stages: support for relations, assistance, integration and cooperation. Based on these stages, components of the logistics chain capability can be formed: interest, openness, creativity and preventive.

The logistics chain object "process" can also be divided using two main classification attributes, such as "value creation" and "value accompaniment". If Cooper et al. (1997), then value creation processes include: order fulfillment, production management, product development and commercialization, as well as return management. In turn, the value maintenance processes include flow management, demand management, and customer and supplier relationship management (Figure 7).

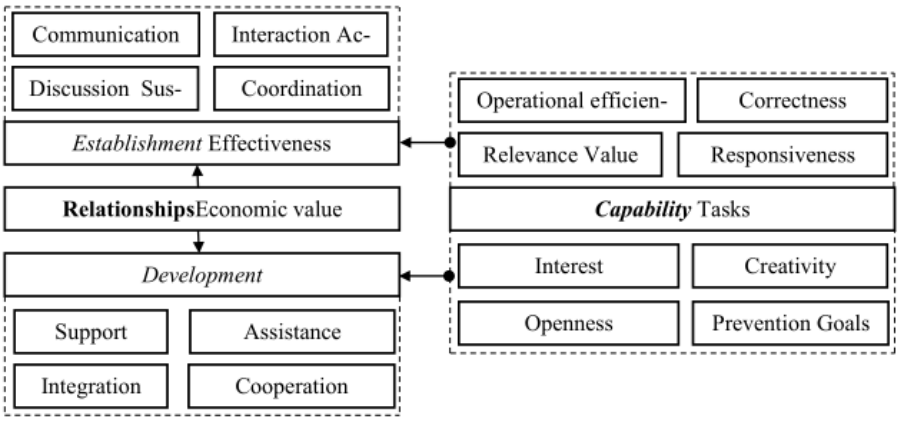

Figure 6 Components of the capability of relationships as an object of the logistics chain (variant R:(T-Q), table 2)

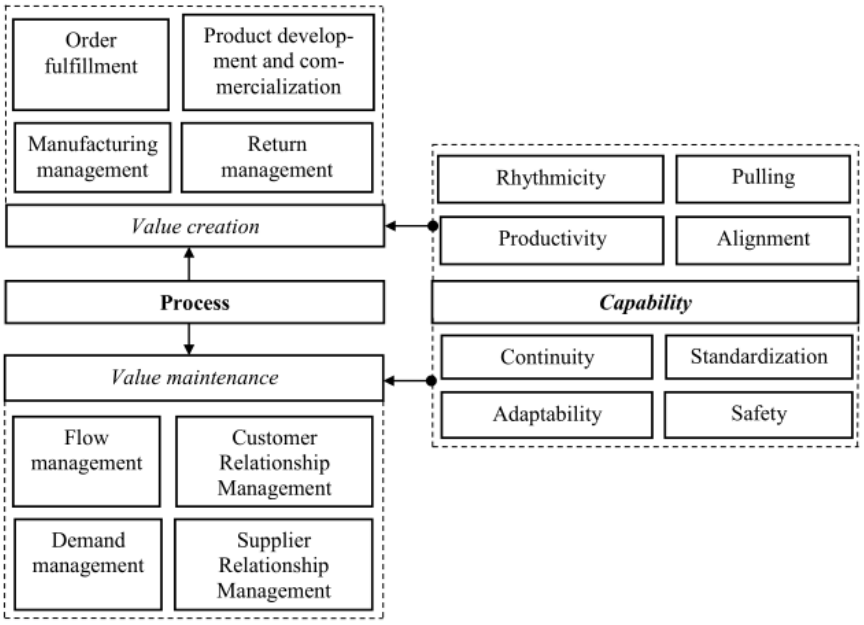

Figure 7 Components of the process capability as an object of the logistics chain (variant P:(T-Q), table 2)

The first group of processes is characterized by such components of the logistics chain capability as rhythmicity, productivity, pulling and alignment (Liker, 2004), and the second group: continuity, adaptability, standardization and safety. In this case, it is possible to recommend the use of the components listed above for

any process, regardless of used classification attribute, if this corresponds to the purpose of the study.

The logistics chain object "flow" is of the greatest interest, since the term "logistics capability" is formed on its basis, as well as other functional capabilities. It is useful to use the classification attributes "resource type" and "logistics chain type" to measure, calculate, and assess logistics chain capability. When using the first classification attribute, the flows of material, information, financial and human resources are taken into account, and when using the second classification attribute:

(1) for the value chain: flows of intuition, logic, consultation and alternatives;

(2) for a demand chain: proposals, approvals, documentation and solutions; and

(3) for supply chains: machinery, technology, authority and instructions (Figure 8).

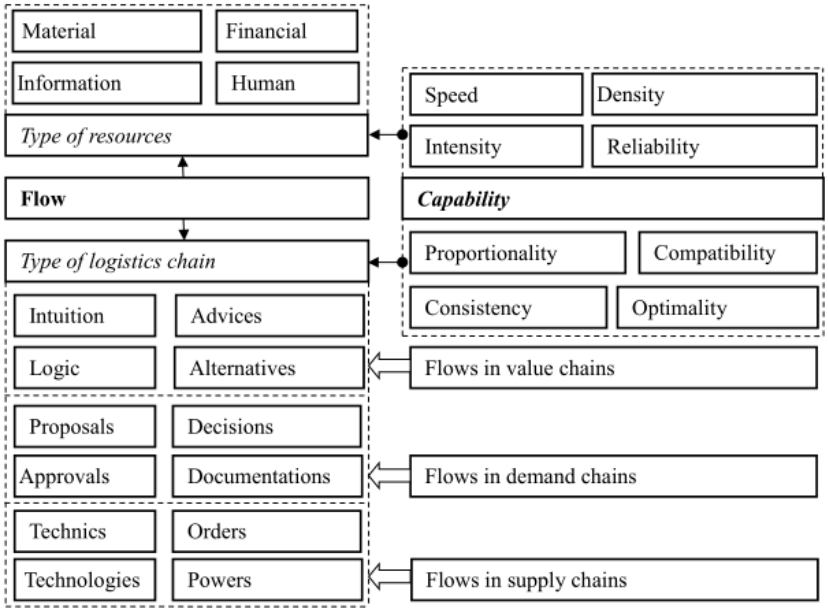

Figure 8 Components of the flow capability as an object of the logistics chain (variant F: (T-Q), Table 2)

According to these flow types, the following logistics chain capability components can be distinguished:

(1) by resource type: speed, intensity, density and reliability:

(2) by type of logistics chain: proportionality, consistency, compatibility, and optimality.

The information presented in Figures 5-8 provides the simplest algorithm for measuring, calculating and assessing of the capability of a logistics chain (Table 3). This Table presents not only alphanumeric codes, but also binary ciphers of the capability components of the logistic chain, as well as formulas for its calculation.

Chain capability components are assessed by the quantitative parameters eij, rij, pij and fij; each component is assigned a weight kij, lij, mij and nij.. From the formulas given in Table 3, integral parameters of groups E1 and E2, R1 and R2, P1 and P2, as well as F1 and F2 are calculated. Then, by analogy, the parameters of the capabilities of the objects of the logistic chain E, R, P and F. Based on these parameters, the parameters of the chain in statics ER, the chain in dynamics PF and, finally, the logistic chain LC are determined. If necessary, the capability of LC can be calculated using other refined methods mentioned earlier.

4.2 Variants and sequence of calculation of the capability of the main objects and the logistics chain as a whole

The information presented in Table 3 is incomplete, since, on the one hand, it does not take into account the peculiarities of the formation of capabilities of the main objects of the logistics chain, and, on the other hand, ignores the influence of environmental factors on them. To solve these problems, consider a five-way logistic chain in static, including the focus enterprise FE, consumer C and supplier S, as well as consumer CC and supplier SS (Figure 9).

Table 3 Codes and ciphers of the main components of the logistics chain capability, as well as formulas for its calculation

Components of the logistics chain capability			
Chain in statics (0)			
Enterprise "e" (00)		**Relationships "r" (01)**	
Subject "e1" (000)	Subject "e2" (001)	Establishment "r1" (010)	Development "r2" (011)
Knowledge "e11" (00000)	Effectiveness "e21" (00100)	Operational efficiency "r11" (01000)	Interest "r21" (01100)
Abilities "e12" (00001)	Efficiency "e22" (00101)	Correctness "r12" (01001)	Openness "r22" (01101)
Skills "e13" (00010)	Sustainability "e23" (00110)	Relevance "r13" (01010)	Creativity "r23" (01110)
Competencies "e14" (00011)	Accessibility "e24" (00111)	Responsiveness "r14" (01011)	Prevention "r24" (01111)
E1 + e14*k14= e11*k11+ e12*k12 + e13*k13	E2= e21*k21 + e22*k22 +e23*k23 + e24*k24	R1= r11*l11 + r12*l12 + r13*l13 + r14*l14	R2= r21*l21 + r22*l22 + r23*l23 + r24*224
Enterprise capability: E = E1*K1+ E2*K2		Relationships capability: R = R1*L1+ R2*L2	
Capability of the chain in statics: ER = E*K12+ R*L12			
Chain in dynamics (1)			
Process "p" (10)		**Flow "f" (11)**	
Value creation "p1" (100)	Value maintenance "p2" (101)	Type of resources "f1" (110)	Type of logistics chain "f2" (111)
Rhythmicity "p11"(10000)	Continuity "p21" (10100)	Speed "f11" (11000)	Proportionality "f21" (11100)
Productivity "p12" (10001)	Adaptability "p22" (10101)	Intensity "f12" (11001)	Compatibility "f22" (11101)
Alignment "p13" (10010)	Standardization "p23" (10110)	Density "f13" (11010)	Consistency "f23" (11110)
Pulling "p14" (10011)	Safety "p24" (10111)	Reliability "f14" (11011)	Optimality "f24" (11111)
P1= p11*m11+ p12*m12 + p13*m13 + p14*p14	P2= p21*m21 + p22*m22 +p23*m23 + p24*m24	F1= f11*n11 + f12*n12 + f13*m13 + f14*m14	F2= f21*n21 + f22*n22 + f23*n23 + f24*n24
Process capability: P = P1*M1+ P2*M2		Flow capability: F = F1*N1+ F2*N2	
Capability of the chain in dynamics: PF = P*M12+ F*N12			
Logistics chain capability: LC = ER*Q1+ PF*Q2			

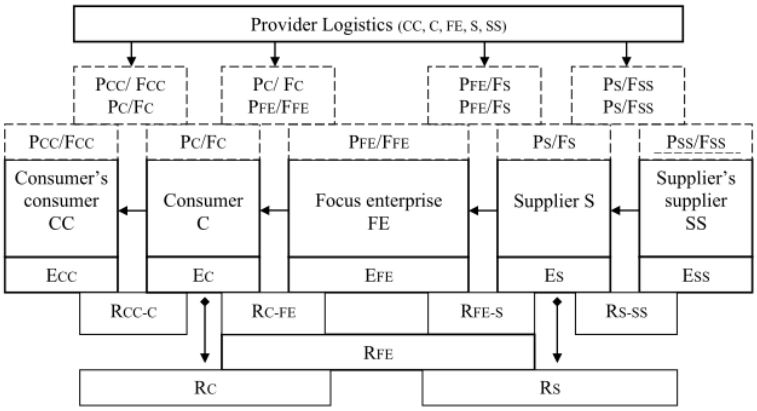

Figure 9 Options for calculating the logistics chain capability

As it is shown in Figure 9, this chain is formed of 4 logistic channels SS-S, S-FE, FE-C and C-CC. For each logistics chain link, you can calculate the capabilities of the Ei enterprises, Pi processes and Fi flows, on the basis of which the capabilities of channels (ECC/PCC/FCC→EC/PC/FC), (EC/PC/FC→EFE/PFE/FFE),

(EFE/PFE/FFE→ES/PS/FS) and (ES/PS/FS→ESS/PSS/FSS) are subsequently formed. At the same time, the capabilities of relationships in the logistics chain are formed differently. First, the relationship between the consumer CC and the consumer C is formed and the RCC-C channel capability is calculated. Further, the consumer C formalizes its relations with the FE focal enterprise, which have the capability of the RC-FE channel. Using the RCC-C and RC-FE capability information, the capability of the RC provider can be determined. The capabilities of RFE, RS and RSS relationships are calculated in the same way. The capability of the RCC can be calculated based on the capability of the RCC-C channel or the front of the consumer relationship of the CC consumer with the Ci consumers, as well as similar capabilities of other links of the investigated logistics chain.

Determining the features of calculating the capabilities of logistic fronts and echelons is the goal of further research. The solution to this problem is extremely relevant due to the possibility of using any type of PL providers in logistics systems that serve several links of the investigated channels, chains, fronts and echelons at the same time. In this case, the person making management decisions will have to compare the capabilities of two options for logistics systems: with and without a logistics provider and determine which option will be more effective for a specific logistics system. At the same time, the task of measuring, calculating and assessment of the capability of a logistics provider serving several logistics systems, which are affected to varying degrees by environmental factors, needs to be solved. Note that to date, the author has not identified the recommendations of specialists on solving these problems or, at least, approaches to solving them.

The need to measure, calculate and assess the impact of environmental factors on the capability of the logistics chain predetermines the development of a classification of options for their impact on the objects of this chain and on the logistics chain as a whole. To justify these options, the following qualitative attributes and dichotomies should be used: "the amplitude and frequency of deviations in the parameters and characteristics of the subject and subject of management under the influence of environmental factors": insignificant and significant. The joint use of these attributes and dichotomies involves taking into account the following options and modes of behavior of the management object: disturbance, code "00", mode "stability", calls, code "01", mode "adaptation", threats, code "10", mode "counteraction", and destruction, code "11", mode "survival" (Figure 10).

	The amplitude of deviations of parameters and characteristics	
	Insignificant (0)	Significant (1)
Insignificant (0) **The frequency of deviations of parameters and characteristics** Significant (1)	Disturbances (00) Mode: "sustainability"	Challenges (01) Mode: "adaptation"
	Threats (10) Mode: "counteraction"	Destruction (11) Mode: "survival"

Figure 10 Classification of environmental factors' impacts on the logistics chain

The information presented in Figure 10 and in Table 3 makes it possible to clarify the sequence of calculating the logistics chain capability, taking into account the impact of environmental factors (Figure 11).

At the beginning, the study object is a focus enterprise, which, among other things, may be the end consumer of products and/or services. As it was previously shown, a focal enterprise can be represented as a micro level logistics chain that includes a chain in statics (enterprise units and relationships between them) and a chain in dynamics (processes performed by the units and the flows connecting them). For each type of micro-level logistics chain, capabilities can be measured and estimated.

When measuring, calculating and assessing the capability of this type, it is necessary to take into account the options for the impact of environmental factors on this enterprise (Figure 10). Next, it is necessary to proceed to measuring and assessing the consumer - focus enterprise channels in static and dynamic, taking into account the fact that environmental factors have different effects on the results of the interaction of these links of the logistics chain.

If in the second stage of measuring, calculating and assessing the capability, the focus enterprise acted as a

supplier, then in the third stage it acts as a consumer. At this stage, the capabilities of the focus enterprise - supplier channels are calculated in static and dynamic and beyond the logistics chain as a whole.

The results of the study set forth in this article create the necessary methodological prerequisites for the digitalization of objects and measurement processes, calculating and assessing the capability of not only three-link logistic chains, but also an "n"-link chain based on them, which makes it possible not only to respond in a timely manner to changes in environmental factors, but also prevent the occurrence of "bottlenecks" in this chain, since reducing the capability of at least one link reduces the capability of the chain as a whole while reducing the synergistic effect, The impact of which on logistics chain management has not been sufficiently studied.

5. Discussion

The problem of measuring, calculating and assessing the capability of such a complex object as a logistics system has many aspects. The theoretical aspects of this problem include, in particular, the imperfection of the terminological apparatus, which is especially clear when trying to create a definition of a term based on a combination of two or more terms having different formulations; impossibility of using unified scales and tools for measuring vaguely formulated research objects; variety of variants of components and data elements of objects, as well as complexity of their identification, structuring and digitalization.

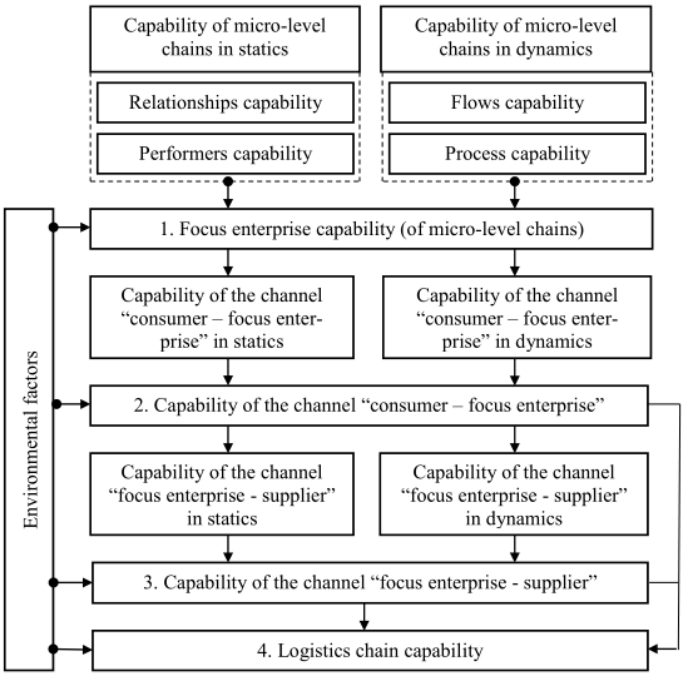

Figure 11 The sequence of calculating the logistics chain capability, taking into account the impact of environmental factors

Methodological aspects of the problem consist in the difficulty of highlighting the criteria for the optimality of research objects, determining the nature of their priorities and relationships, as well as development trends; determining the modes of operation of these objects and their combinations that are most adequate to a specific management situation; selection of principles, approaches and methods for managing these objects.

The practical aspects of the problem are related to the difficulties of assessing the lost profits of the links of the logistics chain and at the joints between them; determining the optimal value of the capability of the chain of this type at the stages of value management, demands and supplies; designing and forming relationships, establishing responsibility, delegating authority, selecting the organizational structure of management, using outsourcing, etc.

Almost each of the above aspects of the problem of measuring, calculating and assessing the capability of the logistics system is the subject of discussion, including on the topic of this study.

6. Conclusion

Despite the significant amount of information related to the problem of maximizing the use and development of the capability of logistics chains, the latest events regarding the COVID-19 pandemic, aggravation of political disagreements, the introduction of various kinds of sanctions, etc., confirm that it is not only not eliminated, but constantly mimics and manifests itself in various forms and with varying degrees of impact, threatening the well-being of the population and provoking social conflicts. In this regard, the relevance of obtaining new scientific results and finding solutions that create the prerequisites for sustainability and sustainable business development is increasing.

This article clarifies the essence and content of the terms "logistics chain capability" and "logistics capability", defines the main options for the capability of the logistics chain focused on creating values for end consumers of products and/or services; proposed structure of logistics chain capability; options are justified and a sequence of calculation of the capability of the main objects and the logistics chain as a whole is developed.

In the course of further studies, it is planned to clarify and supplement the methodology for measuring, calculating and assessing the capability of the logistics chain and logistics capability in accordance with their author's definitions; justify the methodological approach to digitalization of objects, components and capability elements of this type; develop recommendations for managing the capability of the logistics chain taking into account environmental factors and their ambiguous impact on the links of this chain.

Conflict of interest

The authors declare that there is no conflict of interest.

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