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Research Article

Development of Unified, Digital, and Local Terms for “Supply Chain Management”

Alexey Petrovich Tyapukhin

Orenburg branch, Russian Academy of National Economy and Public Administration, Russian Federation

KEYWORDS

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supply chain management
identification series
classification attribute
dichotomy
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management decision

ABSTRACT

To gain additional competitive advantages in the digital economy, supply chain links need to continuously improve management theory and methodology based on the development and implementation of decisions characterized by minimal loss of profits. This problem can be eliminated through the coordinated actions of those making and implementing management decisions. An effective reserve that allows achieving this is the terminology of Supply Chain Management, the structure and content of which are far from ideal. The purpose of this article is to develop recommendations for the creation of a hierarchically ordered system of digitalized terms for “Supply Chain Management” in accordance with the organizational structure for managing links and supply chains. To achieve this purpose, terminological analysis, descriptive and faceted methods, or the TDF methodology, based on a systematic approach to the study of non -physical objects in Supply Chain Management, were used. The article develops a set of unified terms “Supply Chain” and “Supply Chain Management”, formed on the basis of ordered management objects and components of the management system, and also creates prerequisites for structuring and digitalizing the unified terms for “Supply Chain Management” vertically and horizontally of organizational structures for managing links and supply chains. The obtained results create theoretical and methodological prerequisites for the creation of artificial intelligence operating non-physical objects of management, and further a digital twin of not only for supply chains, but also for the management of these chains, allowing management decisions to be made that are characterized by minimal lost profits.

*CORRESPONDING AUTHOR

Alexey Petrovich Tyapukhin; Orenburg branch, Russian Academy of National Economy and Public Administration, Russian Federation; Email: aptyapuhin@mail.ru

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1. Introduction

One of the most popular terms in management science and practice is the term for "Supply Chain Management" [1-2]. However, starting with the justification of this term by Oliver and Weber [3], and up to the present day, attempts have been made to: firstly, to eliminate contradictions in the views on the essence and content of the term [4]and on its basis to create a unified term for "Supply Chain Management" [5]; and secondly, to use the term in its various versions to create derivative terms such as "Sustainable Supply Chain Management" (e.g., [6]) or "Digital Supply Chain Management" (e.g., [7]). In justifying these terms, the deficiencies of the term "Supply Chain Management" are added to the deficiencies of the specificity of its variants, which leads to problems with their use in practice (e.g., [8]).

After 40 years of research into the term for "Supply Chain Management" and unsuccessful attempts to come to a more precise understanding of its essence, it should be recognized that this is not only impossible, but also impractical. This conclusion is confirmed by the fact that supply chain links pursue their own goals, which can change significantly depending on the nature of the impact of various external and internal environmental factors on them. Under these conditions, links are forced to adjust their priorities of Supply Chain Management or, in other words, change the idea of this type of management in specific management situations. Moreover, if a supply chain link uses a hierarchical management structure, then, at each level, decision makers should be guided by their own and, at the same time, organize a vision of Supply Chain Management that is characteristic of that link. For example, they are forced to switch from the management object "process" (the highest level of management) to the management objects "function" (the middle level of management) and further along the hierarchy – "operation" (the lowest level of management). The same can be said for another hierarchy: "enterprise → department → division", etc. This aspect is especially relevant to enterprises using holacracy [9]. In this type of enterprise, any employee can initiate management decisions that must be consistent with the term "Supply Chain Management" that is relevant to this enterprise in a specific management situation. It should be taken into account that chains are formed in almost every workplace and are then integrated and coordinated along the management hierarchy, up to global supply chains (e.g., [10]). This means that local terms for "Supply Chain Management" should be integrated into a global term that characterizes this type of management, eliminating possible contradictions between these terms at the junction between adjacent links in the supply chain, and possibly within them.

It follows that in order to achieve as yet unknown competitive advantages in the digital economy, the term for "Supply Chain Management" should be more precise in form and content: firstly, it should be unique for each link in the supply chain, due to its obvious differences from adjacent links. That is, there should be many such terms; secondly, flexible enough, that is, it can adapt to a specific management situation with changing priorities in Supply Chain Management objects; thirdly, hierarchically ordered in accordance with the organizational structure of each link and the supply chain, as well as the functions performed by persons making and implementing management decisions; and fourthly, digitalized in accordance with the concept of "Industry 5.0" [11].

The last aspect of the requirements for the term "Supply Chain Management" is extremely important from the point of view of digitalization of this type of management. While it is not difficult for a person to come to terms with the unresolved problem of Supply Chain Management terminology, while admitting, in practice an increased loss of profit [12], for a computer and software, the solution to this problem is extremely urgent. It should be noted that terms such as "Supply Chain Management" are not physical objects that are so attractive to the vast majority of researchers who operate with quantitative indicators. However, only through the successful digitalization of Supply Chain Management terminology will the preconditions be created for developing more effective management decisions, which in themselves are non-physical objects, as well as for structuring them down to elementary tasks for each employee in the supply chain. Thus, the implementation of these decisions while simultaneously reducing or eliminating cross-functional barriers will be accompanied by minimal lost profits, which is the main reserve for increasing the competitiveness of not only of the links, but also of the supply chain as a whole [13].

The hypothesis of this study is the assumption about the possibility of increasing the efficiency of Supply Chain Management based on the improvement of its terminology. Confirmation of this hypothesis is based, on the one hand, on an analysis of the essence of previously created terms “Supply Chain Management”, and, on the other hand, on the use of the TDF methodology, including terminological analysis, descriptor and facet methods for qualitative research of complex management objects [14].

The novelty of this study is due to the features of non-physical objects in Supply Chain Management ignored by most researchers, the digitalization of which will allow the creation of artificial intelligence that operates not only on physical but also on non-physical management objects. If this intelligence is created, it will be possible to develop and practically apply management decision support systems [15] aimed at minimizing lost profits in supply chains, as the basis for the digital twins of these chains [16], and in the future, also for value and demand chains.

The objectives of this study include:

(1) development of standard versions of the unified term for “Supply Chain Management” based on the analysis of the essence and content of 290 management terms of this type, as well as

(2) creation of prerequisites for the structuring and digitalization of the term for “Supply Chain Management” vertically and horizontally in organizational structures for managing links and supply chains.

2. Literature Review

The methodology for achieving the first research objective consists of the following steps:

- First, a set of pre-existing terms for "Supply Chain Management" (SCM) is identified.
- Second, duplicate and near-identical terms are removed from this set.
- Third, the remaining SCM terms are systematized into two primary categories: "Management" (the subject) and "Supply Chain" (the object). These categories are then classified further according to key management objects—such as "enterprise,""relationships,""process," and "flow"—and components of the management system—including "goal,""objective,""approach,""principle,""method," and "function"[17].
- Fourth, the options within each group of management objects and system components are identified, systematized, and ranked to determine which best characterize SCM.
- Fifth, the most prevalent options for management objects and system components are identified based on the Pareto principle.
- Finally, a unified definition of "Supply Chain Management" is developed. This definition incorporates the most popular options for these objects and components, reflecting their relative importance as determined by the terminological analysis. It should be noted that this term is primarily intended to delineate the specifics of SCM in comparison to other management approaches, rather than for practical application or digitalization.

It is necessary to point out an important difference between the methodology used in this article and the methodology of Stock and Boyer [5] which focused on a larger group of Supply Chain Management features, such as activities; benefits; and constituents/components. This difference consists in identifying the main management objects and components of the Supply Chain Management system and substantiating, on the one hand, complex objects, and, on the other hand, derivative objects and components, which make it possible to develop not one term, but a set of interrelated terms for "Supply Chain Management" in accordance with the organizational structure of links and supply chains.

In accordance with the above sequence of actions, 356 terms of Supply Chain Management were identified in the Google search engine. In the process of studying these terms for their suitability for terminological analysis, 66 terms were rejected, after which 290 remained. The results of studying the essence and structure of this set are presented in Table 1.

The analysis of the contents of this Table allows us to draw the following conclusions:

- Firstly, Table 1 is divided into two parts A and B horizontally. Part A includes the main objects of Supply Chain Management and is based on 499 references to these objects within the terms under study. The terminological analysis showed that the main objects of Supply Chain Management include enterprises [18]; relationships between enterprises [19]; processes (e.g., [20]) and resource flows (e.g., [21]). The correctness of identifying these objects as the main objects of Supply Chain Management is confirmed using the following classification attributes and dichotomies: the "supply chain impact stage": designing and creating the supply chain, symbol "0", managing the supply chain to create value for consumers of products and services, symbol "1", and the "activities within the supply chain": resource processing using appropriate technologies, symbol "0", and resource acquisition/transfer using logistics management (Figure 1).

Table 1. Results of the analysis of 290 terms for "Supply Chain Management".

A. MANAGEMENT OBJECTS (7 or 100 %)	
1	2
I. Main versions	II. Derived versions
Enterprise (16 or 10,5 %): - organization (49 or 32,0 %); - company (46 or 30,0 %) → 62,0 %. Result: 153 or 30,7 % of references to the main versions of the "enterprise" object	- customer (235 or 43,0 %); - supplier (110 or 20,2 %); - manufacturer (25 or 4,6 %) → 67,9 %. Result: 545 or 100,0 % references to derived versions of the "enterprise" object
Relationship → 3,2%. Result: 16 or 3,2 % of references to the "relationship" object	- demand (22 or 21,7 %); - requirements (19 or 18,7 %); - linking (13 or 12,8 %) → 53,2%. Result: 102 or 100,0 % references to derived versions of the "relationship" object
Process (128 or 53,3 %): - activity (95 or 39,6 %); - operation (15 or 6,3 %) → 99,2%. Result: 240 or 48,1 % of references to the main versions of the "process" object	- deliver (70 or 11,5 %); - distribution (55 or 9,0 %); - production (46 or 7,5 %) → 28,0%. Result: 609 or 100,0 % references to derived versions of the "process" object
Flow → 18,0 %. Result: 90 or18,0 % of references to the "flow" object	- product (421 or 59,2 %); - services (113 or 15,9 %); - information (75 or 10,4 %); - finances (28 or 3,9 %) → 89,4 %. Result: 715 or 100,0 % references to derived versions of the "flow" object
Result: 499 or 100,0 % of references to the "MANAGEMENT OBJECT"	
B. OBJECT MANAGEMENT (137 or 80,1 %), philosophy (9 or 5,2 %), concept (7 or 4,1 %) → 89,4% 171 or 100,0 % of references to the "(object) management" object	
Goals → 16,8 %. Result: 14 or 16,8 % of references to the "goals" object	- value (62 or 27,7 %); - efficiencies (44 or 19,7 %) → 47,4 %. Result: 225 or 100,0 % references to derived versions of the "goals" object
Objectives → 12,5 %.	- cost (43 or 36,7 %); - location (39 or 12,7 %); - quantity (12 or 10,2 %) → 59,6%.

Result: 11 or 12,5 % of references to the “objectives” object	Result: 117 or 100,0 % references to derived versions of the “objectives” object
Principles → 1,1 %. Result: 1 or 1,1 % of references to the “principle” object	- pipeline (3 or 75,0 %); - commitment (1 or 25,0 %) → 100,0 %. Result: 4 or 100,0 % references to derived versions of the “principle” object
Approaches → 13,6 %. Result: 12 or 13,6 % of references to the “approach” object	- strategies (37 or 58,7 %); - systems (22 or 34,9 %); - tactics (4 or 6,4 %) → 100,0 %. Result: 63 or 100,0 % references to derived versions of the “principle” object
Methods → 1,1 %. Result: 1 or 1,1 % of references to the “method” object	- set of methods (1 or 100,0 %) → 100,0%. Result: 1 or 100,0 % references to derived versions of the “method” object
Functions → 53,8 %. Result: 47 or 53,8 % of references to the “function” object	- integration (62 or 17,4 %); - coordination (55 or 15,4 %); - planning (44 or 12,3 %) → 45,1 %. Result: 356 or 100,0 % references to derived versions of the “function” object

Continuation of Table 1

1	2
Organizational structure → 1,1 %. Result: 1 or 1,1 % of references to the “organizational structure” object	- employees (3 or 33,3 %); - behavioural issues (2 or 22,2 %); - communication (2 or 22,2 %) → 77,7 %. Result: 9 or 100,0 % references to derived versions of the “organizational structure” object
Result: 87 or 100,0 % of references to the “OBJECT MANAGEMENT”	

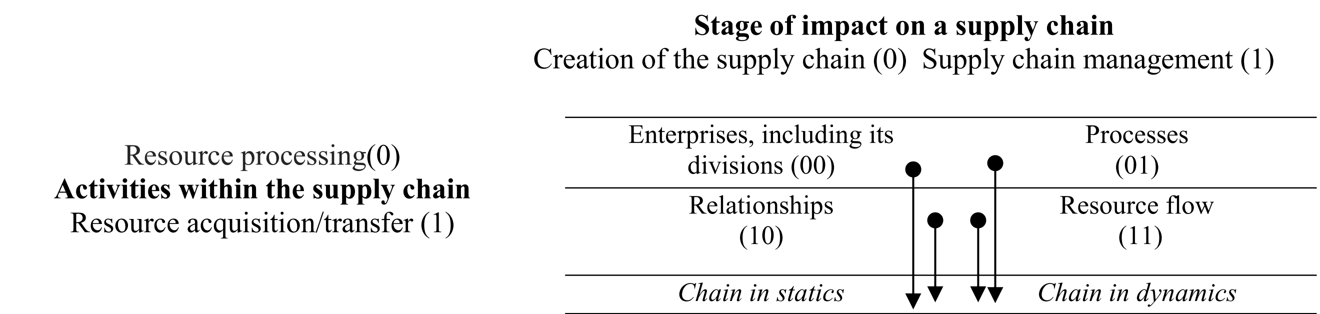

Figure 1. Classification of the main supply chain management objects and their codes[22]

A feature of Figure 1 is the digitalization of the main objects of Supply Chain Management using binary codes. These codes make it possible to begin the digitalization of not only supply chains as physical objects, which are primarily the focus of researchers (e.g., [23]), but also the digitalization of the management of these chains, which is not a physical object.

Part B contains the main components of the enterprise and Supply Chain Management system. It is formed by 87 references to these components in the terms under study. These components primarily include goals, objectives, approaches, principles, methods and functions, which were previously assigned the corresponding binary codes (Figure 2).

Stages of end consumer order management products and/or services	**Groups of components of a management system**			
	Prerequisites *Why?* *(00)*	Concepts *What?* *(01)*	Tools *With what?* *(10)*	Practices *How?* *(11)*
Preparation (0)	Factors (000)	Goals (001)	Approaches (010)	Objectives (011)
Fulfillment (1)	Resources (100)	Principles (101)	Methods (110)	Functions (111)

Figure 2. Classification of components of a management system [22].

- Secondly, Table 1 is divided into two parts I and II vertically. Part I "Main versions" contains the main management objects and components of the first-level Supply Chain Management system and, in addition, synonyms for these objects and components that are found in the terms under study. For example, in addition to the object "enterprise", these terms use the objects: "organization", "company", "firm", etc., and in addition to the object "process" – "activities", "operations", etc. Apparently, researchers do not care that these objects differ from each other but are systemically related.

In turn, Part II "Derived versions" includes options or objects of management and components of the second-level management system with the number of references 1971 and 775, respectively. For example, "enterprise" can be "consumer", "supplier", "manufacturer", "intermediary", etc. The "process" performed by these enterprises include "delivery", "distribution", "production", "sale", etc. Another feature of Table 1 is the distinction between the "process" management object, which is focused on creating value for end consumers of products and services, and the "function" component, which relates to Supply Chain Management system.

- Thirdly, Table 1 does not include all the main and derived management objects and components of the Supply Chain Management system identified during the study process. For example, out of the 153 references to the main object "enterprise", as well as its associated objects – "organization" and "company", 111, or 62%, of the references are accounted for. In turn, within the main object of "enterprise", management objects such as "consumer", "supplier", and "manufacturer" are derived from it and are mentioned in 370 references or 67.9% of all 545 references to this type of object. The remaining 32.1% of references refer to 33 other objects with references ranging from 1 to 20. Therefore, according to the Pareto principle, these objects were not taken into account when creating a unified term for "Supply Chain Management", in line with the first objective of this study.
- Fourthly, the distribution of references to the main and derived management objects and components of the Supply Chain Management system is subject to certain regularities. For example, out of 499 references to the main management objects (Part A), 30.7% are to the "enterprise" object, 48.1% to the "process" object, 3.2% to the "relationships" object and 18% to the "flow" object. This means that when managing supply chains, you can rank its objects according to following scheme: "1. processes – 2. enterprises – 3. flows – 4. relationships". This scheme is confirmed by analyzing the distributions of derived management objects: "1. process (609 references) – 2. enterprise (545 references) – 3. flow (715 references) – 4. relationships (102 references)". The largest number of references to derived objects of the main management object "flow" is explained by the fact that such objects include "product" and "service" found in almost every term for "Supply Chain Management", although they do not fully reflect the specifics of this type of management.

Among the main components of the Supply Chain Management system (Part B), patterns of distribution of references according to the degree of mention in studied terms are also traced according to a scheme: "1.

functions (53.8%) - 2. goals (16.8%) – 3. approaches (13.6%) – 4. objectives (12.5%) – 5. organizational structure (1.1%, by derivative components: 9 references) – 6. principles (1.1%, for derived components: 4 references) – 7. methods (1.1%, for derived components: 1 reference)”.

The results obtained using terminological analysis are the basis for the creation of a unified term for “Supply Chain Management” and its main variants, which include, among other things, the priorities for the main management objects and components of the management system. Based on this term or the first-level term and its variants, you can create a set of second-level supply chain management terms using derived objects and components. In other words, according to the “top–down” principle, instead of an “enterprise” object, you can use a sequence of objects: “1. intermediary → 2. wholesaler → 3. retailer → 4. seller”, and instead of the object “process”: “1. activity → 2. action → 3. operation”. Thus, prerequisites are created for structuring a unified term for “Supply Chain Management” vertically and horizontally within the organizational structure for managing links and supply chains in statics and dynamics (Figure 1) down to each employee of any of the links.

The literature study on the research topic allowed us to formulate its main questions:

RQ1: How to create a set of unified terms for “Supply Chain Management” and their variants based on terminological analysis?

RQ2: How can the term for “Supply Chain Management” be structured and digitized vertically and horizontally across organizational structures for managing links and supply chains based on TDF methodology?

3. Methodology

Terms of any sphere of human activity, including Supply Chain Management, are non-physical objects that are difficult to identify, formalize, structure, combine, digitalize, and model. Virtually any Supply Chain Management object - idea, strategy, plan, project, attitude, value, management decision, authority, order, disposition etc. - is a non-physical object. Therefore, qualitative research methods are needed to create a unified and locally-based version or term for “Supply Chain Management” [24], which include:

Firstly, the terminological analysis, the results of which are presented in Table 1.

Secondly, the descriptive method allows to identify, systematize and rank the classification attributes of non-physical objects of study, as well as their dichotomies in three main variants: (a) quantitative parameters such as “more” or “less”; (b) the state of the studied object: “state 1” or “state 2”; and (c) stages of the process: “stage 1” or “stage 2”. Identification series are created based on the descriptor method. Identification series is understood as a set of linearly ordered, limited in number, time-varying, relevant classification attributes of one or more logically interrelated research objects that allow them to be measured both individually and collectively in order to select appropriate standards, create virtual copies, computer modeling, and develop management decisions. Unlike a numerical series, the identification series is formed based on the factors of a real management situation and can change significantly. Therefore, this method involves the standardization of identification series not only at the global Supply Chain Management level, but also at levels of links and even divisions within the supply chain.

Thirdly, the faceted method, on which binary matrices are formed, a sample of which is shown in Figure 1 and in other illustrations of this article. The faceted method allows us to identify possible variants of research objects and establish relations between them, which is favorable for their modeling, the development of a management decision, and its implementation, taking into account the specifics of managing links and supply chains.

Collectively, terminological analysis, descriptive and faceted methods, or TDF methodology form the basis for the identification, formalization, standardization, structuring, combination, digitalization, and modeling of non-physical objects and components in the Supply Chain Management system.

4. Results

4.1. Development of a set of unified terms for "Supply Chain Management" based on the generalization of existing terminology.

Using the results of the terminological analysis (Table 1), it can be argued that in the projected unified terms for "Supply Chain Management", it is necessary:

Firstly, to point out that Supply Chain Management involves the impact of subjects (decision makers) on objects (enterprises, relationships, processes and flows, Figure 1) based on the components of the management system (goals, objectives, approaches, principles, methods, functions, and organizational structure of management, Figure 2);

Secondly, to use all the main management objects and components of the management system in this term, taking into account their possible priorities; and

Thirdly, to place special emphasis on the delineation of circuits, as well as the management of these chains in statics and dynamics. In the first case, prerequisites are formed for creating values for end consumers of products and / or services, and in the second case, on the basis of these prerequisites, subjects directly influence objects of management using components of the management system.

Taking into account the above aspects, a basic version of a unified term for "Supply Chain Management" is offered to the attention of theorists and practitioners based on a generalization of the previously created 290 variants:

Supply Chain Management is a set of impacts of organizationally independent strategic and tactical decision makers on a seamless system of linearly ordered [***processes***] and associated [***flows***] of resources that require the competencies of [***suppliers*** and ***intermediaries***] and stable [***relationships***] between them. This type of management is based on rational configuration, system integration, and coordination of procurement, production, distribution, and delivery of products and services to create value for consumers.

Note that this term is based on the view that, first of all, the supply chain is a process (e.g., [25]). However, there is a very popular opinion among specialists that the supply chain consists of enterprises (the group of manufacturers, suppliers, distributors, retailers and transportation, information and other logistics management service providers) [26]. If we consider this opinion to be fair, then the above term is transformed into its variant as follows:

Supply chain management is a set of impacts of organizationally independent strategic and tactical decision makers on a seamless system of linearly ordered [***enterprises***] – *suppliers and intermediaries* who are in stable [***relationships***], able to perform the required [***processes***] and manage [***flows***] of resources. This type of management is based on rational configuration, system integration, and coordination of procurement, production, distribution, and delivery of products and services to create value for consumers.

As follows from this term, when it is transformed into other variants, the form of this term remains and at the same time its content changes, in particular, management objects change priorities depending on the specific management situation. In this case, it is recommended to use another variant of a unified term for "Supply Chain Management" in the following modular formulation:

Supply Chain Management is a set of impacts of organizationally independent strategic and tactical decision makers on a seamless system of linearly ordered [***enterprises***, ***relationships***, as well as ***processes***

and ***flows*** of resources]*. This type of management is based on rational configuration, system integration, and coordination of procurement, production, distribution, and delivery of products and services to create value for consumers.

* is module N, where N=1, 2, 3, 4, and:

Module 1: [***enterprises***, including related ***relationships***, ***processes***, and ***flows*** of resources].

Module 2: [***relationships***, including related ***enterprises***, ***processes***, and ***flows*** of resources].

Module 3: [***processes***, including related ***enterprises***, ***relationships***, and ***flows*** of resources].

Module 4: [***flows*** of resources, including related ***enterprises***, ***relationships***, and ***processes***].

In a given management situation, the basic module [***enterprises***, ***relationships***, as well as ***processes*** and ***flows*** of resources] can be replaced by any of the above modules. For example, if one of the links in the supply chain (an enterprise) has gone bankrupt, then it needs to be replaced by another enterprise. In this management situation, module 1 should be included in the term. If the supplier of a focal enterprise is faced with a problem with the manufacturing products due to violations of the technological process, then module 3 should be inserted into this term.

4.2. Development of a unified group of hierarchically ordered digitized terms for "Supply Chain Management"

Digitalization of Supply Chain Management will be successful only if a person understands that the capabilities of a computer are limited, and therefore its use requires a restructuring of human thinking taking into account these limitations. One of the conditions for successful human-computer interaction is the preparation of information for machine processing. If we imagine that a digital twin of Supply Chain Management will be created in the future, then it should include a digital twin prototype designed for management decision makers and an aggregate of this twin, the improvement of its structure and potential is the prerogative of information technology specialists. For effective interaction between developers and users of this digital twin, it is necessary to learn how to digitize non-physical management objects and components of the management system using TDF technology. That is why it is important to create a hierarchically-ordered terms for "Supply Chain Management" adapted to digital technologies.

To solve this problem, it is necessary:

Firstly, to divide Supply Chain Management by analogy with Table 1 into management objects or Supply Chain, symbol "0", and management of these objects or Supply Chain Management, symbol "1";

Secondly, it should be taken into account that management objects and the management of these objects can be static, associated with the inevitable preparation for creating value for end consumers of products and services, and dynamic, directly creating value of this type;

Thirdly, develop six hierarchically linked terms: (a) of management objects: supply chains in statics, supply chains in dynamics, and supply chains in general; and (b) of Supply Chain Management in statics, Supply Chain Management in dynamics, and Supply Chain Management in general;

Fourthly, create sequences for the use of management objects and system components to design algorithms for developing and implementing digital decisions in Supply Chain Management. These algorithms make it possible to proceed with the formation of a concept of artificial intelligence operating on both physical and non-physical management objects and system components. If this concept is created, then the idea of using a digital twin for Supply Chain Management can become a reality. The solution to this problem is shown in Figures 3 and 4.

Figure 3 shows the main objects and types of supply chains, as well as the sequence of their use when creating the term for "Supply Chain". Since the goal of this type of management is to create value for consumers of products and services, any link or enterprise in the supply chain can be a focal one [27], integrating processes and flows with adjacent links in the chain. First of all, this enterprise must identify the products and/or services that it can produce and/or provide properly.

The solution to this problem requires the development of a project in which, along with the products and/or services, future processes 1 and flows of resources 1 are determined, forming a virtual supply chain in dynamics 1. Based on this project, a supply chain in statics is being created which includes real enterprises and the relationships between them. When creating value for consumers of products and services, these enterprises perform the required processes 2, while managing the flows of 2 material, information, financial and human resources, that is, transforming into a supply chain in dynamics 2. As a result, this type of chain produces products and/or provides services that may differ in some ways from their original intent, but nevertheless they are the sources of creating desired value for consumers.

Figure 4 shows the main components and types of Supply Chain Management, as well as the sequence of their use in creating the term for “Supply Chain Management”. Chains in statics and dynamics suggest two different management options, respectively, Supply Chain Management in statics and dynamics. In the first management variant, the following sequence of using the components of the management system is traced. First, the goals of the focal enterprise are defined or what it wants to achieve. To do this, it is necessary to formulate objectives that show how these goals will be achieved. To solve these objectives, it is necessary to choose approaches to Supply Chain Management, such as directive, marketing, strategic, regional, etc. These approaches can vary significantly, therefore, management principles are developed for each of them and collectively. Based on this component, management methods are defined: administrative, economic, organizational, and socio-psychological. The components of a Supply Chain Management system listed above are extremely difficult to understand and apply in real management situations, so they involve the use of necessary competencies of management decision makers. These persons should be given appropriate authority to perform required functions using management technologies and necessary resources. Based on the processes and activities outlined above, an organizational management structure is formed and approved, not only for the link, but also for the supply chain. We also note that each of the above components can be formalized and digitized using the TDF methodology and, together with management objects and components of the management system, form an integrated concept for managing these chains.

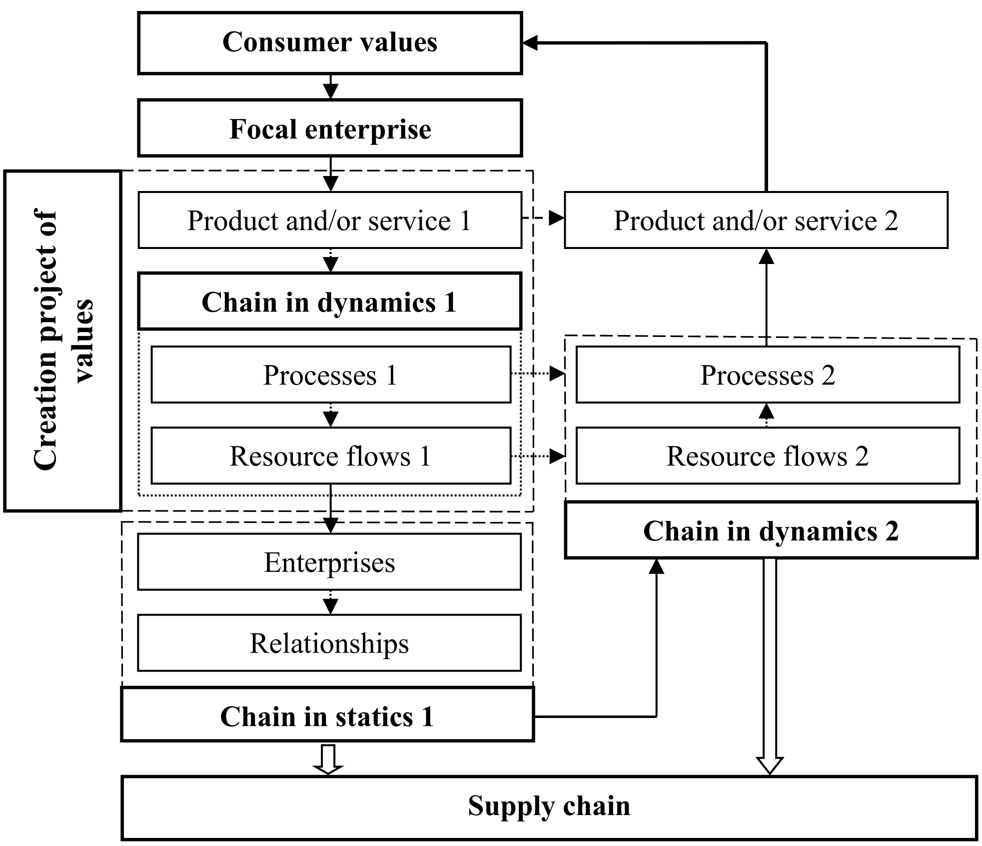

Figure 3. Main objects and types of supply chains, as well as the sequence of their use when creating a term for "Supply Chain Management".

The contents of Figure 3 make it possible to digitize not only of the main (Figure 1), but also of complex Supply Chain Management objects. Moreover, in some cases, in addition to one main and three related management objects, the main objects can simultaneously be 1, 2, 3 or 4 Supply Chain Management objects. This is especially important in tactical and strategic planning of their activities. In this case, for the correct presentation of the content of a unified management term of this type and its digitization, it is recommended to use a binary matrix presented as Table 2.

The information presented in Table 2 allows us to draw the following conclusions:

Firstly, since there are four main Supply Chain Management objects, considering them as dichotomies, we can distinguish 2^4 or 16 main and complex management objects, including the supply chain as a whole;

Secondly, each of the main management objects, by analogy with the information in Figure 1, can be designated by a five–digit binary code: enterprises - code "0.1000", relationships - code "0.0010", processes – code "0.0100", and flows – code "0.0001". The first symbol of the code "0" means that we are talking about the Supply Chain Management object;

Figure 4. Main components and types of Supply Chain Management, as well as the sequence of their use when creating a term for "Supply Chain Management".

Table 2. Options for complex supply chain management objects.

Main objects of supply chain management				Complex objects of supply chain management
Enterprise	Process	Relationships	Flow	
0	0	0	0	-
0	0	0	1	Flow
0	0	1	0	Relationships
0	0	1	1	Communication
0	1	0	0	Process
0	1	0	1	Chain in dynamics
0	1	1	0	Technology
0	1	1	1	Chain of relationships in dynamics
1	0	0	0	Enterprise
1	0	0	1	Trajectory
1	0	1	0	Chain in statics
1	0	1	1	Chain of flows in statics
1	1	0	0	Chain link
1	1	0	1	Chain of enterprises in dynamics
1	1	1	0	Chain of processes in statics
1	1	1	1	Supply Chain

Thirdly, if there is no priority between two and three main management objects (e.g., [28]), it is recommended to use complex management objects in the appropriate version of the unified term for "Supply Chain Management". For example, if the objects of equal importance are "process", code "0.0100", and "relationships", code "0.0010", then they can be combined into a complex term denoting "technology", code "0.0110". If such objects are simultaneously "enterprise", code "0.1000", "process", code "0.0100", and "relationships", code "0.0010", then they can be replaced by the complex object "chain of processes in statics”, code “0.1110”. It is noteworthy that the same complex management object, for example, “chain of flows in statics”, code “0.1011”, may consist of a main object – “enterprise”, code “0.1000”, and the complex object – “communication”, code “0.0011”. At the same time, another option for using this complex object is possible. It provides for a combination of the main object “flow”, code “0.0001”, and the complex object “chain in statics”, code “0.1010”.

When authority is transferred from those making managerial decisions at the highest management level to those making managerial decisions at middle and lower management levels, derivative objects can be used instead of the main objects in a unified term for “Supply Chain Management”. First of all, we are talking about those objects that are presented in Table 1.

The information in Figure 2 allows us to bring to the attention of specialists to three hierarchically linked terms that allow a computer, guided by corresponding codes (Table 2), to understand the essence and structure of Supply Chain, such as:

Supply chain in statics (code “000.1010”) is a set of linearly ordered [***enterprises***] (code “0.1000”) and [***relationships***] between them (code “0.0010”), designed to create value for consumers of products and services.

Term code is “000.1010” → “0.1000.0.0010”.

Supply chain in dynamics (code “001.0101”) is a set of linearly distributed, in time- and space-synchronized [***processes***] (code “0.0100”) and [***flows***] of resources (code “0.0001”) used by enterprises to create value for consumers of products and services.

Term code is “001.0101” → “0.0100.0.0001”.

Supply chain (code “010.1111”) is a set of linearly ordered, flexible responsive to external influences, integrated [***enterprises***] (code “0.1000”), [***relationships***] (code “0.0010”), [***processes***] (code “0.0100”) and [***flows***] of resources (code “0.0001”) designed to create value for consumers of products and services (or, for example, code “0.1111” → code “0.0101” + code “0.1010”, as well as possible options according to information in Table 2).

Term code is “010.1111” → “0.1000.0.0010.0.0100.0.0001”.

Since the object of this study is primarily the term for “Supply Chain Management”, it is necessary to substantiate the prerequisites for designing this term from the perspective of its digitization. To solve this problem, it is advisable to use the information in Figure 2. At the same time, such management components as “goals”, code “1.001”, “approaches”, code “1.010”, “principles”, code “1.101”, and “methods”, code “1.110”, should be attributed to static components, and the components “factors”, code “1.000”, “resources”, code “1.100”, “objectives”, code “1.011”, and “functions”, code “1.111” are dynamic components.

Taking into account this aspect of the study, the information in Figs. 2 and 4 allow us to bring to the attention of specialists three hierarchically linked terms that allow the computer, based on corresponding codes (Table 3), to understand the essence and structure of Supply Chain Management, such as:

Table 3. Identification series for creating a unique local term for “Supply Chain Management”.

Objects and components	Classification attribute	Dichotomies	Choice	Result
1	2	3	4	5
Form of insufficiency of something	1. Parameters and attributes of products and services	typical (standard) (0)		Values
		unique (1)	+	
	2. Parameters and attributes of consumer demand	typical (standard) (0)		
		unique (1)	+	
Type of value	3. Stage of creation values	formalization and design (0)	+	Value prototype
		embodiment and consumption (1)		
	4. Type of chain link	customer (0)		

		supplier (intermediary) (1)	+	
Form of enterprise	5. Attitude to the value of end consumer	creature (0)	+	*Technolo-gical enterprise*
		maintenance (1)		
	6. Form of valueatthe output from the enterprise	product (0)	+	
		servise (1)		
Type of enterprise	7. Nomenclature of resources at input	small (0)		*Firm*
		big(1)	+	
	8. Nomenclature of resources at outnput	small (0)		
		big(1)	+	
	9. Level of cooperation	low (0)	+	
		high (1)		
Divisions of enterprise	10. Type ofdivision	formal (0)	+	*Department*
		informal (1)		
	11. Duration of existence	temporary (0)		
		permanent (1)	+	
	12. Centralization of management functions	low (0)	+	
		high (1)		
Relationships between an enterprise or its divisions	13. Duration of the relationships	short (0)	+	*Subordination*
		long-term (1)		
	14. Having a common goal	yes (0)		
		no (1)	+	
	15. Counterparty dominance	yes (0)		
		no (1)		
Processes of enterprise	16. Process assignment	value creation (0)	+	*Order fulfillment*
		value maintenance (1)		
	17. Type of management object	link in chain (0)		
		chain as a whole (1)	+	
	18. Chain link priority	customer (0)	+	
		supplier (1)		
Flows of enterprise	19. Perceptibility of resource	tangible (0)		*Information flow*
		non-tangible (1)	+	
	20. Type of enterprise processes	value creation (0)		
		value creationmanagement (1)	+	
Goals of enterprise	21. Option for evaluating the enterprise's activities	quantitative (0)	+	*Result*
		qualitative (1)		
	22. Formalization of future condition of the enterprise	not formalized (0)		
		formalized o (1)	+	

Continuation of Table 3

1	2	3	4	5
Objectives	23. Way to achieve a goal	standard (0)		*Problem*
		unique (1)	+	
	24. Stages of overcoming threats and exploiting opportunities	determination ofobjective (0)		
		solving anobjective (0)	+	
Approaches	25. Management object	chain in dynamics (0)	+	*Innovative approach*
		chain in statics (1)		
	26. Value chain management object	product and/or service (00)		
		demand (01)		
		Novelty (10)	+	

		value (11)		
Principles	27. Type of enterprise environment	external (0)	+	*Reliability*
		internal (1)		
	28. Subjects influencing the decisions of chain links	customers (0)		
		stakeholders (1)	+	
Methods	29. Object to which the impact is directed	личность (0)		*Organiza-tional methods*
		группа людей (1)	+	
	30. Nature of impact	relatively stable (0)		
		situational (1)	+	
Functions	31. Time to achieve the result of impact	short (0)	+	*Regulation*
		long-term (1)		
	32. Management object	chain in dynamics (0)	+	
		chain in statics (1)		
	33. Management situation	standard (0)		
		non-standard (1)	+	
Organiza-tional structure of management	34. Stability of management system	stable (0)		*Adaptive structure*
		unstable (1)	+	
	35. Stability of management process	stable (0)	+	
		unstable (1)		

Supply Chain Management in statics (code "100.0101") is a set of impacts of organizationally independent persons (management subjects) on a seamless system of linearly ordered [***enterprises*** (code "0.1000"), ***relationships*** (code "0.0010"), ***processes*** (code "0.0100") and ***flows*** (code "0.0001")] using [*goals*] (code "1.001"), [*approaches*] (code "1.010"), [*principles*] (code "1.101"), and [*methods*] (code "1.110") of the management system.

Term code is "100.0101" → "1.001.1.010.1.101.1.110.0.1000.0.0010.0.0100.0.0001".

Supply Chain Management in dynamics (code "101.1010") is a set of impacts of organizationally independent persons (management subjects) on a seamless system of linearly ordered [***enterprises*** (code "0.1000"), ***relationships*** (code "0.0010"), ***processes*** (code "0.0100") and ***flows*** (code "0.0001")] using [*factors*] (code "1.000"), [*resources*] (code "1.100"), [*objectives*] (code "1.011"), and [*functions*] (code "1.111") of the management system.

Term code: «101.1010» → «1.000.1.100.1.011.1.111.0.1000.0.0010.0.0100.0.0001».

Supply Chain Management (code "110.1111") is a set of impacts of organizationally independent persons (management subjects) on a seamless system of linearly ordered [***enterprises*** (code "0.1000"), ***relationships*** (code "0.0010"), ***processes*** (code "0.0100") and ***flows*** (code "0.0001")] using [*goals*] (code "1.001"), [*approaches*] (code "1.010"), [*principles*] (code "1.101"), [*methods*] (code "1.110"), [*factors*] (code "1.000"), [*resources*] (code "1.100"), [*objectives*] (code "1.011"), and [*functions*] (code "1.111") of the management system.

Term code: «110.1111» →«1.001.1.010.1.101.1.110.1.000.1.100.1.011.1.111.0.1000.0.0010.0.0100.0.0001».

Depending on the specific management situation, various combinations of the terms presented above and their corresponding binary codes are possible. For example, the management situation does not imply an impact on the relationships between adjacent links in the supply chain. In this case, both the term and the binary code may lack the "relationships" management object, code "0.0010". In addition, it is possible to include complex management objects and management system components in these terms (Tables 2 and 3), as well as create new terms for these objects and components, if necessary.

4.3. Substantiation of a method for creating derived (situational) terms for "Supply Chain Management"

The terms outlined above are typical of those who make managerial decisions at the highest management level. Therefore, they are of little use to management decision makers at the middle and lower levels of Supply Chain Management. To effectively use the potential of these persons, it is necessary to propose a method for creating local terms for "Supply chain management" corresponding to the authorities of managers at different levels. As shown earlier, this method is based on an identification series that can be created based on the information set out in Table 1. After appropriate processing of this information, it is recommended to use Table 3 to solve the problem.

An analysis of the contents of this Table allows us to draw the following conclusions:

Firstly, the basis for this Table is the information presented in Figs. 3 and 4;

Secondly, each of the objects and components of Supply Chain Management in Table 3, with the exception of such components as "goal" and "objective", are structured, identified, digitized, and formalized using classification attributes and dichotomies presented in columns 2 and 3 [14]. For example, in order to determine the main types of organizational structure of enterprise management, it is advisable to use classification attributes "stability of management system" and "stability of management process" and their corresponding dichotomies. On their basis, bureaucratic, divisional, adaptive and organic organizational structures for enterprise management are formed in a corresponding binary matrix, each of which is digitized by binary code;

Thirdly, in order to identify and digitize the main types of the "goal" and "objective" components, corresponding classification attributes and dichotomies were used (Figs. 5 and 6).

	Option for evaluating an enterprise's activities	
	Quantitative (0)	Qualitative (1)
Not formalized (0)	Landmark (00)	Setting (01)
Formalization of future state of an enterprise Formalized (1)	Result (10)	Mission (11)

Figure 5. Classification of options for the goals (final state) of an enterprise.

The options presented in these Figures are also structured, identified, digitized and formalized. For example, the result (Figure 5) is a formalized (symbol "1") type of the enterprise's goal, estimated by quantitative parameters (symbol "0"). In turn, a dilemma is a type of objective that provides for its solution (symbol "1") using standard methods (symbol "0") to achieve the goal of the enterprise (Figure 6).

	Way to achieve a goal	
	Standard (0)	Unique (1)
Determination of an objective (0)	Appointment (00)	Task (01)
Stages of overcoming threats and exploiting opportunities Solving anobjective (1)	Dilemma (10)	Problem (11)

Figure 6. Classification of enterprise objectives.

Fourthly, the 35 classification attributes listed in column 2 of Table 3 form an identification series similar to a digital series for measuring physical management objects. In order to create a unique term for "Supply

Chain Management" (the term of the second, third, etc. level), which best corresponds to the position and functions of the person making management decisions and at the same time does not contradict the unified term for "Supply Chain Management" (the first-level term), the user should:

(a) in each of the 35 classification attributes, select a dichotomy according to the pattern shown in column 4 of Table 3; and

(b) determine which variants of the object or component of the management system correspond to the selected dichotomies.

For example, in Table 3, the adaptive organizational structure of enterprise management corresponds to the dichotomies of classification attributes 34 and 35. By analogy: the dichotomies of classification attributes 23 and 24 (Table 3 and Figure 6) corresponds to the objective option "problem", etc.;

Fifthly, based on the obtained set of options for management objects and components of the management system, it is easy to develop local terms for "Supply Chain Management" or second-level terms in the following formulations:

(1) based on the unified term:

Supply chain management is a set of impacts of strategic and tactical decision makers on a seamless system of linearly ordered [***order fulfillment operations***] and related [***flows of information resources***] that require the competencies of a [***firm's department***] and its [***subordination***] with related departments. This type of management involves achieving a [*result*] in solving a [*problem*] based on an [*innovative approach*] focused on the principles of [*reliability*] of the [***firm***] using [*organizational methods*] in [*regulating*] management objects within the framework of an [*adaptive organizational management structure*] in order to create a [*prototype of value*] for consumer X.

(2) based on terms intended for the digital economy:

Supply chain in statics is a set of linearly ordered divisions of a ***firm's department*** and ***subordination*** between them, possessing technologies, resources and competencies to create a prototype of value for consumer X.

Supply chain in dynamics is a set of linearly ordered, time– and space-synchronized ***order fulfillment operations*** for consumer X and ***flows of information resources*** used by a ***firm's department*** to create a prototype of value for this consumer.

Supply chain is a set of linearly ordered, flexibly responsive to external influences, integrated divisions of the ***firm's department***, ***subordination***, ***order fulfillment operations*** of consumer X and ***flows of information resources*** designed to create a prototype of value for this consumer.

Supply Chain Management in statics is a set of impacts of organizationally ordered persons (management subjects) on a seamless system of linearly ordered divisions of a ***firm's department*** and ***subordination*** relationships using *results*, an *innovative approach*, principles of *reliability*, and *organizational methods* within an *adaptive organizational structure* of a management system.

Supply Chain Management in dynamics is a set of impacts of organizationally ordered persons (management subjects) on a seamless system of linearly ordered ***order fulfillment operations*** of consumer X and ***flows of information resources*** using *factors* and *resources* to solve *problems* by *regulating* these operations and flows.

Supply Chain Management is a set of impacts of organizationally ordered persons (management subjects) on a seamless system of linearly ordered divisions of a ***firm's department***, ***subordination*** relationships, ***order fulfillment operations*** of consumer X and ***flows of information resources*** using *results*, an *innovative approach*, principles of *reliability*, *organizational methods*, *factors* and *resources* to solve *problems* by *regulating* within the *adaptive organizational structure* of a management system.

If necessary, you can proceed to the development of local terms for "Supply Chain Management" of the third, fourth, etc. levels. At the same time, a hierarchically ordered system of terms for "Supply Chain Management" is formed, starting from each workplace up to the level of global supply chains, that is, along the chain of command. At the same time, prerequisites have been created for designing specific management terms, such as "Sustainable Supply Chain Management" or "Digital Supply Chain Management", which were discussed earlier.

5. Discussion

Supply Chain Management is an unexplored and extremely tempting topic for researchers and practitioners. During its study, numerous promising results have been obtained, creating a basis for improving enterprises, their relationships, processes and resource flows. Moreover, these results are confirmed by high socio-economic efficiency and are strongly promoted not only in the scientific literature, but also in the media. However, this raises the question: "What do researchers and practitioners understand by the term "Supply Chain Management"? Without an answer to this question, it is difficult to draw an unambiguous conclusion about the expediency of implementing and using this type of management. Indeed, if the authors of a scientific article convince the reader that they have established a way to improve processes in supply chains based on empirical methods, then it is unclear how much these improved processes affect relationships, resource flows, and, finally, enterprises. Is it possible that achieving results in process management leads to the degradation of other management objects? And is it possible to achieve a clear competitive advantage in supply chain links by explicitly ignoring the systematic approach to using components of the Supply Chain Management system in practice? To gloss over these issues is to prevent the achievement of new, as yet unknown methods for increasing the competitiveness of enterprises, relationships, processes, and resource flows on any type of market.

With a high degree of objectivity, it can be argued that the currently hushed-up problem of Supply Chain Management terminology is debatable. The main issues of this discussion include: the development of the TDF methodology, which includes terminological analysis, descriptive and faceted methods for the study of non-physical management objects and components of the Supply Chain Management system; development of methods for designing and adapting identification series to factors of the external and internal environment, with the help of which it is possible to timely adjust their structure using relevant classification attributes and dichotomies; creation of a concept of artificial intelligence operating with non-physical management objects and components of the Supply Chain Management system; development of the structure of prototypes, instances and aggregates of the digital twin of chain management of this type, as well as value chains and demand chains; substantiation of a methodology not only for the development and adoption of management decisions, but also for their implementation, taking into account the specifics of organizational structures for managing links and supply chains.

6. Conclusion

In the study the following results were obtained that have signs of scientific novelty: based on terminological analysis and the TDF methodology, a set of unified terms for "Supply Chain Management" was developed, formed on the basis of management objects and components of the management system, and prerequisites were created for structuring and digitalization of the term for "Supply Chain Management" vertically and horizontally within the organizational structures management of links and supply chains.

The contribution of the obtained results to theory is due to improvement of Supply Chain Management terminology, which, unlike existing terminology, solves problem of creating hierarchically ordered system of terms based on identification series, including classification attributes and dichotomies of non-physical management objects and components of the Supply Chain Management system.

The contribution of the study results to practice is confirmed by the possibility of structuring the unified term for "Supply Chain Management" vertically and horizontally within the organizational structure management of links and supply chains. This opportunity creates theoretical and methodological prerequisites for the development of artificial intelligence operating on non-physical management objects and system components, and further the digital twin for Supply Chain Management. As a result of solving these tasks, it will be possible to develop and implement management decisions in links and supply chains that are characterized by minimal lost profits and, consequently, high competitiveness.

In the future, it is planned to refine, supplement and develop methods for identifying, formalizing, structuring, combining, digitalizing and modeling non-physical management objects and components of the Supply Chain Management system. When solving these problems, it is proposed to synthesize methods for modeling and managing physical and non-physical objects in supply chains, which should lead to the creation of a comprehensive methodology for the study of complex socio-economic objects and components.

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Data Availability

Data supporting reported results can be found in the links to publicly archived datasets analyzed.

Conflicts of Interest

The authors declare no conflict of interest.

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