

# Research of Supply Chain Strategies in Project Activities

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## Abstract

The use of project management, logistics, and supply chain management knowledge enables enterprises to systematically organize the process of managing investment, material, service, financial, and information flows to achieve competitive advantages in a dynamic environment.

During the implementation of the enterprise development project, logistics and supply chain management covers almost the entire spectrum of resource-functional support from initiation to closing processes. Such processes are implemented in a sequence of phases, stages and activity of the life cycle, and their effective implementation is based on the rules of logistics, with the help of supply chains and coordinated interaction of participants.

Hierarchical levels of the supply chain have been studied, the factors influencing the external and internal environment on the enterprise's supply chain and the choice of alternative strategies for the entire supply chain have been determined. Objectives and strategies for supply chains have been identified, leading to better customer service that will result in increased supply and lower costs, which will benefit all stakeholders in the supply chain.

The selection of reasonable strategies for the development of supply chains, and on their basis - the preparation and implementation of individual projects, taking into account the stage of the life cycle at which the enterprise is located, it is possible to establish specific strategies for the development of the enterprise. This necessity is realized through formalized methods for selecting projects that best align with the company's development strategy and its life cycle stage. Depending on the goals pursued by management, the strategies for further development implemented through individual projects will be different. Analyzing the stages of the enterprise life cycle has led to the formation of a number of strategic alternatives for its operation. Based on what kind of development strategy the company sets before itself, this will be the main list of projects that have the greatest value for the company.

## Keywords

Project management, supply chain management, planning, strategy, life cycle

## 1. Introduction

At the beginning of the 21st century, the growing interest of countries in supply chains (SC) is associated with increased globalization and integration, digitalization and competitiveness of logistics services etc. Whether it's adapting known solutions or integrating new ones, adopting new equipment or dealing with complex infrastructure and other challenges faced by managers today, they are accompanied by tools and new technologies related to Internet services and business analytics. "Consistency" for SC managers means that they face fundamental changes every day. In such a turbulent environment (pandemic, world crisis, development of information technologies) there is no permanence, which requires a critical look at the principles and fundamental tools of SC management [1]. For the first time, the phenomenon of SC control was at a crossroads in the late 1990s, when companies realized that the regulations on SC written in the 1950s should be adapted for an era of increasing global competition. The SC control phenomenon again reached a turning point in the era of Industry 4.0 (Fourth Industrial Revolution), which is associated with the rapid development of information technology [2].

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Organizations such as the Association for Supply Chain Management (ASCM), Project Management Institute (PMI), Council of Supply Chain Management Professionals (CSCMP), and Operations Management Association (APICS) have made significant contributions to the study, development of a modern concept, and the implementation of effective SC [3,4]. As a result of the joint efforts of scientists and practitioners, the supply chain capabilities of business structures have expanded from the integrating forecasting, planning, and execution of operations to seamless end-to-end management of SC. In the identified resources of the world literature, there is a lack of research on the issues of organizing the supply chain within the framework of project management with consideration for strategic management.

Project management (PM) in supply chains expands the capabilities of professionals in the field of SC, including forecasting, customer service skills, planning, control and risk management [5]. However, a systematic understanding of the hierarchical levels of planning processes in supply chains is required.

The development of methodologies for managing supply chains (SCM) and project management (PM) belongs to those that require a joint consideration and utilization [6]. The theoretical foundations and practical skills in these fields of knowledge enable the attainment of a synergistic effect in the processes of planning and implementing project activities. Research [7] proposes a conceptual basis for integrating SCM into project management. This research classifies critical elements into four main areas: IT integration, organizational coordination, risk management, and supply chain resilience and complexity. In [8], the main perspectives in the theory of strategic management related to SCM and their interaction are examined. It is demonstrated how they complement each other, explaining the characteristics of customer-oriented supply chain management and the processes that create value. The authors of [9] examine supply chain management strategies in enterprises, identifying their advantages and disadvantages. According to [10], a competition model between supply chains is proven, and strategic decisions in the supply chain are identified. However, for the successful implementation of supply chain management in a project environment, it is necessary to consider the entire lifecycle, the supply chain strategy, and development projects together, along with their interrelationships. This will enhance the competitiveness of the entire supply chain.

Thus, based on the results of the analysis of current research dedicated to the strategies in supply chain management, it can be concluded that scientific works are more focused on strategic decisions and project resource provisioning, without considering the enterprise lifecycle and modeling the selection of development projects in supply chains. The above justifies the prospects of considering the "lifecycle-strategy-project" triad in the functioning of supply chains in project activities.

The purpose of this research is to enhance the efficiency of project management within supply chains, taking into account both the strategy and the lifecycle in which the enterprise operates.

To achieve this goal, the following tasks have been set:

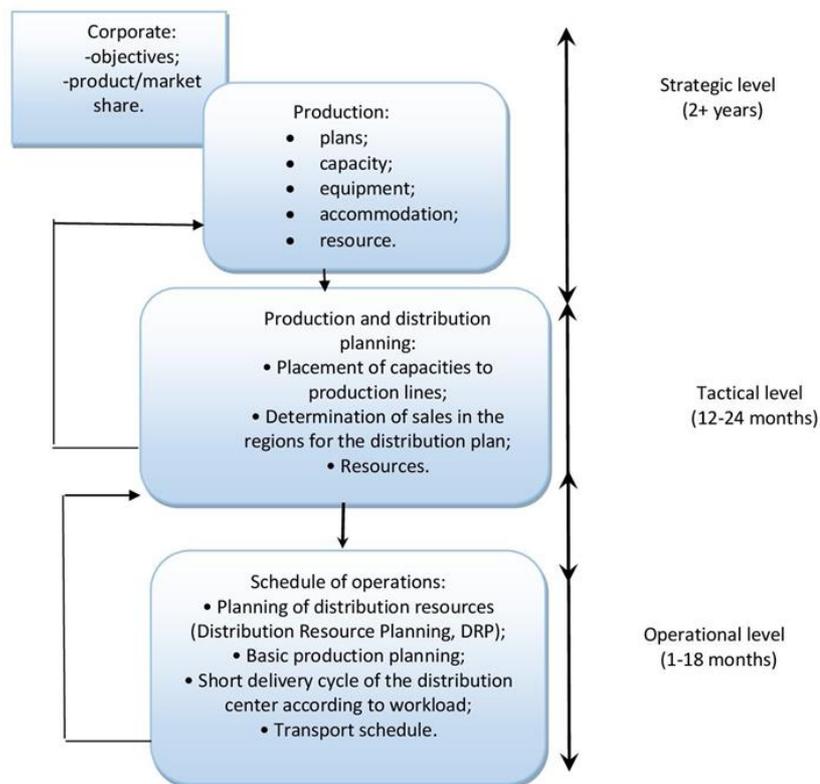
1. Investigate the hierarchical levels of supply chains concerning production capacity planning.
2. Specify the lifecycle of a long-term project from the perspective of various participants in the supply chain.
3. Justify supply chain development strategies and, based on these strategies, prepare and implement individual projects, taking into account the stage of the enterprise's lifecycle.

## **2. Hierarchical levels of planning in SCs**

Successful project management in supply chains includes four critical processes: strategy, project planning, project execution, and personnel (people). Therefore, it is relevant to study the hierarchical levels of the supply chain, determine the factors influencing the external and internal environment on the company's supply chain, and choose alternative strategies for the entire supply chain.

The division of management levels includes strategic, tactical and operational, each of which has its own planning horizon [11]. According to the planning horizon, the success of the enterprise depends on the corresponding goals, the presence of an effective system of planning of SC, establishment of priority connections and control points between levels. An enterprise should have guidance for different planning horizons and components respectively. Strategic action planning is focused on approximately 2 years and beyond, while tactical and operational planning ranges from 12 to 24 months and 1 to 18 months, respectively (Figure 1).

At the strategic level, such key issues as setting corporate goals, winning market or business share, acquiring other enterprises (organizations), strengthening existing market positions, exiting a business that does not meet strategic plans, etc., are solved. For example, an increase in market share affects the strategy of forming production capacities.



**Figure 1:** Hierarchical levels of planning in SC

At the strategic level, the enterprise in the SC must decide on the planning of production capacities for the next two or more years, the types and amount of equipment and its location, resource provision of production operations. Decisions at the strategic level are related to the tactical level of planning. Typical tactical decisions are the deployment of capacities and resources within 12-18 months, labor management, distribution development, etc.

At the tactical level, the company plans activities such as balancing the demand for storage capacity in the network and determining the more efficient loading of this capacity of each distribution center. Planning the capacity level of each center can include the total number of labor resources and the connection of project demand using the planning horizon, the use and location of the provided warehouse space (for example, the type of racking equipment). In general, tactical warehouse planning focuses on determining how best to use network infrastructure (existing warehouses and physical equipment ownership, etc.). However, if infrastructure issues, for example, do not match the network capacity, which the enterprise cannot solve at the tactical level, they should be transferred to the strategic level for resolution. Therefore, feedback should be taken into account during hierarchical planning for the effective functioning of SC.

The key decisions at the operational level are the scheduling of labor resources and the short-term allocation of warehouse resources. As a rule, atypical components of this activity (temporary labor staff or necessary storage space that significantly overlaps the capacity) require significant attention. Also, the "anticipation" or "non-standard" requirements of operational planning and scheduling of operations is something that managers must report or feed back to the tactical level. For example, when there are unplanned storage actions, insufficient storage capacity, the information is transferred to the tactical level for coordination. A possible scenario could be when there is excess capacity in a certain warehouse, while other warehouses face insufficient capacity, leading to an imbalance that requires a general network solution.

Enterprises can improve the process of hierarchical planning of SC through management actions, taking into account how:

- specific decisions correspond to each level, who makes decisions and how often;
- long-term decisions affect short-term operations;
- planning and calendar support are used at each level of hierarchical planning and how input and output flows are linked and coordinated.

Strategic business decisions in SC are often related to the implementation of various logistics projects, and effective operational management and development projects are integral components of management in SC.

### **3. Life cycle from the perspective of different participants**

As you know, project management (PM) is a methodology for creating structures and predictability while considering complexity. PM provides the unique requirements of projects for the formation of dynamic relationships of supply chain participants located inside and outside organizations.

A good example of a long-term project in the SC is the ship acquisition project. It can be represented as a sequence of six phases. The first phase is the preparation of proposals for the formation of requirements for the object and the initiation of the project.

Design is an indispensable element in the process of updating equipment and the fleet, in particular. At this stage, the life cycle (LC) needs to be carefully studied. The conditions for the acquisition of ships in the domestic and world markets should be compared and evaluated, first of all, in connection with the increasing requirements regarding the safety of navigation, the protection of human life and the environment, and also consider the conjuncture of the freight market. Ship design is carried out by specialized design organizations that have the appropriate licenses. Financing of such works is carried out, as a rule, at the expense of the shipping company (customer).

When preparing a proposal for a construction contract, the contractor specifies strategic decisions with the customer. The project participants are determined, the timing of the project is specified, a schedule is compiled.

The implemented project goes through all phases of the LC, each of which has a wide circle of participants, and the overall level of project efficiency is formed under the influence of the management methods used.

In figure 2 there is a specified vessel's life cycle from the perspective of different participants in the fleet renewal (replenishment) project [12]. Dashed arrows indicate the continuity of the project implementation process since the development of the plan begins at the pre-investment stage. It should be noted that for the investor, the LC of the project could be completed at various points in time, depending on the conditions for credit debt repayment; a similar situation is reflected by several arrows. Such situations can be caused by various loan repayment schemes (straight-line, uneven schemes, with the provision of a grace period, as well as with the possible early repayment of credit debt).

#### **3.1. Strategies of supply chain management**

The strategic nature of cooperation between the participants of the SC is aimed at quality customer service. Each participant in the SC, regardless of its size and production profile, can perform its function because there are clients who are ready to buy its goods or services. Therefore, the SC should be structured in such a way as to connect links that have a direct or indirect influence on the end user, creating value for the buyer both in relation to the product and the entire logistics service. The logistics system created by all units of the SC should be developed in a way that considers the market analysis results, carried out taking into account the needs of various groups of clients.

SCs must have their own strategies [13]. If the goal of all efforts is the final recipient, then the strategic decisions of the SC include:

1. The study of demand for a product, product features.
2. Contractual relations between participants in the SC.
3. Selection of suppliers, distribution channels, location of warehouse space, transportation services, etc.
4. Inventory management concept.
5. Identification of key competencies of the SC as a whole and its main elements.
6. Supply chain design and flow chain planning.
7. Configuring the SC, deciding to "make or buy."

The focus of the SC on the client is most clearly emphasized by the Quick Response concept (QR). It consists in determining the demand and quick response to its changes, in closer cooperation between the participants of the SC in order to provide a high level of customer service at minimal cost. This becomes possible if customers quickly provide their suppliers with the necessary information on demand, and suppliers are required to provide quick deliveries, offering a high level of service, properly managing inventory, using modern logistics technologies, in particular Electronic Data Interchange (EDI). This, obviously, requires partnerships in the SC, a shorter time frame, the exchange of information (in particular, information about stocks), quality obligations (Total Quality Management, TQM), fast transportation and reorganization of production operations, as well as reducing the time required to switch production. Thanks to better customer service, these operations lead to increased supplies and lower costs, bringing benefits to all SC participants.

The flexibility of supply or, more broadly, the flexibility of suppliers is becoming increasingly relevant. This applies to strategic supply chain activities. Thus, the problem lies in the flexibility of individual participants in the SC, namely, suppliers and consumers. The flexibility of the entire SC is the ability to adapt to changes in market structures and changes in strategy [14].

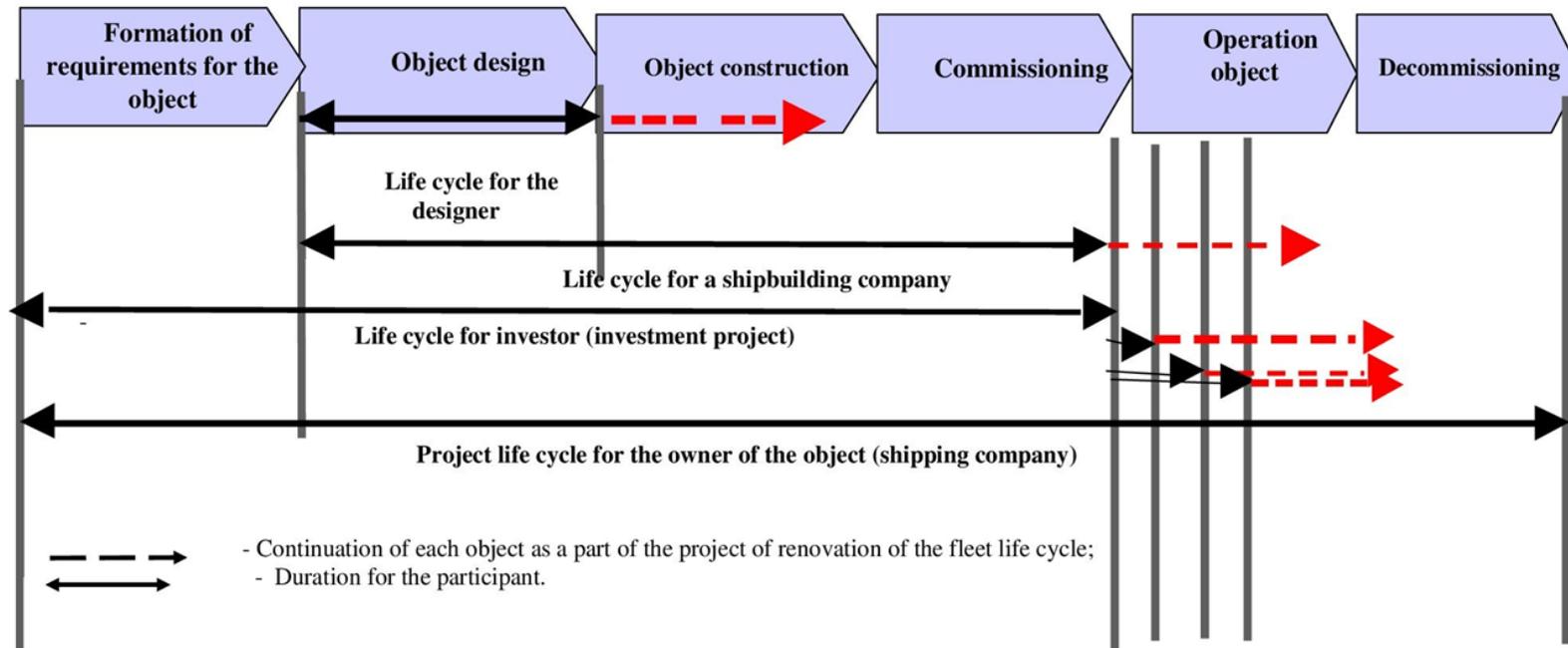
Strategies based on the concepts of Lean Management and Agile Management can be helpful in meeting agility requirements. These concepts can be applied both to the company and to the entire SC. Lean Management is aimed primarily at reducing costs. Such management creates value for the client, eliminating all losses, such as stocks of work in progress, production losses, assuming fast delivery and no shortage of stocks.

On the other hand, Agile Management is primarily aimed at quickly responding to changes in demand both quantitatively and qualitatively. In this case, the strategy of the companies is the perfect end user service. Key features of this strategy include flexibility and short delivery times. Agile SC strategies are best for differentiated products in the face of changing demand. This strategy is the easiest to implement when the total lead time is shorter.

However, in reality, these two approaches can complement each other, and in many cases, a hybrid strategy is implemented where both lean and agile SCs practices are used, known as "Leagile" [15].

Considering the main goals of SC management, we can distinguish the following:

1. Reducing the overall Lead Time;
2. Ensuring reliability, the correct frequency of delivery (Tack Time), quality and flexibility of supply (Agile Management);
3. Optimization of inventory levels throughout the supply chain;
4. Minimization of total costs.



**Figure 2:** The LC from the perspective of different participants in the fleet renewal project

Inventory optimization means that inventory management cannot be seen as an autonomous activity, inventory levels must be flexibly adjusted to customer preferences. Minimized total costs for the flow of material resources should be compared with the level of delivery service, as this is the main compromise of the entire logistics system.

It should be noted that individual companies in SC are suppliers and consumers at the same time. Each supplier is a customer of another supplier, which means that they all must operate in two markets: they are part of the sales market as customers, and as suppliers in the procurement sphere. Each company in the SC should listen to the signals of the customer market - in this case, study the needs of the next link and, having received the necessary knowledge, purchase the necessary resources in the market, i.e. from the previous link in the SC.

### 3.2. Modelling of project development in SCs

Having a development strategy is an integral part of the effective functioning of any enterprise, many of which have already realized the importance of strategic management and project management methodologies. Of particular importance is the development of well-founded strategies for the development of the SC, and on their basis - the preparation and implementation of individual projects, taking into account the life cycle stage at which the company is located. This need is realized using formalized methods for selecting projects that best suit the enterprise development strategy and the stage of its life cycle. To select LC development projects, a method is needed that allows for both quantitative and qualitative assessment of such compliance. The apparatus of fuzzy sets meets similar requirements.

Let  $E$  be a set and  $x$  - element of  $E$ . Then a fuzzy subset  $\tilde{A}$  of the set  $E$  is defined as a set of ordered pairs  $\{(x, \mu_A(x))\}, \forall x \in E$ , where  $\mu_A(x)$  is a characteristic membership function that takes the degree of membership in a completely ordered set  $M$ , indicating the degree of membership of an element in the subset  $A$ . The set  $M$  is called the membership set [16].

When implementing development projects, taking into account the above-mentioned parameters, the theory of fuzzy sets is used in order to compare the matrices of characteristics of enterprise development projects in the SC in accordance with its possible strategies and find the best project that can be implemented at this stage of its life cycle.

Let's denote:  $X = \{x_1, x_2, \dots, x_n\}$  - many enterprise development projects;

$Y = \{y_1, y_2, \dots, y_p\}$  - many stages of the enterprise life cycle;

$Z = \{z_1, z_2, \dots, z_m\}$  - set of possible strategies of the enterprise included in the SC.

Let  $\xi_R : X \times Y [0;1]$  - membership function of a binary relation  $R$ , determined using an expert. The relationship  $R$  is represented in matrix form (1) as follows:

$$R = \begin{matrix} & \begin{matrix} y_1 & y_2 & \dots & y_p \end{matrix} \\ \begin{matrix} x_1 \\ x_2 \\ \dots \\ x_n \end{matrix} & \left[ \begin{array}{cccc} \xi_R(x_1; y_1) & \xi_R(x_1; y_2) & \dots & \xi_R(x_1; y_p) \\ \xi_R(x_2; y_1) & \xi_R(x_2; y_2) & \dots & \xi_R(x_2; y_p) \\ \dots & \dots & \dots & \dots \\ \xi_R(x_n; y_1) & \xi_R(x_n; y_2) & \dots & \xi_R(x_n; y_p) \end{array} \right] \end{matrix} \quad (1).$$

In this matrix, the elements of each row express an assessment of the compliance of the development project in accordance with the stage of the enterprise's life cycle.

Let  $\psi_s : Y \times Z [0;1]$  - binary relation membership function  $S$ . For all  $y \in Y$ , and all  $z \in Z$ ,  $\psi_s(y; z)$  is equal to the degree of importance of the life cycle stage of the enterprise for the implementation of the development strategy. The higher the value of the function, the more likely

the strategy will be successfully implemented at this stage of the life cycle. In matrix form, this relationship has the form (2):

$$S = \begin{matrix} & \begin{matrix} z_1 & z_2 & \dots & z_m \end{matrix} \\ \begin{matrix} y_1 \\ y_2 \\ \dots \\ y_p \end{matrix} & \begin{bmatrix} \psi_s(y_1; z_1) & \psi_s(y_1; z_2) & \dots & \psi_s(y_1; z_m) \\ \psi_s(y_2; z_1) & \psi_s(y_2; z_2) & \dots & \psi_s(y_2; z_m) \\ \dots & \dots & \dots & \dots \\ \psi_s(y_p; z_1) & \psi_s(y_p; z_2) & \dots & \psi_s(y_p; z_m) \end{bmatrix} \end{matrix} \quad (2).$$

The values of the matrix  $S$  reflect the degree of compliance of the life cycle stages  $Y_i$  of the enterprise when the company adopts an appropriate development strategy  $z_j$ .

From matrixes  $R$  and  $S$  we get the matrix  $T$  (3):

$$T = \begin{matrix} & \begin{matrix} z_1 & z_2 & \dots & z_m \end{matrix} \\ \begin{matrix} x_1 \\ x_2 \\ \dots \\ x_n \end{matrix} & \begin{bmatrix} \mu_A(x_1; z_1) & \mu_A(x_1; z_2) & \dots & \mu_A(x_1; z_m) \\ \mu_A(x_2; z_1) & \mu_A(x_2; z_2) & \dots & \mu_A(x_2; z_m) \\ \dots & \dots & \dots & \dots \\ \mu_A(x_n; z_1) & \mu_A(x_n; z_2) & \dots & \mu_A(x_n; z_m) \end{bmatrix} \end{matrix} \quad (3),$$

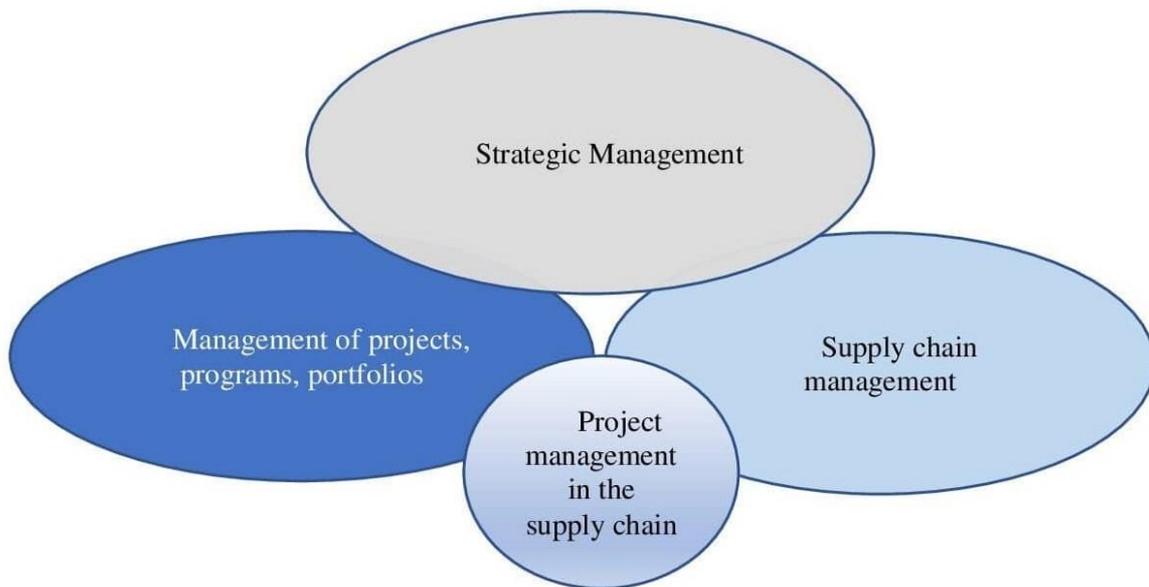
whose elements are determined by the membership function (4):

$$\mu_A(x, z_i) = \frac{\sum_y \xi_R(x; y) \cdot \psi_S(y; z)}{\sum_y \psi_S(y; z)} \quad (4),$$

for all  $x \in X, y \in Y, z \in Z$ .

This is an integrated assessment, which is assigned to the project in all respects and is compared with other assessments of other development projects. Thus, we obtain a measure of compliance of the life cycle stage of the enterprise with the implementation of the strategy through the development project. Those projects whose membership functions turn out to be the highest are selected for the portfolio. Another way is to set in advance the so-called "threshold", below which, no matter what the score, the project will not be accepted.

Summarizing the above, the methodological foundations of logistics, project management, and strategic management form the basis of the concept of supply chain project management (SCPM) (see Fig. 3).



**Figure 3:** Interdisciplinary place of PMSC

Supply chain project management is a process that allows you to coordinate resources and activities to achieve a specific goal within established deadlines, budgets and boundaries.

Project management in the supply chain is a process that allows you to coordinate resources and actions to achieve a certain goal within established deadlines, budgets and boundaries.

PM in the supply chain creates order and predictability among requirements that are complex and variable. The tactics, resources, and changes that need to happen become concrete and measurable in advance. The same tactics affect the organization of communications and behavior in predictable terms. The development of project management methods in the supply chain involves selecting a development strategy, forecasting production and consumption volumes, optimizing and monitoring of the resource status by determining the indicators of supply chain performance and increasing the overall project efficiency, taking into account the risk minimization strategy.

## 4. Conclusion

This research is dedicated to the development of methodological support for project selection within supply chains. Unlike existing approaches, these developments take into account the goals and objectives of the hierarchical level of the supply chain, the enterprise's lifecycle, and the supply chain development strategy. This symbiosis allows for a more comprehensive examination of supply chain strategies within the context of project activities.

1. The main objectives have been identified at each hierarchical level of the supply chain concerning the processes of planning and providing project resources, namely at the strategic, tactical, and operational levels.

2. The examined fleet replenishment lifecycle serves as a vivid example within the supply chain for its various participants.

3. Conceptual modeling of supply chain projects has been conducted using formalized methods for selecting projects that best align with the enterprise's development strategy and its lifecycle stage. The measure of the alignment between the enterprise's lifecycle stage and the implementation of the strategy through the development project has been determined.

This research holds both theoretical and practical significance. Theoretically, it contributes to the development of the theory of supply chain management, project management, and strategic

management, particularly in the domain of project planning and execution. Practically, it serves as a decision-making tool in the development and implementation of strategies through projects within the supply chain.

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