

# **CRISIS AND RISK ENGINEERING FOR TRANSPORT SERVICES**

Collective monograph

*Edited by Nataliia Chernova, Konrad Lewczuk*

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Materials of scientific and practical research within the framework of the implementation of the project of the program of the European Union Erasmus+ «Crisis and Risks Engineering for Transport Services» (CRENG) are presented in the monograph.

Issues of the impact of crisis situations on the work of transport enterprises and ways to increase the efficiency of the functioning of transport and logistics systems in conditions of crises and risks are considered.

The publication is intended for scientific and pedagogical workers, graduate students and students of higher education, as well as managers and specialists of industrial enterprises and business structures, who are interested in the current state and prospects of the development of scientific research.

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## **Chapter 7**

# **SUPPLY CHAIN MANAGEMENT AND NETWORKS**

Foreword

List of Abbreviations

1. Concept of Supply Chains
2. Structure of Supply Chains and Networks
3. Current Trends in the Development of Supply Chains
4. Logistic Approach to Supply Chain Management
5. Risks in Supply Chain Management
6. Organization of Logistics in Supply Chains

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### **LIST OF ABBREVIATIONS**

SMC — Service Metal Centers

4PL — Fourth-Party Logistics Provider

SAP — System Analysis and Program

SAP APO SNP — System Analysis and Program Advanced Planner and Optimizer Supply Network Planning

SCM — Supply Chain Management

SCRM — Supply Chain Risk Management

TQM — Total Quality Management

JIT — Just-in-Time

# SUPPLY CHAIN MANAGEMENT AND NETWORKS

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## FOREWORD

The relevance of supply chain management issues, which are presented in this section, is associated with the versatility of supply chain management and with the modern realities of the information society, which contributes to the rapid development of modern logistics tools, which include: Big Data technology; GRID technology; Blockchain technology; sensory technologies; transport digitalization technologies.

The development of supply chain management began in the 90s. XX century. It was then that the tendencies emerged: the excess of supply over demand, the globalization of markets and the informatization of business. These trends have caused changes in the strategies of ensuring the competitiveness of enterprises, which were forced to take into account the needs of customers as much as possible and, therefore, individualize products (customization of production). At the same time, the markets of Southeast Asia, South America, and a little later, Eastern Europe and Ukraine began to actively develop.

Many developed countries, for reasons of ecology and economy on a relatively cheap labor force, moved their production capacities to these regions, as a result, the volume of traffic began to rapidly increase. All this together led to the fact that the optimization of the entire value chain, and not just individual functions of your own enterprise, became a decisive factor in ensuring the competitiveness and profitability of the business, which determined the development of science and practice of supply chain management [1].

According to most experts, the starting point for the emergence and development of the concept of supply chain management (Supply Chain Management or SCM) was also the desire to reduce risks and uncertainties based on models of cooperation and layered (i.e., at several enterprises at the same time) inventory management [2, 3]. In the 70-80s. In the twentieth century, the concept of synchronization of supply, production and distribution processes was also actively developed — the Just-in-Time (JIT) system.

Many experts associate the emergence and development of supply chain management with the need for rational use of production capacities. Unable to manage supply chains, businesses were forced to plan production with significant stocks of raw materials, materials and work in progress, since the supply processes were not synchronized with either suppliers or customers. Corporate information systems and Internet technologies have appeared, which have significantly improved the efficiency of coordination of processes in the supply chain. It is integration and coordination that significantly distinguish the ideology of supply chain management from traditional approaches to inter-firm cooperation.

The science and practice of real supply chain management has proven the effectiveness of building a business based on a holistic consideration of all elements of the process of creating the consumer value of a product, and not just the costs and

revenues of your own enterprise, without taking into account the influence of interfirm relationships with suppliers and relations with customers.

In our country, people began to learn about supply chain management in the 90s. It was then that the first translated editions of famous foreign authors D. Bowersox and D. Clos, M. Christopher, and later K. Lambert and D. Stock appeared, which were mainly focused on strategic management of supply chains. Logistics issues explored in the scientific works of many Ukrainian scientists, in particular K.V. Zakharov A.G. Kalchenko, Y.V. Krykavskyy, V.K. Hubenko, M.Y. Grygorak, O.M. Sumets and many others.

Supply chain management is viewed from three main perspectives: business concept; independent scientific discipline; environment of information interaction of enterprises. Establishing relationships between these three areas is currently one of the most important tasks.

## **1. CONCEPT OF SUPPLY CHAINS**

The concept of supply chain management is one of the most dynamically developing areas of scientific and practical activity over the past decades.

The blurring of geographic and organizational boundaries that is happening around the world thanks to e-business is shifting the focus of enterprise management from the internal business processes of enterprises to the integration of external relations with partners and customers.

Supply Chain Management (SCM) is one of the most powerful global integration concepts that make the most efficient use of existing production resources.

A logistics chain is a set of links linearly ordered according to the material (information, financial, service) flow and performing a certain set of logistics functions and operations.

The organizations that make up the supply chain are «connected» to each other through physical flows and information flows. Physical flows include the transformation, movement, and storage of goods and materials. Information flows allow different supply chain partners to coordinate their long-term plans and control the daily flow of goods and materials up and down the supply chain.

Supply Chain Management — is a complex concept that is considering the logistics industry not as a supply of ready-made materials, components, assembly units and units, as well as the active search on a competitive basis the best partners for placement based on the specialization of engineering, technology and production orders. As a result, not a static, but a constantly updated and modernized supply network of partner enterprises is created [4]. And the logistics concept allows you to move from discrete to end-to-end management along the entire logistics chain.

Today, suppliers of companies regularly move materials and goods around the world through dozens of trade routes, with each supplier maintaining its own supply chain. All of this leads to the fact that organizations are less and less seeing their full supply profile at a time when risks and their consequences are growing.

Analysis of the main trends in the economy that affect the modern logistics concept allows you to highlight such factors:



- deepening of specialization in industry;
- new relationships with trading partners, requiring new approaches to organizing cooperation and new forms of management;
- development of world integration processes;
- increased competition in all areas of business;
- transition from the introduction of new information and computer technologies to their more efficient use;
- introduction of flexible technological equipment, design automation systems, flexible automated and robotized production;
- widespread dissemination of the philosophy of TQM — Total Quality Management;
- enhanced implementation of logistics principles in the service industry.

Therefore, effective supply chain management in today's global economy requires an approach that includes more than just timely delivery and insurance against losses [5]. To meet the challenges of today's global operating environment, companies need to fundamentally rethink what poses a threat to their business and then align resources to make their supply chains more agile and resilient.

The types of disruption that manufacturers face today are broader and more unpredictable, partly as a result of expanding supply chains in search of savings and partly because in a dynamic global economy, change is the only constant.

According to McKinsey & Company Global Supply Chain Survey, 80% of goods will be produced in a country other than the one where they are consumed by 2022.

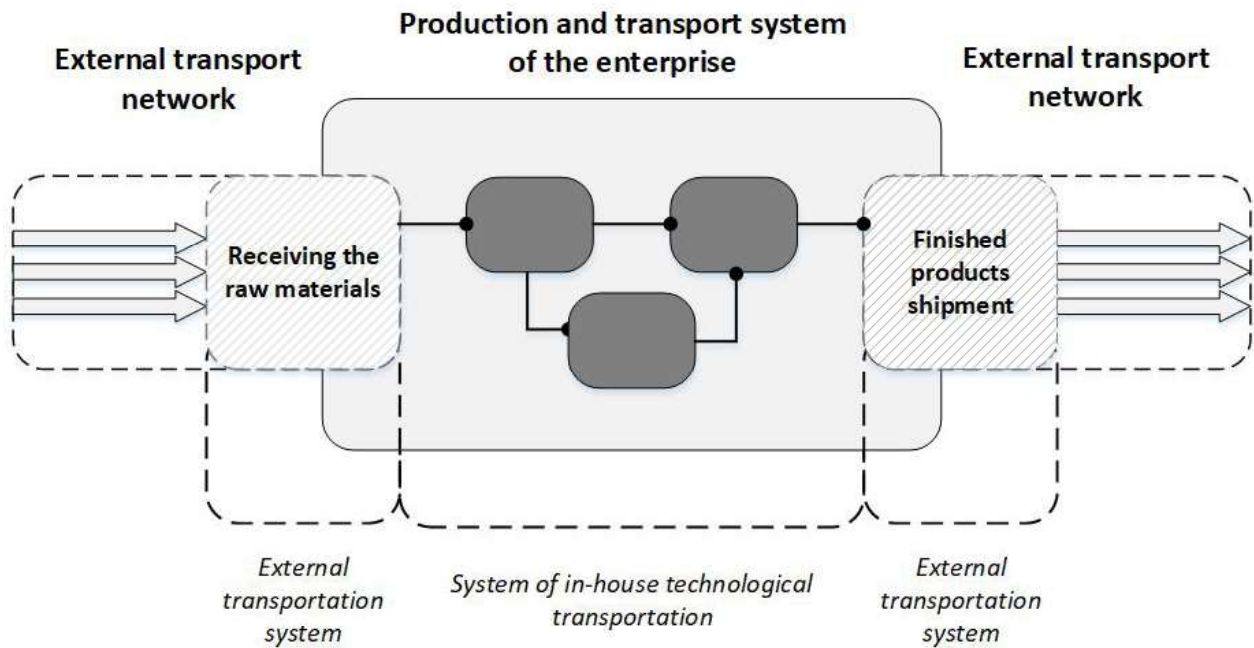
Expanding and developing a supply chain network is a complex operation and requires an incredible amount of careful planning and attention. The global environment, regulations, trade wars, politics and other risks must be taken into account before benefits such as faster lead times, enhanced capabilities and an expanded product range are recognized.

**Supply Chain Management** is the management of upward and downward relationships with suppliers and buyers in order to provide high value to the consumer at the lowest cost for the entire supply chain (*Christopher, 2011*).

The Supply Chain Management process ensures the movement of raw materials, components and finished products of an enterprise to communicate with each other the systems of procurement, production and sales (Figure 7.1).

By linking production and sales, the supply chain management system must flexibly adapt to the company's strategy and adapt to the existing economic model.

Moving materials into an organization from suppliers is called inbound or intralogistics; Moving materials out of the organization and to customers is called outbound or external logistics; movement of materials within an organization is usually described as material management (see figure 7.1).



**Figure 7.1. Moving Material Flows in the Supply Chain**

The logistics concept of organizing production includes the following basic provisions:

- rejection of excess stocks;
- refusal of excessive time for performing auxiliary and transport and storage operations;
- refusal to manufacture series of parts for which there are no orders from buyers;
- elimination of equipment downtime;
- mandatory elimination of marriage;
- elimination of irrational intra-plant transportation, etc.

For example, the production logistics of a metallurgical plant is responsible for the design, formation and optimization of concentration and distribution systems within the enterprise and their effective use in managing the flows of raw materials (sinter, coke), iron and steel, and finished products (slabs, pipes, sheets, etc.) in the internal environment of an industrial enterprise.

The success of the supply chain is assessed according to three criteria: operability (ensuring work without disruptions), reducing costs and reducing the turnover time of a unit of production within the system.

This requires a deep analysis of: places of production, the number of production facilities, platforms and warehouses, which determine the physical flows between various participants in the supply chain and affect the optimal distribution of finished products in the right stocks for further delivery to the consumer.

All characteristics of supply chains are conceptualized and calculated (transport or production costs, production, operational or warehouse constraints).

On the basis of simulations, a model of an optimized logistics network is developed, including the economic justification of this model and its detailed overview (flows between production points, production capacities of enterprises, etc.).

A series of «What if?» simulations are created, such as «What if transportation costs increase by 2%? If a business can ship 10% more goods per day, how will this affect the rest of the chain?»

This analysis must be done prior to planning and executing operations, and updated at regular intervals.

Supply Chain Management extends from raw material suppliers through manufacturing, assembly, quality control, warehousing and onward through distribution channels, wholesalers and retailers to the final consumer of the product or service.

SCM is a management philosophy in which the delivery of products or services to the end user is viewed as a process. This process must be managed as a whole, regardless of the functions of an individual enterprise and the boundaries between enterprises, in order to ultimately increase the value of the business of all its participants.

Supply Chain Management focuses on supplying the end user with the product or service with the highest possible customer value at the lowest possible cost and in the shortest time on the market. This goal can only be achieved by an enterprise that works together with suppliers and customers to optimize the overall trade relationship, and not just its own parts of the process.

SCM emphasizes the fact that it is not enough to focus only on improving internal processes and functions, because the business activities of the enterprise also involve a network of relationships that extend far beyond the walls of the company. Therefore, the purpose and purpose of SCM is to manage and improve this complex web of relationships through the integration of connections, the provision and sharing of technologies, information and resources.

Timely and accurate supply chain information enables manufacturers to manufacture and ship as many products as can be sold. Efficient supply chain systems help both manufacturers and retailers reduce excess inventory.

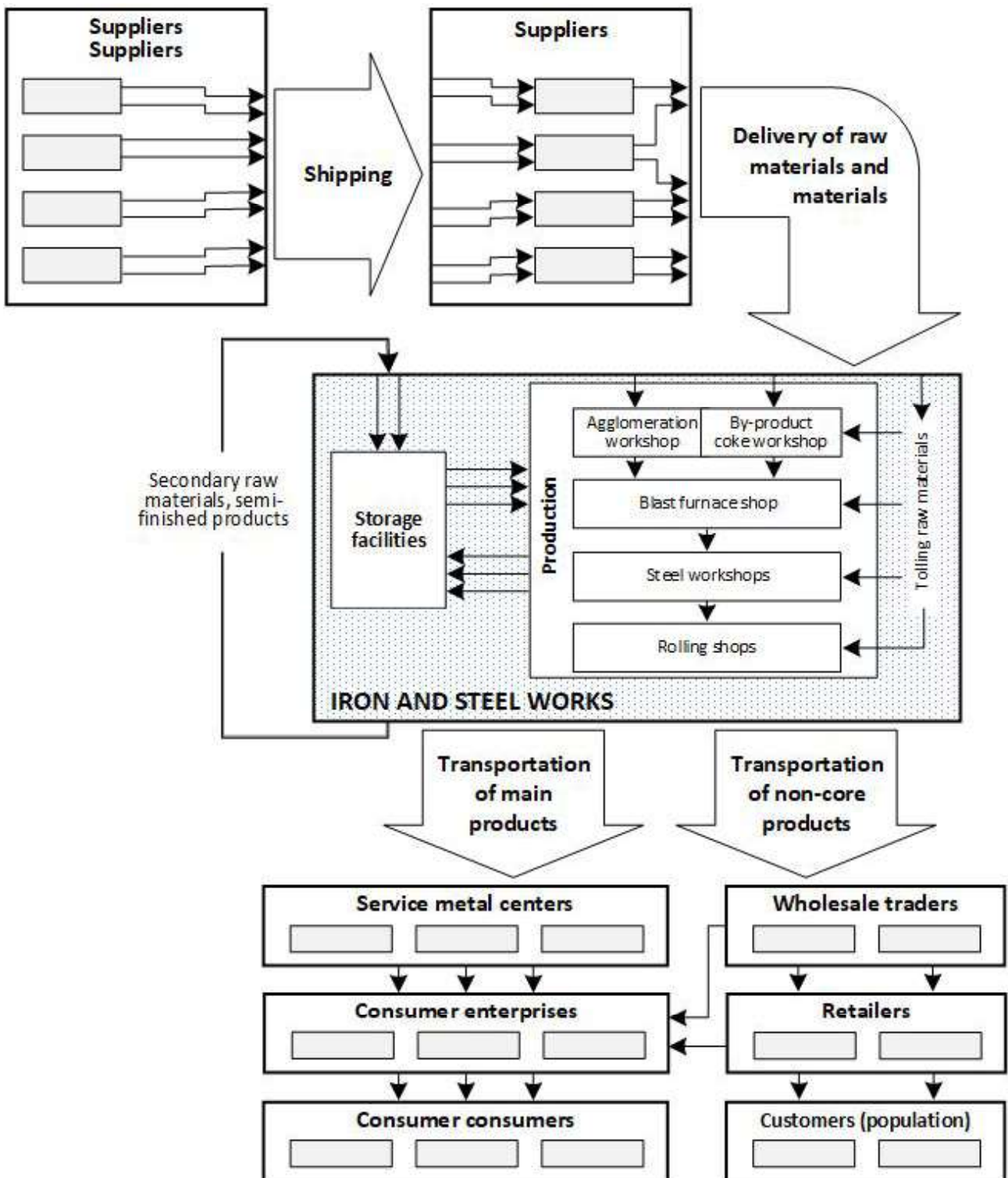
## **2. STRUCTURE OF SUPPLY CHAINS AND NETWORKS**

Logistics networks and chains link the functional areas of supply, production and sales in each of the organizations, connected to each other by cross-functional and inter-organizational business processes.

A logistics supply network connects all companies and enterprises that contribute to the product. At the same time, the network includes suppliers for its own suppliers, as well as customers for its own customers (Fig. 7.2).

Organizations do not operate in isolation, each one acts as a buyer when it purchases materials from its own suppliers, and then it acts as a supplier when it delivers materials to its own customers. Thus, a wholesale buyer is a buyer when buying goods from manufacturers and then a supplier when selling them to retail stores: a component manufacturer buys raw materials from its suppliers, assembles them into components, and transfers the results to other manufacturers. Products move through a number of organizations on the way from original suppliers of raw materials, through intermediate organizations and to end users.

When managing material flows in the process of selling finished products, the problems of distribution logistics are solved [6]. This is a wide range of tasks that are dealt with by enterprises engaged in trade and intermediary activities.



**Figure 7.2. Logistic Supply Chain of Metal Products**

The functioning of the supply chains of metal products is in a constantly changing high-tech environment, so solving big problems takes time, accuracy and perfection. Service Metal Center (SMC) is an important link in supply chains and chains, which provides material and informational communication between the stages of production and consumption. This is a specific industry that deals with metal processing and performs most of the blank production operations: cutting into strips and sheets, making profiles and structures of varying degrees of complexity.

SCM focuses on delivering the highest possible customer value to the end user at the lowest possible cost and in the shortest time on the market. This goal can only be achieved by businesses that work together with suppliers and customers to optimize the overall trading relationship, not just their own parts of the process. SCM emphasizes the fact that it is not enough to focus only on improving internal processes and functions, because the business activities of the enterprise also involve a network of relationships that extend far beyond the walls of the company. Therefore, the purpose and purpose of SCM is to manage and improve this complex web of relationships through the integration of connections, the provision and sharing of technologies, information and resources.

The criteria for the efficiency of supply chains are: the ratio of the net working time of the order (work) to the time of preparation, fulfillment and completion of the fulfillment of contractual obligations, the level of added value or margin minimization, as well as the quality of service of the production services provided.

Implementation of SCM and the implementation of appropriate systems are appropriate where the costs of working with suppliers, distributors and logistics make up a significant proportion of the cost of production. These enterprises primarily include diversified metallurgical holdings and chemical industry enterprises, manufacturers of consumer goods, large distributors and retailers.

### **3. CURRENT TRENDS IN THE DEVELOPMENT OF SUPPLY CHAINS**

In the next decade, digital platforms will dominate the global steel industry by digitally connecting all market participants. The main goal of this process is to improve efficiency for all links, which will allow forecasting the demand for steel products and price trends with much greater accuracy.

In the world, at least one third of all manufactured metal products pass through service metal centers. Just-in-time delivery is one of the main objectives of the steel center, with 24/7 service to respond in a timely manner to unforeseen demand for steel products. At the same time, the organization of the effective work of the SMC should be ensured through the active use of modern digital methods of managing all operations, as well as the timely implementation of information technologies.

In the coming years, metal service centers will face quite serious changes in the organization of work. Digital platforms in the steel and metal market are changing traditional business models that rely on off-the-shelf inventory and arbitration agreements as key elements of the supplier-customer relationship. SMCs must find new ways to create value for buyers, manufacturers and other participants in the supply chain — otherwise they will disappear.

The main goal of a modern metal service center is to provide a comprehensive service for both metal buyers and manufacturers. In the short term, SMC customers will be able to use modern digital tools such as contract portals, online shops and order reviews. Customized solutions allow service centers to offer customers more specialized metal products and a variety of services.

Research and practical experience of competitive enterprises in the metals market show that a higher value-added business has great potential and prospects.

A good example of this is the investment in 3D lasers, which can be used to combine multiple customer tasks such as drilling, sawing and cutting at an attractive price, with a high level of accuracy and quality in order fulfillment.

The introduction of digital workplaces allows you to receive not only the advantage of an affordable solution for the modernization and integration of disparate operations, but also solutions that unite all participants in production and service centers, allowing them to communicate and collaborate with the production goal, meeting both their individual needs and preferences, as well as the general needs of the enterprise and the supply chain of metal products.

Along with the digitization of processes in the supply chain of metal products, the intelligent use of the data obtained is also becoming increasingly important. For example, one of the largest European distributors of steel and metal products Klöckner & Co cooperates with the leading supplier of artificial intelligence, the German company Arago GmbH. The use of artificial intelligence helps the service center to automate parts of the IT infrastructure through constant learning and self-improvement processes.

The development of metal service centers entails the expansion and improvement of sales channels for metal products, which in turn contributes to the development of the metallurgical industry and the country's economy.

One of the limiting factors for these innovations is the closedness of the databases of raw material suppliers and enterprises. Reducing the time of preparatory operations in the production cycle (switching to work on specific contracts) and the delivery time of raw materials is in direct proportion to the extent to which all participants in the supply chain will have limited access to their databases on planned volumes, assortment of finished products and data on raw material supply opportunities.

The COVID-19 crisis has accelerated the use of Industry 4.0 business models, i.e. introduction of automation technologies, autonomous systems and artificial intelligence. The more the supply chain depends on people, the greater the risks. At the same time, Industry 4.0 technologies do not depend on the human factor. Also, the use of automatic machines will significantly reduce transport costs, import duties and the risk of overproduction.

Technologies such as autonomous systems and additive manufacturing are deployed in a confusing, human-filled environment, with inevitable mistakes and consequences for corporate strategy, risks and damage to reputation.

Logistics experts believe more sustainable shorter and simpler supply chains are more likely to be used.

An idea that is gaining traction is bimodal supply chains:

1. «First mode» (traditional) — lean efficiency, low risks, high predictability.
2. «The second mode» — the need for flexibility (agility), speed and exploring new opportunities.

Most companies will have to become bimodal, and their priority will be the second mode — quick recognition of opportunities, adaptability, readiness to solve unexpected problems.

#### **4. LOGISTIC APPROACH TO SUPPLY CHAIN MANAGEMENT**

The application of elements of end-to-end management in relation to the foundation of the supply chain allows all participants to fully use the accumulated logistics potential.

Some of the most well-known international standards in the field of supply chain management are currently considered:

1. Supply Chain Operations Reference.
2. Global Supply Chain Forum.
3. Collaborative Planning, Forecasting, and Replenishment.
4. Supply Chain Consortium Best Practice Framework.
5. European standards ISO/PAS28000, ISO-9000.

On their basis, the development of standards for logistics service enterprises and complete supply chains can be carried out, but, without fail, taking into account national requirements and peculiarities.

An important direction for improving logistics processes is improving the inter-functional interaction of participants [7]. Mutual integration of supply chain partners into the business leads to an understanding of how suppliers work, in which direction to develop joint technical potential, how to build a control system and exchange information and, as a result, jointly improve activities.

No less important is the involvement of customers in the process of logistics services, a joint assessment of the true problems of customers and the formation for them not so much of specific types of services, but of integrated logistics proposals aimed at the final result and comprehensive development of the consumers' business.

Correct assessment and forecast of market development trends, timely proposal of management decisions aimed at consumers and profit, re-focusing and coordination of the activities of supply chain participants (bringing suppliers, distribution centers, trade enterprises closer to the places of production and sale of finished goods and services, involvement of suppliers and consumers into the design processes, development of services, etc.), all these measures allow service companies to reduce logistics costs without compromising the quality of service, staying in the profit zone for as long as possible.

Close cooperation with logistics operators provides enterprises with the ability to successfully manage global supply chains of raw materials and finished products, covering various countries.

Many larger companies are turning to third party logistics providers (3PLs) and fourth party logistics (4PL) providers because of the cost-efficiencies they can provide. This allows organizations to focus on their business priorities and core activities.

A 3PL does not take ownership of (or title to) the products being shipped. This third party comes into play as an intermediary or manager between the other two parties.

This includes facilitating the movement of parts and materials from suppliers to manufacturers, as well as finished products from manufacturers to distributors and retailers.

A 3PL may or may not have its own assets, such as trucks and warehouses. Most 3PLs offer a bundle of integrated supply chain services, including: Transportation, Warehousing, Cross-docking, Inventory management, Packaging, Freight forwarding.

Companies turn to 3PLs when their supply chain becomes too complex to manage internally.

A fourth-party logistics provider, or 4PL, represents a higher level of supply chain management for the customer. The 4PL gives its clients a «control tower» view of their supply chains, overseeing the mix of warehouses, shipping companies, freight forwarders and agents.

The Council of Supply Chain Management Professionals defines a Fourth-Party Logistics Provider as: «An integrator that assembles the resources, capabilities, and technology of its own organization and other organizations to design, build and run comprehensive supply chain solutions».

Typically, the 4PL does not own transportation or warehouse assets. Instead, it coordinates those aspects of the supply chain with vendors. The 4PL may coordinate activities of other 3PLs that handle various aspects of the supply chain.

The 4PL functions at the integration and optimization level, while a 3PL may be more focused on day-to-day operations. The 4PL has integrated technology offerings that deliver a high level of visibility into the supply chain for tactical and strategic analysis.

Key drivers of the continued growth in demand for logistics services include the globalization of the world economy, the use of just-in-time manufacturing (JIT) and the development of e-commerce. Globalization is driving the expansion and sophistication of distribution channels and supply chains.

## **5. RISKS IN SUPPLY CHAIN MANAGEMENT**

In light of the growing complexity of the business and the growing general uncertainty, the creation of a systematic approach to risk management in the supply chain is becoming more and more urgent.

With regard to supply chain management, there is Supply Chain Risk Management (SCRM) — risk management in supply chains, in which three key elements are usually distinguished:

- Determination (identification) of risks;
- Risk analysis;
- Management of risks.

Supply chain risks are diverse and affect virtually all key business processes. Risk identification, analysis and management methods are highly dependent on their type and possible place of occurrence in the supply chain.

When managing risks in supply chains, it is advisable to apply simple rules: specificity in describing risks, quantifying specific risks, moving from studying risks to managing them, identifying the necessary resources for risk management, drawing up an acceptable schedule for risk management.

A systematic classification of risks and the development of an appropriate response strategy is essential to strategically increase the resilience of the supply chain while keeping costs to a minimum.

Common logistics risks in supply chains include:

a) risks associated directly with the transportation of goods on a specific vehicle, including breakdown of rolling stock, road accidents, theft or loss of a vehicle,



explosions, damage during loading, stacking, unloading, damage to containers (packaging), loss or incorrect design documents, etc.;

b) risks of loss of quality or damage to cargo during storage, warehousing (cargo handling) and other operations in warehouses and in preparation for shipment;

c) risks associated with the delay of cargo during customs clearance of import-export, etc.

It is possible to identify potential risks in the supply chain before they arise with the involvement of experts or specialists in the field of risk forecasting. When identifying, it is important to highlight the factors influencing the magnitude of uncertainty and risk. In the logistics business processes of the supply chain, they include:

- characteristics of the product and its packaging;

- means of transportation, features of the logistics infrastructure (for example, types of warehouses, types of equipment for cargo handling, etc.);

- time of order fulfillment cycle, type of route upon delivery of cargo, etc.

The entire supply chain is influenced by the risks of the macro environment — economic crises, restrictions on the availability of raw materials, political instability, new legal requirements, natural disasters.

The risks of the extended supply chain, which include operational risks, i.e. risks in own supply chain and supply chain risks of suppliers and customers.

Operational risks include risks in planning, procurement, manufacturing, new product launches, and deliveries.

Supply chain risks for suppliers and customers include risks of suppliers and their contractors, risks of companies providing outsourcing services, risks of consumers.

In addition, there are functional risks, that is, the risks of «related» business processes, organization and infrastructure — the risks of incorrect legal, tax support, recruitment risks, IT support risks [8].

The more complex the supply chain, the more risks need to be considered when managing it. Integrated supply chains are subject to great risks: dependence on suppliers of raw materials and services (for example, logistics); dependence on infrastructure; less time to respond to disruptions in the extended supply chain; the greater the cost of any management error.

Risk identification allows you to subsequently obtain a quantitative and qualitative risk assessment — an assessment of the likelihood of a hazard, forecasting the probability of the level of losses in the supply chain and their value or actual value. The estimates obtained allow us to further develop solutions for the prevention (control) of risk — organizational, technological and economic measures taken in order to minimize the amount of damage and when regulating losses of counterparties in the supply chain.

In absolute terms, the risk can be determined by the amount of possible losses in material (physical) or monetary (monetary) terms, if the type of damage is measurable in this form. In relative terms, the risk is defined as the amount of possible losses attributed to any base: property of the enterprise; total resource costs; expected income (profit).

The most difficult to assess and prevent risks in supply chains arise as force majeure circumstances.

Natural disasters are a particularly vivid illustration of the difficulties faced by supply chain managers. So in 2019, global losses due to earthquakes, floods, fires and the like reached USD 150 billion.

When managing risks in supply chains, the integration of their links is important, since the risk can be realized in one organization, the consequences of this risk are automatically transferred to all enterprises. All participants in the supply chain need to work together for mutual benefit, thereby reducing overall vulnerability.

More advanced companies have permanent supply chain risk management teams and processes. This group typically includes the leading automotive, chemical and electronics manufacturers with highly complex global supply chains.

Risk management is about preventing adverse events, not just preserving tangible assets or avoiding risks.

The risk management process covers the entire supply chain with the ability to seamlessly incorporate new links. SCM leaders not only recognize the risks, but also try to minimize them. An adaptive supply chain looks like this: developing a multipurpose workforce, flexible rescheduling of goods flows, increasing the ability to maintain brand reputation, developing SRM and SCRM processes, developing the ability to quickly influence changes in demand, contingency plans, engaging in lobbying activities, hedging.

The following technologies are used to manage risks: modeling of financial risks, operational planning of the supply chain, strategic planning of the supply chain, risk management tools, predictive modeling, scenario modeling, process simulation.

By developing and evaluating scenarios with different probabilities for predetermined risks, the most advanced organizations can perform high-level impact calculations that allow for better prioritization. Accordingly, the choice of priority is based not only on financial factors, but also on business-specific factors such as regulatory and strategic considerations, as well as the company's propensity for specific risks. Supply chain risk leaders develop a set of response and proactive response strategies and raise overall risk awareness among their workforce by creating openness to address potential gaps and disruptions.

## **6. ORGANIZATION OF LOGISTICS IN SUPPLY CHAINS**

The active involvement of Ukrainian enterprises in global supply chains, the entry of domestic manufacturers to world markets, the consequences of hostilities, a pandemic, etc. led the management of industrial, agricultural, trade and service enterprises to the need to pay attention to the logistics of their business, to the organization of logistics processes (purchases, production, distribution). Ukrainian and international logistics companies are increasing the volume and range of services for the coordination of customer logistics processes and supply chain management. This is in line with global trends. The leaders of the world 3PL market are increasingly positioning themselves not as tellers who perform operations for the transportation and storage of goods for cargo owners, but as consultants who help the business in promoting goods to consumers. They offer clients not services, but solutions to logistical problems.

Supplies to enterprises, their impact on the performance of enterprises are important in supply chain management and interaction with suppliers. Supply chain management is an effective strategy for enterprises to gain a competitive advantage. One of the prospects is the integration of marketing and supply chain management, which provides opportunities for significant improvement in supply efficiency.

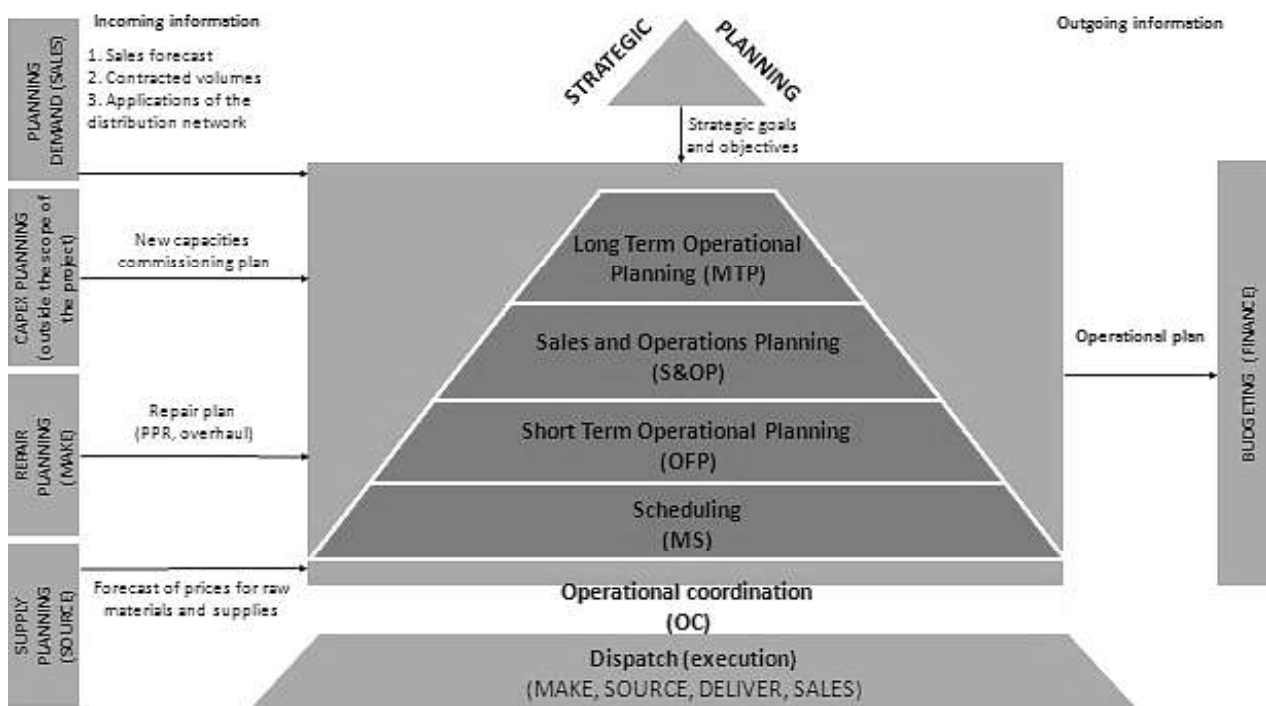
Supply chain planning is a form of regulation and control of the processes occurring within a separate supply chain, through the development of time parameters of these processes, showing how and when they should be performed. There are three levels of planning:

- strategic level — long-term planning (10-15 years);
- tactical level — mid-term five-year planning;
- operational level — current short-term planning (monthly, quarterly, annual).

These three levels of planning correspond to the objectives set within the supply chain: strategic objectives, tactical objectives, and operational objectives.

Supply chain planning begins with the adoption of strategic decisions at the highest level: the mission, corporate strategy and business strategy are developed [9]. Then functional and logistics strategies are formulated as part of strategic logistics decisions. At the level of making tactical decisions, plans for the use of capacities and generalized plans are developed, and the main schedule is built. The level of operational logistics solutions corresponds to the construction of short-term schedules.

One of the ways to involve Ukrainian business in global integration processes is the creation and development of Ukrainian companies' own supply chains and their inclusion, thus, into global supply chains. One of the striking examples is a large metallurgical company, which plans its work in the supply chain as an end-to-end production and logistics chain. To implement it, a business planning model was created in SAP APO SNP (Fig. 7.3).



**Figure 7.3. Business Model of Operational Planning**

As part of long-term planning, the company formulates its own mission, vision and strategic goals. The overall mission sets medium-term goals for two years. The next level is the level of tasks, which can be divided into two parts: external and internal.

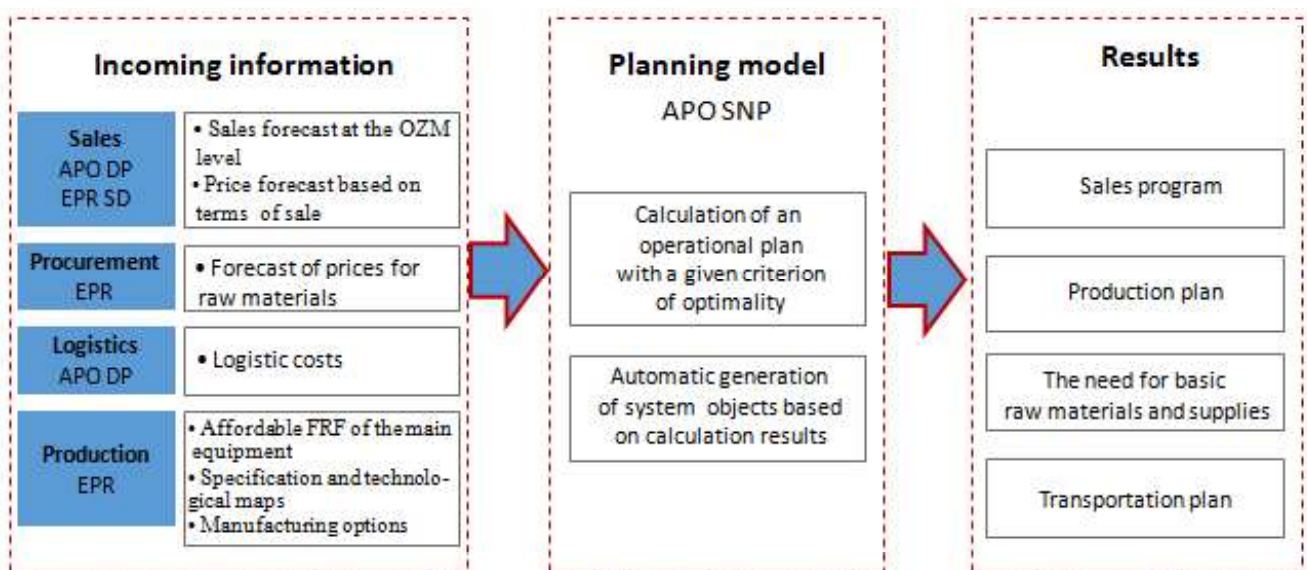
External tasks are aimed at the buyer: increasing customer service, developing distributor logistics, developing service providers, etc. Internal tasks are aimed at ensuring competitive advantages in steel production, achieving the level of best business practices. Figure 7.4 shows the elements of the operational planning business model.

Operational planning processes are cross-functional processes and involve tight interaction between the functions of Sales, Production, Purchasing, Logistics and Planning.

Target planning levels	Purpose	Horizon (target)	Horizon (transitional)	Periodicity	Detailing	Implementation status SAP
Long-term operational planning (MTP)	Translation of strategic goals and objectives to the level of operational planning	5 years	3 months	Annually	Food families, 1-2 years with a monthly breakdown, 3-5 years with a quarterly breakdown	Not implemented
Sales and Operations Planning (S&OP)	Monitoring the progress of the medium-term operational plan Supply chain optimization	15 months	3 months	Monthly/Quarterly (rolling plan)	Food families, broken down by month	Implemented
Short-term operational planning (OFP)	Optimization of detailed functional plans Preparation of data for calculating the projected cost price	3 months	1 months	Weekly	Product detailing at the GPM level with a monthly breakdown	Implemented
Scheduling (MS)	Optimizing performance and cost	2 months	1 months	Monthly	Product detailing at the GPM level with daily breakdown	Not implemented
Operational coordination (OC)	Placing an order in production and ensuring a given level of customer service  Updating operational plans	2 months	1 months	Monthly	Detailing at the order level, with daily breakdown	implemented in terms of placing orders for production

**Figure 7.4. Elements of the Business Model of Operational Planning**

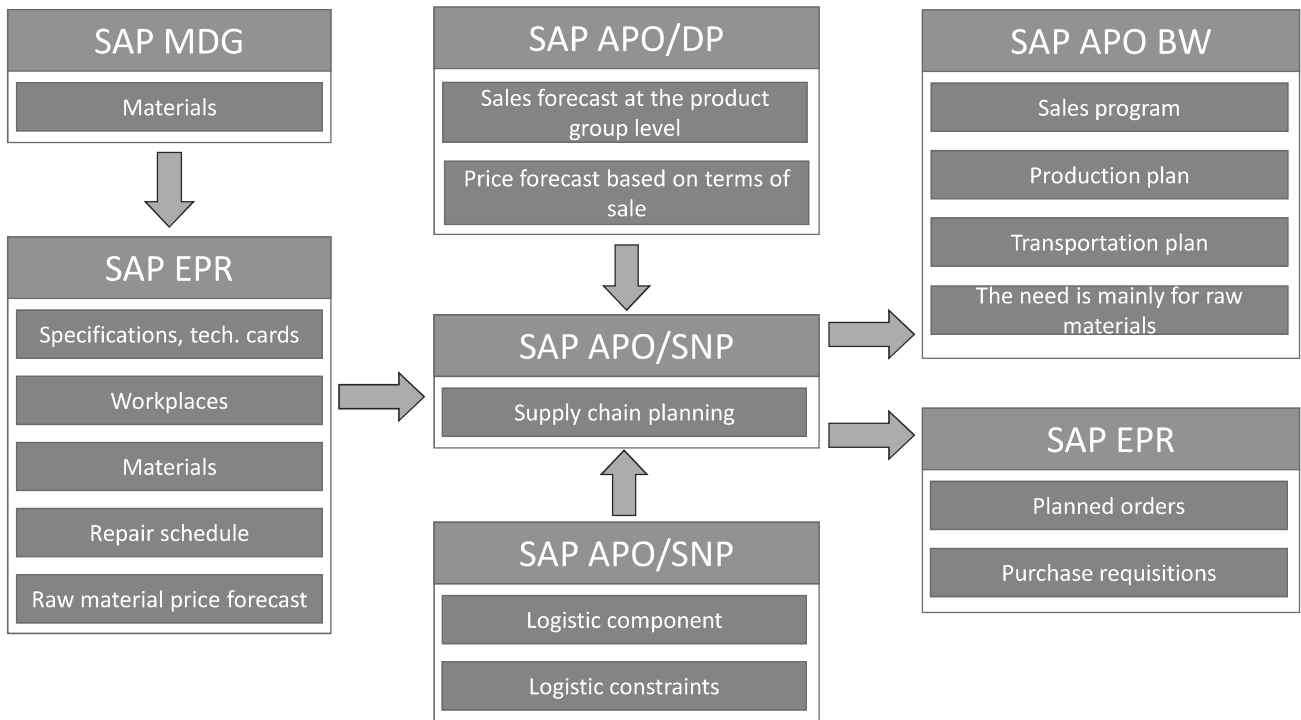
The diagram below shows the organization of the data flow in the operational planning processes (Fig. 7.5).



**Figure 7.5. Data Flow in Operational Planning Processes**

The implementation of operational planning processes for SAP software involves the integration of SAP modules into a single whole, allowing: to generate a sales forecast, update the logistics component, generate a forecast for raw materials prices, manage the maintenance of basic production data

These modules are: materials, sales forecast at the product group level, price forecast based on sales conditions, sales plan, production plan, transportation plan, demand for basic raw materials (Fig. 7.6).



**Figure 7.6. Technical Architecture of the Operational Planning Solution**

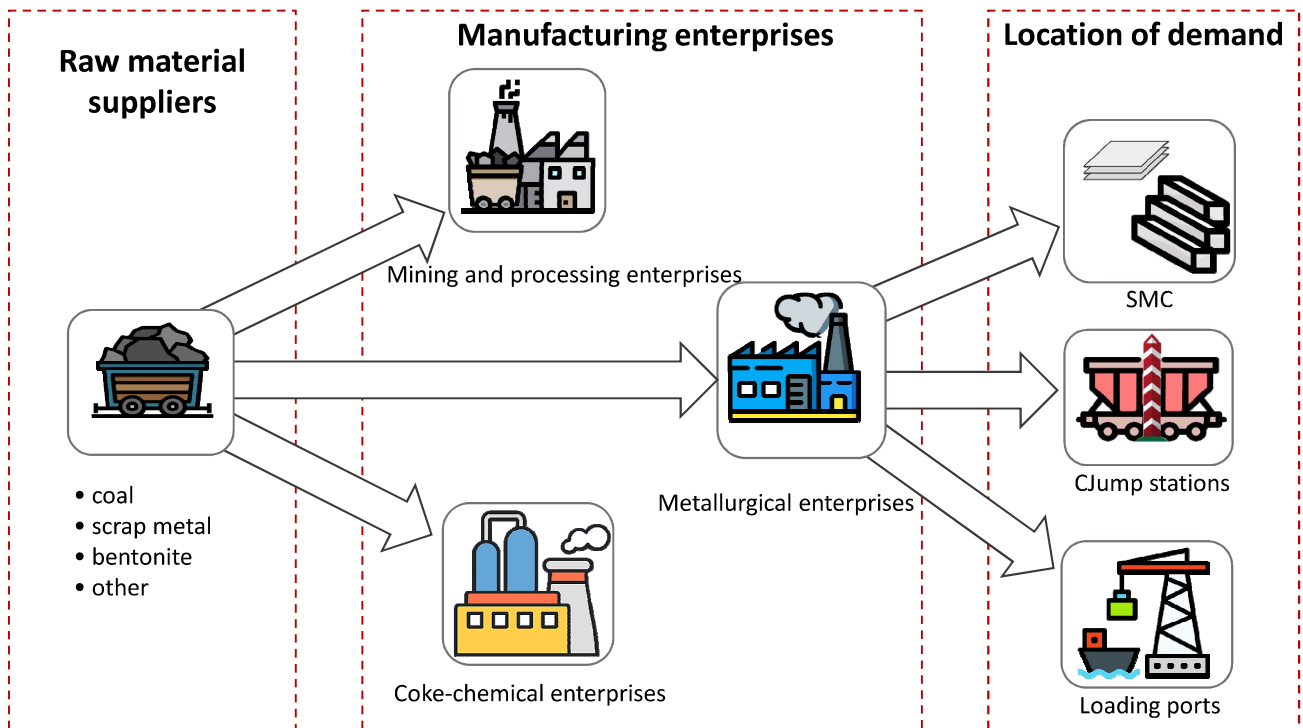
The company is developing a supply management system: it provides production with raw materials, materials and equipment, and also supplies metal products to consumers.

For example, the company in question has its own freight forwarding company and shipping lines in its structure for the purpose of prompt supply of raw materials and products around the world.

To increase the efficiency of supply chains, top-level strategic solutions, strategic logistics solutions, tactical logistics solutions are being developed.

The key link in the architecture of the implementation of planning processes in SAP is the supply chain planning model. The supply chain planning model is a graph whose vertices are suppliers, manufacturers, transfer points, and demand locations. The edges of the graph are transport relations that characterize the routes of traffic flows. Planning the throughput of the graph vertices corresponding to manufacturing enterprises is carried out using production planning models (Fig. 7.7).

The structure of the company's supply chain planning model is quite complex, due to the wide geography of product supplies, as well as the complex structure of intragroup cooperation between enterprises. The company's supply network includes 14 enterprises, 394 consumers, 1116 transport links (routes).

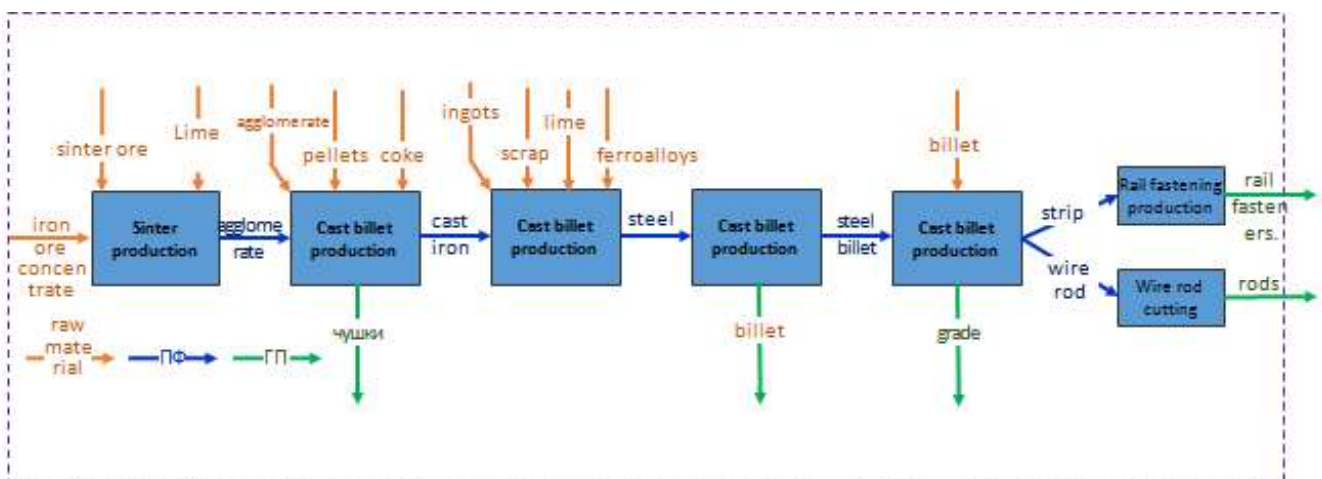


**Figure 7.7. Structure of the Supply Chain Planning Model**

The main elements of production planning models (Figure 7.8) are:

- the main production units of the enterprise (workplaces);
- a list of materials produced for each production unit;
- a set of basic production data (specifications, datasheets) for each material.

Linear programming models and methods for their optimization play a major role in all types of supply chain management problems [10]. The production planning task takes into account the dynamics of demand, production and storage of products.



**Figure 7.8. Structure of the Supply Chain Planning Model**

In order for the supply chain planning process to be as effective as possible, it is necessary to clearly understand what and how to achieve the final result, i.e. there must be some kind of «ideal» model that already exists and is used in the

management of other supply chains (a method of using best practice) or designed in a «laboratory» environment, the achievement of the parameters of which must be strived for. It can be difficult, if not impossible, to fully implement the «ideal» model in practice. This is due to the fact that it is impossible to accurately recreate all the conditions in which the already existing «ideal» model of another supply chain operates, and all the more, it is impossible to implement an artificial «ideal» model created in laboratory conditions, since in this case there cannot be all real parameters of the market economy are taken into account.

## CONCLUSIONS

Growing globalization, interaction with Western companies, as well as domestic research and publications in the field of logistics and supply chain management make it possible to use world experience in practice. Many foreign companies, expanding the geography of supply chains, include the territory of Ukraine as markets for finished products, as well as with the aim of locating production facilities for their manufacture, into their own supply chain, thus involving Ukrainian partners in world integration.

Thus, at present, Ukrainian companies, along with their Western colleagues, can use or are already using the potential of the concept of logistics and supply chain management, which should contribute to strengthening their competitiveness and economic development.

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