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Flows in Value Chains

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ABSTRACT

Achieving the goals of enterprises and their survival in market conditions is achieved through implementation of supply chain management concepts, values, and demands focused on managing resource flows to create and deliver value to their end users.

The subject of the research is relationship between consumers and suppliers as links in the supply chain that form and transform flows of values, demands, products and/or services, as well as novelty in a competitive environment.

The objectives of the research are to clarify and supplement the theory and methodology of managing flows of values, demands, products and/or services, as well as novelties while introducing and implementing management concepts for linearly ordered enterprises or chains.

The tasks of the research are to clarify interrelationship of objects, management components, and types of flows; to identify the roles of the consumer and supplier as sources of flows in supply chains; to develop classification of flows considering the objects of the concepts of chain management; to create a form of a flow map regarding flows in supply chains.

Research has used the methods of classification, analysis and synthesis, induction, and deduction, and the tools of binary matrices developed based on relevant qualitative characteristics of the objects under the study.

The results of the research make it possible to clarify and supplement provisions regarding supply, value and demand chain management based on a systematic approach; to develop practical recommendations to reduce lost profits when managing flows in supply chains; to create prerequisites for more efficient value creation and its supply.

Keywords: *flow, chain, consumer, supplier, value, demand, novelty, supply chain management, transportation, logistics.*

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For the original Russian text of the article please see p. 110.

INTRODUCTION

Achieving the goal of enterprises in a constantly changing external environment is ensured through adoption of modern approaches, principles and methods that form various management concepts, implementation of which implies a continuous change in the way of thinking of managers, as well as in forms and algorithms for managing business entities in their various combinations, depending on the demands of end users of products and/or services.

In recent decades, the concepts of managing several linearly ordered enterprises or chains have been intensively developed. These concepts comprise:

1) Supply Chain Management or SCM [1] and its variants: Supply Management [2]; Integrated Supply Management [3]; Integrated chain management [4]; Sustainability Supply Chain Management [5].

2) Value Chain Management [6].

3) Demand Chain Management [7].

One of the features of these concepts is their focus on the management component «flows», the importance of which was emphasised in 1958 by J. W. Forrester [8]: «*Management is on the verge of a major breakthrough in understanding how industrial company success depends on the interactions between the flows of information, materials, money, manpower, and capital equipment. The way these five flow systems interlock to amplify one another and to cause change and fluctuation will form the basis for anticipating the effects of decisions, policies, organizational forms, and investment choices*».

The variety of objects of supply, value and demand chains' management predetermines not only the specifics of parameters and characteristics of their flows, which should be considered within the framework of a particular management concept, but also the features of transformation of these objects and flows. In this case, the priority task is to eliminate barriers on the trajectories of movement of flows of objects, including in the process of their transformation, which is the most important condition for satisfaction of the end consumer of products and/or services with the value the consumer has received.

Review of literature

Analysis of research publications confirms that flows are indeed objects of value [9], demand [10] and supply [11] chain management. Let's remind that «*Flow is... 2. A moving mass of something ...*» [12].

Supply refers to « *a system of people, processes, or organizations that work together in a particular order*[1]. This definition allows us to assert that, on the one hand, supplies relate to several management components: organisations and processes, and, on the other hand, organisations, using relationship between them, form a chain and carry out processes to manage flows. In this regard, the point of view of C. Georgi and G. Kaiser deserves attention: «*Defining SCM as the difference of integration/disintegration and not as the difference of movement/non-movement, clearly delimits SCM from logistics: Whereas decisions taken in logistics are concerned with movement, decisions in SCM are concerned with integration. Therefore, logistics and SCM are (or ought to be) two distinct areas of study*» [13].

International sources provide scant information on the classification of flows. Basically, three classifications are used: by the type of resources (material, informational, financial flows, etc.) [8]; according to the direction of movement to a particular enterprise (entry and exit flows) [14]; according to the direction of movement to the final consumer («downstream» and «upstream» flows) [15]. It should be noted that many Russian scientists have made a significant contribution to the study on this issue [16–18].

Several literary sources mention such types of flows as: demand flows [19]; cash flows [20]; capital flows [5]; service flows [21]; cost, value, profit flows and logistic flows [22]; knowledge flows [23; 24]; flows of ideas [25], as well as workforce flows [8].

Flows differ not only in quality, but also in quantity. For example, the sources mention: a flow [26]; two flows [27]; three flows [28]; four flows [25]; five flows [8]. More than six flows are listed by T. Goldsby and R. Martichenko [23]. However, the authors do not always provide sufficient arguments to support these conclusions. A reasonable argument tool, in our opinion, might be substantiation and use of the appropriate classification features to solve the problem stated by the authors.

The problem of efficient flow management is compounded by the fact that flows change

[1] Chain. [Electronic resource]: https://dictionary.cambridge.org/dictionary/english/chain. Last accessed 13.10.2020.

parameters and characteristics in the process of their consolidation and downsizing. In this case, one must deal with the so-called integrated flows, the development sequence of which is presented in [29]. Proceeding from this, the work [30] substantiates the content of a systemic approach to flow management.

The above information regarding flows in supply chains needs to be clarified and supplemented by considering the specifics of objects (values, demands, supplies) and components (enterprises, processes, relationships) of the above concepts of chain management.

The *objectives* of the research are to clarify and supplement the theory and methodology of managing value, demand, products and/or services flows, as well as novelty flows, while introducing and implementing the concepts of managing linearly ordered enterprises or chains.

The importance of value for supply chain management

As a reminder, the American Marketing Association, since 2007, has used the definition of marketing in the following form: «*Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large*»[2]. The importance of value for supply chain management is emphasised, for example, by D. Sexton: «*the organization's financial success depends on how to manage value-a customer's perception of what they receive and the cost of providing value to the consumer*» [31].

At the same time, it should be borne in mind that value is created not only by the end consumer of products and/or services, but also by their supplier or with participation of a supplier. In this case, we are talking about a new product and/or service. At the same time, as practice shows, not every novelty creates value for the end user and does not pay back the supplier's costs, therefore not every novelty is an innovation.

The *tasks* of the research are to clarify interrelationship of objects, management components, and types of flows; to identify the roles of the consumer and supplier as sources of flows in supply chains; to develop the classification of flows considering the objects of the concepts of chain management; to create a form of a flow map regarding flows in supply chains.

The methods of classification, analysis and synthesis, induction and deduction were chosen as research *methods*, and binary matrices were used as a tool [32]. The peculiarities of using these methods and tools are described in the works of K. D. Bailey [33], J. W. Creswell [34], H. Hameed [35], K. Charmaz [36].

RESULTS

Clarification of relationship of control components and flow types in supply chains

The main components of chain management can be revealed using the following steps: selection from the chain of a channel that includes two links: the supplier and consumer of resources, as well as of the relationship between them; defining the tasks of these links with a focus on creating and delivering value to the consumer (who is a channel link); establishing the correspondence of tasks of links of the channel to a certain control component.

The tasks set out above and the relevant management components are presented in Table 1.

As follows from Table 1, the links of the channel (supplier and consumer) perform four consolidated tasks each, which are interdependent and interrelated. The first tasks concern respectively the supplier and the consumer as economic entities or enterprises. The effectiveness of solving the second tasks depends on the content of the relationship between the supplier and the consumer. The third tasks involve implementation of processes (operations) provided for by the agreements reached between them. Finally, the fourth tasks directly relate to delivery, transfer and receipt of products and/or services, either in the form of their flows or in the form of stocks.

The content of Table 1 allows developing a diagram of interaction of management components shown in Pic. 1.

The model shown in Pic. 1 assumes implementation of a systemic approach to supply chain management, focused simultaneously on four control objects, the main of which are numerous flows with corresponding codes processed by the software product in order to reduce the lost profit of the supply chain links.

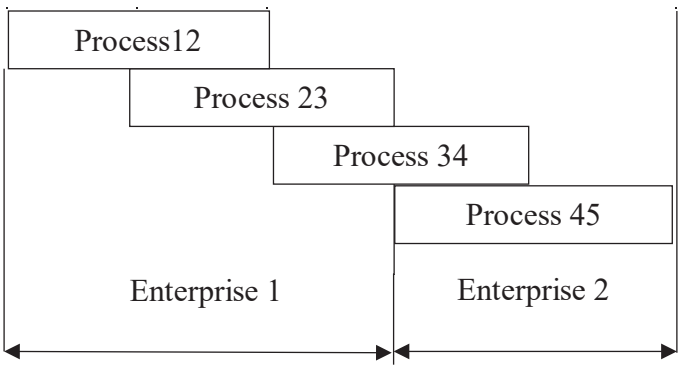
[2] About American Marketing Association. Definition of Marketing. [Electronic resource]: https://www.ama.org/AboutAMA/Pages/Definition-of-Marketing.aspx. Last accessed 29.10.2018.

Table 1

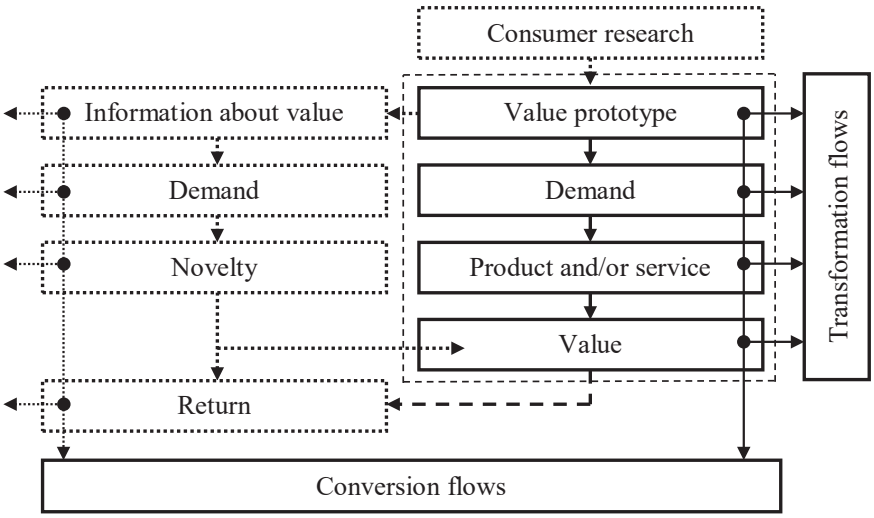
The tasks of the links of the supply chain and relevant management components (developed by the authors)

Supply chain tasks:		Management component
of a Consumer	of a Supplier	
1) Identification of insufficiency of something and determining the way to eliminate it.	1) Survival in a competitive environment due to production of a product and/or provision of a service.	Enterprises
2) Selection of a product and/or service and of their supplier.	2) Attracting consumers of the product and/or service.	Relationship
3) Registration of a demand, expectation and purchase of a product and/or service.	3) Manufacture of a product and/or preparation for provision of a service.	Processes (operations)
4) Receipt of a product and/or service and then of a value.	4) Delivery and transfer of a product and/or provision of a service.	Flow (stock)

Type of a flow (stock)	Code of a flow (stock)	State of an object of a flow (stock)				
		S1	S2	S3	S4	S5
Material (M)	00	**SFX1**	**SFX2**	**SFX3**	**SFX4**	**SFX5**
MF1	000000	M1FX1	M2FX1	M3FX1	M4FX1	M5FX1
ME..	...	...	...	...	...	...
MFK	001111	M1FXK	M2FXK	M3FXK	M4FXK	M5FXK
Information (I)	01					
IF1	010000	I1FX1	I2FX1	I3FX1	I4FX1	I5FX1
IE..	...	...	...	...	...	...
IFL	011111	I1FXL	I2FXL	I3FXL	I4FXL	I5FXL
Financial (F)	10					
FF1	100000	F1FX1	F2FX1	F3FX1	F4FX1	F5FX1
FE..	...	...	...	...	...	...
FFM	101111	F1FXM	F2FXM	F3FXM	F4FXM	F5FXM
Labour (L)	11					
LF1	110000	L1FX1	L2FX1	L3FX1	L4FX1	L5FX1
LE..	...	...	...	...	...	...
LFN	111111	L1FXN	L2FXN	L3FXN	L4FXN	L5FXN



Pic. 1. Scheme of connections of management components (developed by the authors).



Pic. 2. Managed objects and flow types in supply chains (developed by the authors).

This model is based on an object (value, demand, product and/or service) in the form of a flow or stock. At various stages of creation and delivery, this object is characterised by a certain state depending on operations of technological, logistic, and other processes. In Pic. 1, five such states are identified. In addition to the above-mentioned managed object, which is the main one, it is necessary to consider the accompanying managed objects. This status of managed object presupposes allocation of the main and accompanying flows (stocks), which can be material, informational, financial, and labour flows. At the same time, the value for the end user, formed by his perception, feelings, and impressions, can be created by objects of these flows both in aggregate and separately. In Pic. 1, the main flow is the material flow, and the object is the product. When managing this flow, the states of this product (in the form of raw materials, semi-finished products, etc.) are considered. Those states are indicated by the symbols «*SfXi*», where *S* is the state of the main object, *fx* – its parameters and characteristics, *i* – ordinal number of the state of this object. Each state of an object corresponds to a certain number of related objects as part of material, information, financial or labour flows (stocks). For each state of the main managed object, quantity and quality of thee flows can vary. Each of these flows can get a binary code for digital processing and be described by the corresponding parameters and characteristics. Flow codes can be obtained based on binary matrices containing actual classification features describing a specific object and/or flow. The transfer of the main managed object from one state to another is provided based on four processes carried out by a particular enterprise. Pic. 1 indicates that three (13) of four processes are performed by enterprise 1, and the fourth (45) is performed by enterprise 2. Flow management is performed based on the relationship 13–45 between these enterprises.

If the content of Pic. 1 considers only a single changing managed object (in particular, the product), then the content of Pic. 2 relies on the change (transformation) of several objects of chain management (value, demand, product and/or service, as well as novelty chains).

The use of a novelty as of a managed object is due to the well-known fact that «firms offer value propositions, and customers accept these value propositions and cooperate in creating value» with these firms [37–39].

The content of Pic. 2 is based on the phenomenon that the consumer, experiencing insufficiency of something (Table 1), forms a prototype of value, which he further specifies either independently or with involvement of a competent organisation, e.g., the same supplier that studies preferences and behaviour of the consumer himself, and of his prototype of value. After specifying this prototype, the consumer forms a demand, which is formalised as an order, including acquisition of resources, their processing and delivery of the product

Product and/or service Consumption		Form (variant) of value	
		Prototype	
		Consulting	
Form of manifestation of insufficiency at the consumer's side	Sensation	Tester	Communicator
	Elimination	Developer	Researcher
		Design	Creativity

Pic. 3. Roles of consumer and supplier as sources of flows (developed by the authors).

Object (in relation to what?)		Component of flow management system	
		Subject (who?)	
Way to solve the task by the subject	Copy the existing	Skill	Knowledge
	Create the new	Proficiency	Competence

Pic. 4. Classification of consumer and supplier characteristics (developed by the authors).

and/or service to the destination. This product and/or service, in the process of consumption, either creates the value the consumer needs, or is subject to return. In turn, the supplier, having received the necessary information about the prototype of value, also forms demands for its suppliers, and manufactures a product or prepares to provide a service. The product or service in this case may be new to both the consumer and the supplier. This novelty is offered to the consumer and then either creates value or is rejected by the consumer.

In Pic. 2, there are two types of flows: transformation flows that contribute to a change in the state of a particular managed object (Pic. 1), and conversion flows that provide a transition from a managed object to another.

Identifying the roles of consumer and supplier as sources of flows in supply chains

Marketing-based chain management uses the concept of the consumer, or «*The customer concept is the conduct of all marketing activities with the belief that the individual customer is the central unit of analysis and action*» [40]. Consequently, development and movement of flows within the framework of basic concepts of chain management depend on the role played by a given consumer, as well as by a supplier, who has an indirect impact on the value generated by the consumer.

If we consider such classification features as a source of value creation (product and/or service or prototype); form of manifestation of deficiency in the consumer (sensation or elimination), the following roles of the consumer and the supplier can be established: tester, communicator, developer, and researcher (Pic. 3).

From the content of Pic. 3 it follows that each role of a consumer and a supplier provides for implementation of a specific process, starting with consumption as the basis for formation of a prototype of value, then supposing consulting/training, creativity, design, and ending with consumption of a product and/or service and obtaining value. Each role and, accordingly, each process involves the study of parameters and characteristics or some «qualifications» of the consumer and the supplier, which can be described based on such classification features as: a component of a flow management system (an object or a subject), as well as a way of solving a problem by a subject (copying an existing one or creating a new way). These features make it possible to identify four characteristics of a consumer and a supplier: skill, knowledge, proficiency, and competence (Pic. 4).

The role of the researcher assumes, on the one hand, the identification by the consumer of those sensations and impressions that he plans to receive in the process of consumption of the product and/or service, and, on the other hand, identification by the supplier of the customer properties of the given product and/or service, capable of creating these feelings and impressions.

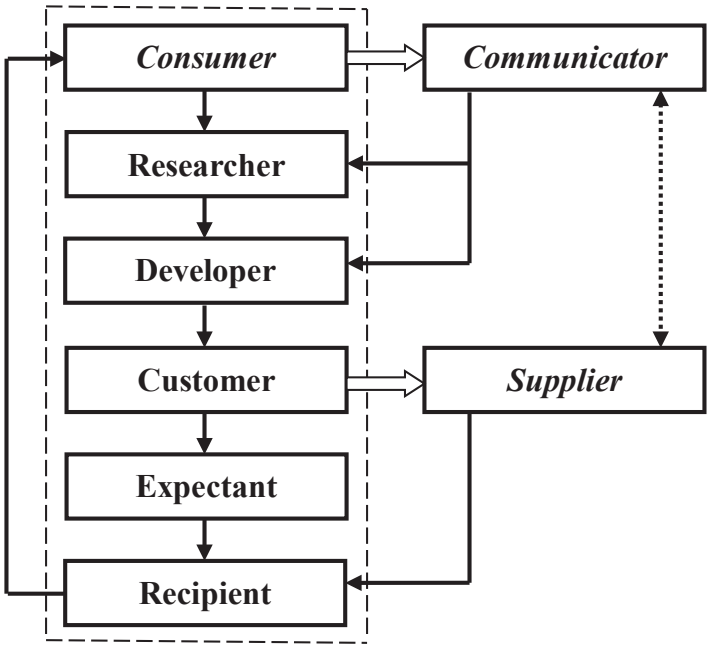
The developer's role, performed by both the consumer and the supplier, is to design and develop a product and/or service capable of creating the required value.

The role of the communicator considers the nature of the relationship and the characteristics

Table 2

Characteristics of roles of the consumer and the supplier as supply chain links (developed by the authors)

Roles of the consumer and the supplier	Characteristics of the consumer and the supplier			
	Skill	Knowledge	Proficiency	Competence
Tester				
Researcher				
Developer				
Communicator				



Pic. 5. The sequence of roles of the consumer and the supplier as links in the supply chain (developed by the authors).

of communication between the consumer and the supplier, as well as with counterparties about creating the required value.

The role of the tester is implemented at the stage of testing the product and/or service by the supplier to assess their compliance with the demands of the end user and their possible revision before shipping to the consumer. Obviously, this role is also played by the consumer, who compares the prototype of the value with sensations and impressions received.

Sharing the content of Pics. 3 and 4 allows giving a preliminary assessment of parameters and characteristics of the consumer and supplier in terms of effectiveness of solving the problems presented in Table 1. It is shown in Table 2.

Among other things, information in Pic. 4 allows developing a sequence (dynamics) of roles of the consumer and the supplier as links in the supply chain (Pic. 5).

As follows from the content of this Pic. 5, besides the consumer's roles shown in Pic. 3, it is possible to add the roles of customer, expectant, and recipient. Moreover, reducing waiting time for order fulfilment is the most important management decision ensuring the supplier's competitiveness. The role of the communicator is played by both the consumer and the supplier. In some cases, this role can be played by a third-party organisation, whose characteristics (Pic. 4) make it possible to exert a decisive influence on the consumer's decision on the parameters and characteristics of products and/or services.

Development of flow classification considering objects of chain control concepts

Using the information in Pic. 2, based on binary matrices, it is possible to determine the

Prototype		Form (variant) of value	
		Product and/or service	
Stages of formation of consumer's value	Creation	Flow of images (Im)	Flow of sensations (Sens)
	Analysis and evaluation	Flow of thoughts (Th)	Flow of impressions (Impr)

Pic. 6. Classification of flows of value (developed by the authors).

Previous (future consumer)		Place of the enterprise in the supply chain	
		Subsequent (future supplier)	
Operations with value prototype	Agreement	Flow of requests (Req)	Flow of offerings (Of)
	Preparation for implementation	Flow of tasks (claims) (Cl)	Flow of orders (Ord)

Pic. 7. Classification of demand flows (developed by the authors).

Not new		Novelty of the management situation	
		New	
Uniqueness of the approach to management	Unique	Experience flow (Expce)	Intuition flow (In)
	Proven	Flow of calculations (Calc)	Flow of experiments (Expment)

Pic. 8. Classification of flows of new products, formed by the consumer (developed by the authors).

main types of flows that gravitate towards one or another object of the chain management concept.

To determine the options for flows while managing value chains, it is proposed to use the following classification features: form (variant) of value (product and/or service or prototype); stages of customer value formation (creation or analysis and evaluation). As a result of using these features, it is possible to supplement the existing classification of flows with such flows as: flow of images, flow of thoughts, flow of sensations and flow of impressions (Pic. 6).

To determine the options for flows in demand chain management, it is proposed to use the following classification features: the place of the enterprise in the supply chain (previous as of future consumer of value or subsequent as of future supplier of value); operations with the prototype of customer value (agreeing on/ preparing for implementation). As a result of using these characteristics, it is possible to supplement the existing classification of flows with such flows as: flow of requests, flow of tasks (claims), flow of proposals and flow of orders (Pic. 7).

To determine the flow options when managing novelty (chains of new products), it should be borne in mind that these new products are created by both the consumer and the supplier. When they interact, flows of new products are formed by the consumer and the supplier, respectively. To determine the options for flows generated by the consumer, it is proposed to use the following classification features:

- Degree of novelty of the management situation: not new (known) situation or new (unknown) situation.
- Uniqueness of the approach to managing novelties: unique or proven approach.

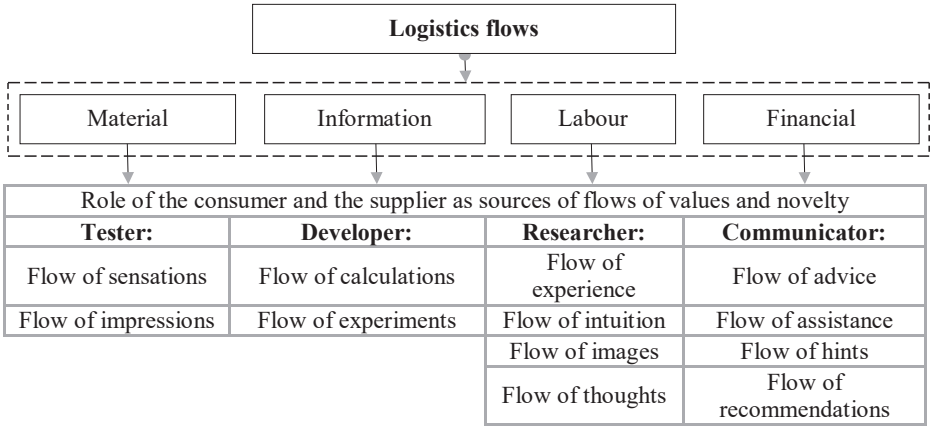
As a result of using these features, it is possible to supplement the existing classification of flows with such flows as:

- Experience flow.
- Intuition flow.
- Flow of calculations.
- Flow of experiments (Pic. 8).

As follows from the content of Pic. 8, flow, as an object of logistics research, goes beyond the basic concepts of managing economic objects and can be an object of research in marketing when studying consumer behaviour, in sociology when studying organisational culture and conflicts, in anthropology when studying norms, values and positions, in psychology when studying a person at large, etc. This aspect of the study significantly

Consultation		Variant of support of prototype of supplier's value	
		Support	
Uniqueness of the approach to management	Unique	Flow of advice (Adv)	Flow of assistance (Assist)
	Proven	Flow of hints (Hints)	Flow of recommendations (Recom)

Pic. 9. Classification of flows of new products, formed by the supplier (developed by the authors).



Role of the consumer and the supplier as sources of flows of values and novelty			
Tester:	**Developer:**	**Researcher:**	**Communicator:**
Flow of sensations	Flow of calculations	Flow of experience	Flow of advice
Flow of impressions	Flow of experiments	Flow of intuition	Flow of assistance
		Flow of images	Flow of hints
		Flow of thoughts	Flow of recommendations

Pic. 10. Main types of roles of the consumer and the supplier as well as flows of values and new products (developed by the authors).

Direct		Nature of connection of a flow object with value	
		Indirect	
Function of a flow object in relation to value	Creation	Flow of products (Pr)	Flow of vehicles (V)
	Accompanying	Flow of containers (packages) (Pack)	Flow of loading-unloading equipment (HAND)

Pic. 11. Classification of flows of main (products) and auxiliary objects (developed by the authors).

expands the capacity of logistics beyond the traditional economy and management.

To determine the options for flows generated by the supplier, it is proposed to use the following classification features: the option of supporting the value flow by the supplier or consultation and support; uniqueness of the approach to managing novelties (unique or proven). As a result of using these features, it is possible to supplement the existing classification of flows with advice flow.

Sharing of Pics. 3, 6, 8, and 9 allows us to refine the classification of the proposed flows depending on the role of the consumer and the supplier (Pic. 10).

Flows of values and flows of new products are informational (except for layouts, models, etc., which can be attributed to material flows), and people are their generating and absorbing points. Since not only its direct consumer, but also the supplier could be developer, researcher, communicator and even the consumer of the value, then the flows shown in Pics. 6, 8 and 9 are typical for the supplier as well.

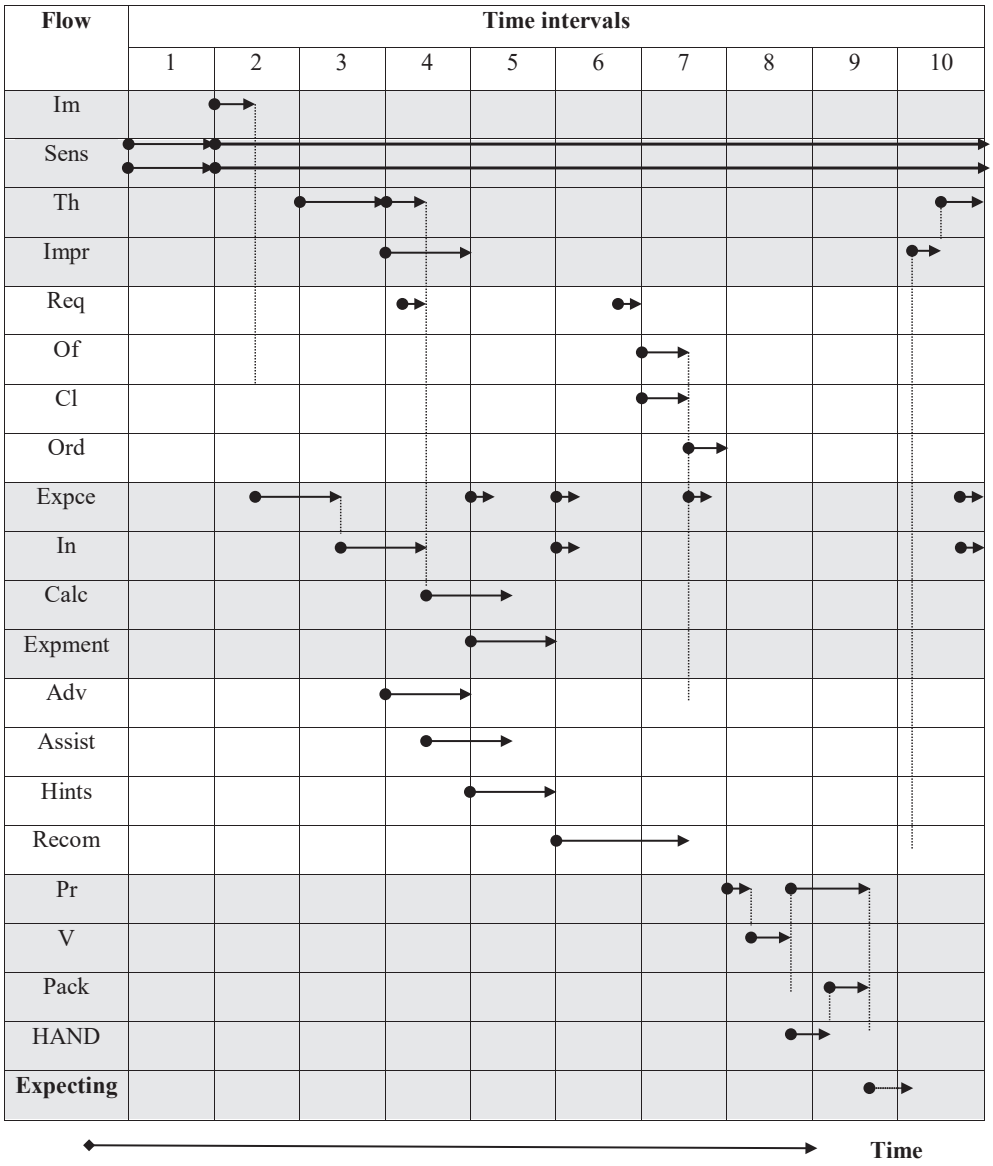
To determine the options for flows in managing the flows of products and/or services, it is proposed to use the following qualification features: the nature of the relationship between the flow object and the value of the consumer (direct or indirect (accompanying) relationship); function of the flow object in relation to value (creation or maintenance of value). As a result of using these features, it is possible to identify such flows as: flow of products, flow of containers (packages), flow of vehicles and flow of handling equipment (Pic. 11).

Development of a flow map in supply chains

The above material allows us to develop a flow map in supply chains (Table 3). The content of Table 3 allows us to draw the

Table 3

Example of a flow map of values, new products, demands, products and/or services (developed by the authors)



following conclusions. Time of movement of the flow is divided into several intervals. Table 3 shows ten intervals. Flows move sequentially and in parallel, depending on the specifics of the tasks solved by the consumer and the supplier. The initial and most important flow is the flow of consumer sensations associated with the lack of something. Moreover, this deficiency can be felt to varying degrees. The main reserve for creating additional value for the consumer is to reduce the interval of his waiting time from ordering products and/or services to receiving value. Besides, an additional reserve here is an earlier understanding of the prototype of customer value and operational management of flows presented in Pic. 10.

Presented in Table 3, flow map of flows of value, new products, demand, products and/or services is the basis for implementation of a process approach to supply chain management and differs from traditional maps of business processes since, on the one hand, it takes into account the values of end users of

products and/or services, and on the other hand, it assumes that for each flow one should select specific systems and specific processes necessary to control this flow, focusing on the data in Pic. 1.

CONCLUSIONS

Within the framework of this study, the following results were obtained, which have signs of research novelty: the relationship of management components and types of flows in supply chains (Table 1, Pics. 1 and 2); the role of consumer and supplier as sources of these flows (Pics. 3 and 5); classification of flows considering the objects of chain management (Pics. 6–9; 11); form of a flow map in supply chains (Table 3).

The above results, during further research, will make it possible to clarify and supplement the relationship of supply chain management and management of value chains and requirements based on a systemic approach; to develop practical recommendations to reduce lost profits when managing flows in supply chains; to create prerequisites for more efficient value creation and delivery.

Based on the results obtained, it is planned to further clarify the essence and content of the chain management concept at large; to supplement the provisions of the theory and methodology of chain management in terms of design, formation and optimisation of the main objects and management components of this type; to develop guidelines for improving the efficiency of the chain management system, considering the features of their activity at regional and sectoral levels.

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