

# ECONOMIC AND MATHEMATICAL MODELING AND INFORMATION TECHNOLOGIES IN ECONOMICS

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## MODELING OF BUSINESS PROCESSES OF THE SUPPLY DEPARTMENT OF AN INDUSTRIAL ENTERPRISE

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The article is devoted to the study of issues related to the modeling of business processes of the supply department of an industrial enterprise. A study of the stages of organization of business processes at the enterprise, in particular the supply department, was conducted. Business processes are considered as a way of organizing enterprise management. Scientific works investigating the modeling of business processes were analyzed. It has been established that the supply department is one of the most important links of the enterprise, the task of which is to provide the necessary materials and components for smooth and successful functioning, as well as to reduce costs and risks. In order to achieve these goals, the supply department must have a clearly coordinated sequence of actions performed by it. To formalize the actions that take place in the supply department, it is worth presenting them in the form of a business process, which will avoid unnecessary expenditure of time and resources. A number of stages of modeling business processes of the supply department are proposed, which are consistent and interconnected. The stages of modeling include the identification of the entire set of processes occurring in the department, their current analysis and the sequence of execution of all operations. The next step is the design and creation of a model, which involves a structural analysis of the business process, the formation of regulations for each of its components, and establishing their sequence. And the last stage is the analysis of the effectiveness of the proposed solutions and their implementation. A model of the business process of the supply department of an industrial enterprise was built, which provides an analysis of production needs, based on which a production plan is formed. On the basis of this plan, the purchase of material resources and the quality control of purchased components take place. The implementation of the developed model will allow the enterprise to reduce the time spent on the purchase and manufacture of finished products, thereby increasing the efficiency of its activities.

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## МОДЕЛЮВАННЯ БІЗНЕС-ПРОЦЕСІВ ВІДДІЛУ ПОСТАЧАННЯ ПРОМИСЛОВОГО ПІДПРИЄМСТВА

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**Ключові слова:**

моделювання, модель,  
бізнес-процеси,  
промислове підприємство,  
відділ постачання

Стаття присвячена дослідженню питань щодо моделювання бізнес-процесів відділу постачання промислового підприємства. Проведено дослідження етапів організації бізнес-процесів на підприємстві, зокрема відділу постачання. Розглянуто бізнес-процеси, як спосіб організації управління підприємства. Проаналізовано наукові праці, які досліджують моделювання бізнес-процесів. Встановлено, що відділ поставок є однією із найважливіших ланок підприємства, завданням якого є забезпечення необхідних матеріалів і компонентів для безперебійного та успішного функціонування, а також зменшення витрат та ризиків. З метою досягнення цих цілей, відділ постачання

повинен мати чітко скоординовану послідовність дій, які ним виконуються. Для формалізації дій, які протікають у відділі постачання варто представити їх у вигляді бізнес-процесу, що дозволить уникнути зайвих витрат часу та ресурсів. Запропоновано ряд етапів моделювання бізнес-процесів відділу постачання, які є послідовними та взаємопов'язаними між собою. Етапи моделювання включають ідентифікацію усієї множини процесів, що відбуваються у відділі їх поточний аналіз та послідовність виконання усіх операцій. Наступним кроком є проектування та створення моделі, що передбачає структурний аналіз бізнес-процесу, формування регламенту кожної його складової та встановлення їх послідовності. І останнім етапом є аналіз ефективності запропонованих рішень та їх реалізацію. Побудовано модель бізнес-процесу відділу постачання промислового підприємства, яка передбачає аналіз потреб виробництва на основі якого формується план виробництва. На основі даного плану відбувається закупівля матеріальних ресурсів та контроль якості покупних комплектуючих. Впровадження розробленої моделі дозволить підприємству скоротити витрати часу на закупівлю та виготовлення готової продукції тим самим підвищити ефективність своєї діяльності.

### Statement of the problem

The procurement department is a key element of any business, responsible for supplying the necessary materials for its successful operation. The activities of the department depend on many internal and external factors, such as price fluctuations, transport problems, changes in the terms of agreements with suppliers, etc. All these factors need to be monitored, controlled as well as taken into account in the management process. The enterprise management process requires the introduction of new approaches to improve the efficiency of its operations by upgrading business processes based on the principles of cost reduction and savings. Improvement of business processes is aimed at establishing coordination and interrelationships between individual structural units of the enterprise. That is why business process modeling is an important scientific and practical task, the solution of which allows for an increase in the efficiency of not only a single department but also the enterprise.

### Analysis of recent studies and publications

The study of issues related to the modeling of business processes of an enterprise is covered in many scientific works by Shepilenko. V. [1] systematized theoretical approaches to the peculiarities of the organization of business processes, and allocated methods of their optimization, considering foreign experience. However, the issue of the structure of hierarchical business processes of an enterprise is not sufficiently covered.

Paper [2] considers the possibilities of using methods of structural modeling of business processes to formalize the processes taking place at an industrial enterprise. Also, the author proposed a conceptual model for solving the problem of multi-criteria selection of instrumental technologies for the structural modeling of business processes. However, the issue of the structure of business processes and information flows between them is not considered.

Larina R.R. and Lukianova O.Y. in their work [3] substantiated the feasibility of modeling the business processes of an enterprise and developed several recommendations for logistics management. The article

also provides an example of a model of business processes of an enterprise in logistics management and considers the stages of logistics management, which made it possible to form a holistic view of the logistics processes taking place at the enterprise.

In [4], the authors consider the features, principles, and goals of business process optimization, formulate recommendations for improving the modeling of enterprise business processes, and substantiate their feasibility and economic efficiency for the enterprise. Ilchenko N.B. [5] studied the features of functional and process approaches to the formation of an enterprise business model. The author proves the effectiveness of combining functional and process approaches when creating a business model. An example of the process approach of a business process is also given.

Thus, because of the analysis of literature sources, it is found that many problematic issues regarding the modeling of business processes of enterprises, in particular the supply department, remain unresolved.

### Objectives of the article

The article is aimed at analyzing the stages of the organization of business processes at an enterprise, modeling the business process of the supply department of an industrial enterprise, developing a model, and evaluating its efficiency.

### The main material of the research

In today's conditions, the successful functioning of an industrial enterprise requires the supply department to provide production with the necessary materials and inventory in a timely and efficient manner. For this purpose, it is important to organize business processes correctly, which will reduce costs, improve product quality, and ensure the rational use of material and technical resources and inventory. The business process model reflects all stages of the resource flow from procurement to the manufacturing of finished products. This model defines the sequence of actions that contribute to the achievement of the goal and allows you to predict the time and resources required

to complete each stage. Thus, the process of modeling business processes is an important stage in the management of an enterprise and allows it to improve its efficiency, reduce costs and improve product quality. The process of modeling the business processes of the supply department can be represented in several successive stages (Fig. 1).

Each of the stages (Figure 1) performs an important function in the management of business processes and contributes to the efficiency of the enterprise. Maximum efficiency from the implementation of a business process model is achieved through effective communication between individual departments of the enterprise and cooperation between them.

The first step in modeling the business processes of the supply department is to identify all the processes that take place. Next, each process is analyzed and its critical points and possible problems that hinder their effective execution are identified. At this stage, the time requirements for each process are also determined.

The next stage is the selection of modeling methods and tools. There are many different tools available for building a business process model, such as ARIS Express, Microsoft Visio, IDEF0, BPwin, and others. With the help of these software products, you can describe in detail the business processes that take place at the enterprise in the form of graphical diagrams. The choice of tools depends on the specific tasks and purpose of modeling. In this study, to build a model of the business process of the supply department, the software product Microsoft Visio is used, which allows creating of diagrams of business processes based on the BPMN2.0 (Business Process Model and Notation) modeling standard and visual checking the correctness of building these diagrams.

The third stage is the actual development of the business process model. At this stage, a detailed diagram is drawn

up that reflects all the stages of the department’s work. Next, the model is designed and created. When creating the model, business processes are optimized to reduce the time required for their execution and reduce the number of possible errors.

The fourth stage is to analyze the model and evaluate its effectiveness. At this stage, it is determined how effective the modeling was and what opportunities there are for improvement. Quantitative and qualitative analysis of the business process, analysis of costs, time of operations, and product quality are carried out. The model is also tested to identify shortcomings, improve its efficiency, and ensure the accuracy and validity of the proposed solutions. The last stage involves the actual implementation of the business model in the company’s operations and monitoring its effectiveness.

The proposed stages of modeling the business processes of the supply department are tested on the example of Metinvest Business Service Limited Liability Company. The author has analyzed the activities of the supply department and identified the main stages of its activity, analyzed, and identified problem areas. Based on the information obtained, the author developed a business process model of the supply department using the Microsoft Visio software product, which is a powerful graphic tool. When creating the model, a standard business process design module was used, which provides opportunities for its improvement and optimization (Fig. 2).

According to the developed model (Fig. 2), the business process begins with the receipt of an order. Based on the order received, a production plan is formed, which includes detailed planning of the required amount of material resources and components. The production plan is signed by the deputy head, approved by the CFO, and commercial director, and approved by the first deputy CEO.

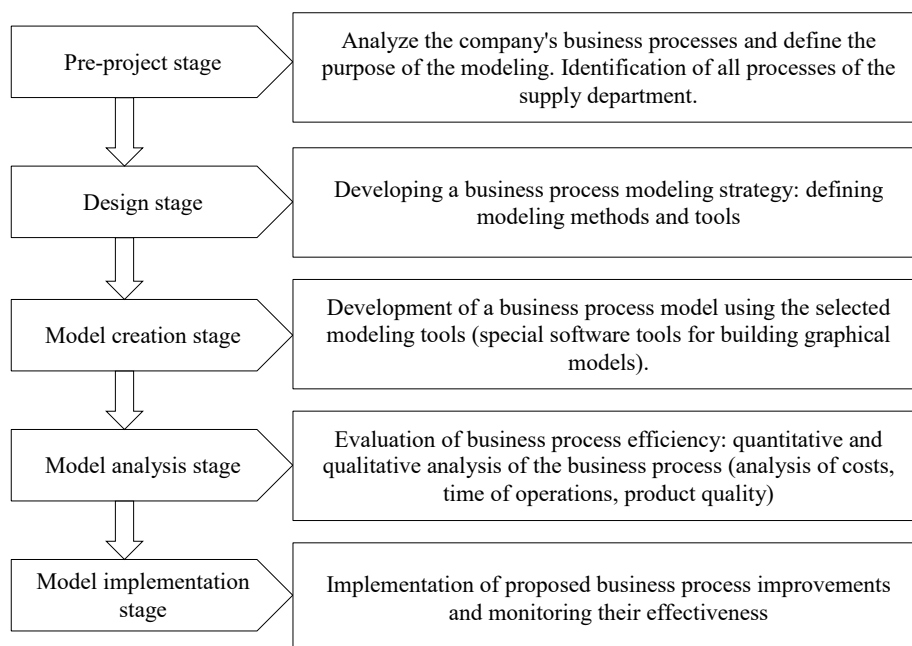


Fig. 1 – Stages of business process modeling for the supply chain department

Source: built by the authors

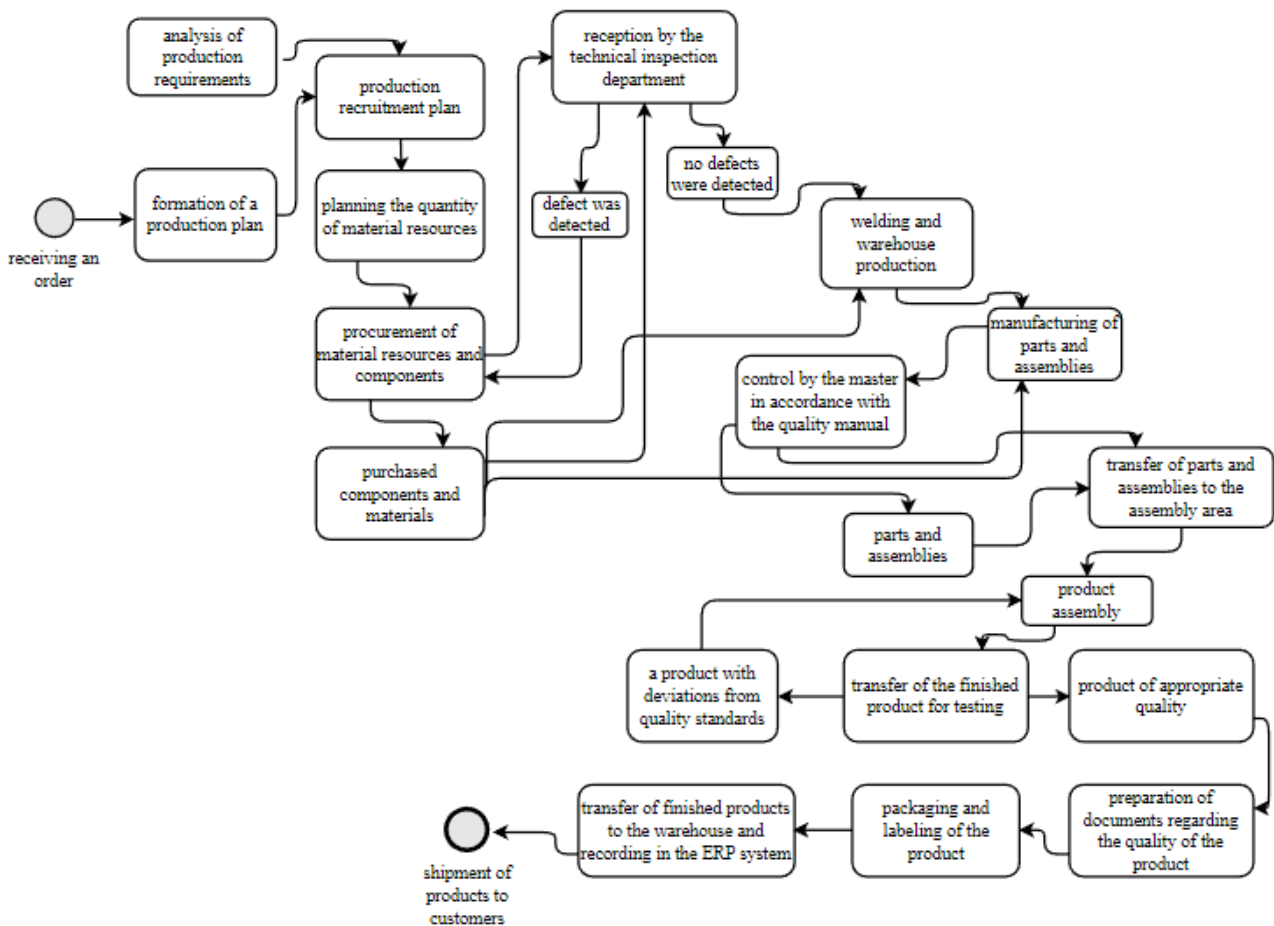


Fig. 2 – A business process model of the supply department of a manufacturing enterprise

Source: built by the authors

Guided by the «Production Plan Set», the production plan calculation, and the factory order, the engineer generates an application in electronic form using an automated document management system for the receipt of material resources and components by the master. Based on the plan, the materials and components are directly purchased. The purchased material and technical resources are checked for defects by the technical inspection department. All resources of the appropriate quality are transferred to the next logistics operation, namely welding and assembly production. The manufactured parts and assemblies are subjected to quality control in accordance with established standards and transferred to the assembly shop.

The lead engineer sends the «Plan for the production of assembly units and parts for the product» to the assembly shop foreman using the internal document management system. The assembly shop manufactures the required number of products (finished goods) and submits them to the quality control department, where they are checked in accordance with the instructions. Finished products must meet the requirements of regulatory, design, and technological documentation.

Finished products of the appropriate quality are transferred to the next stage – packaging and labeling. At the same time, all the relevant documentation is prepared in the ERP system, including information on finished

parts and products. After that, the finished products are shipped and sold.

All the processes described in the model are automated using the corporate automated ERP system, which allows the department to automate its work and promptly formulate production plans, and conclude contracts with suppliers, which reduced the time for some operations and ensured more accurate planning of inventory purchases. In addition, the ERP system controls the supply processes and automates the ordering process, which simplifies control processes and ensures the stable operation of the supply department.

The next stage of business process modeling is to assess their effectiveness. As a result of the qualitative analysis of the developed business process model, it was found that all the described processes are clearly structured, and logistics operations are performed on time and in a coordinated manner. The quantitative analysis was carried out in accordance with [7; 8] and found that the time spent on manufacturing products was reduced by 5% due to the reduction of downtime while waiting for the transfer of material resources from one operation to another. The level of business process regulation and controllability increased.

The last stage of modeling involves the process of implementing the proposed measures and monitoring their effectiveness. The developed business process model helped to improve the efficiency of the supply department

by eliminating problem areas related to the reduction of costs for warehousing and transportation of material resources. Thus, modeling the business process of the supply department helped to increase the efficiency of its work, reduce costs, improve the quality of supplies, and optimize the procurement management system through continuous analysis of production needs.

### Conclusions

Business process modeling is an important element of enterprise management that helps to increase the efficiency of its operations and reduce costs. In addition, it helps to identify possible problems and shortcomings in the work of both individual departments and the enterprise as a whole and develop effective measures to address them. One of the most important divisions of an enterprise is the supply department, which meets the needs for raw materials and supplies for production. In this regard, modeling the work of the supply department is particularly important for ensuring the stable operation of the enterprise.

Our proposed stages of business process modeling include preparation for modeling, namely, analysis of all operations and processes that take place in the supply department, model design, model creation, analysis of the effectiveness of the proposed solutions, and their implementation. The successful implementation of the developed model is based on a corporate automated ERP system that ensures instant interaction of all logistics operations, continuous improvement, and updating of the model, considering emerging problem situations. The proposed business process model allowed us to reduce the time spent on manufacturing products and increase the level of business process regulation and control.

However, it is worth remembering that business process modeling is a dynamic process, so it requires constant updating and improvement. Therefore, the proposed model takes into account the possibility of tracking changes in production and the market to respond in a timely manner and adapt the business process of the supply department to new conditions.

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