

# Optimization of Order Calculation for Machine-Building Enterprises

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**ABSTRACT:** *The issue of using information systems in industrial enterprises is considered. The implementation of ERP systems allows to manage business spending financial and time resources more efficiently. The modernization of the document management system to optimize the calculation of orders is proposed.*

**KEYWORDS** – *automation, control system, enterprise resource planning, order calculation, product cost*

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## I INTRODUCTION

The main goal of automation control is an expanding markets by improving the efficiency and cost of manufacturing products [1]. In current market conditions, the flexibility to configure the system for automated control of a manufacturing enterprise is certainly a necessary criterion. In practice, machine-building enterprises need to upgrade the technical base. Given the replacement of equipment in automated control system (ACS) must implement appropriate changes, including changes in production standards, the cost of materials, changes in pay and others [2].

Integration information systems are widely used in the manufacturing sector. Their using makes it possible to significantly simplify the document circulation and interaction between departments of the enterprise. Enterprise resource planning (ERP) systems allow to track the production process. In this paper it is proposed to modernize certain elements of the document circulation at the enterprise using ERP-system in order to reduce the time for processing the order and the cost of manufacturing it.

## II INFORMATION SYSTEMS FOR INDUSTRY ENTERPRISES

A lot of different information solutions were created for the automation and increasing the efficiency of enterprises [3]. ERP-systems give the maximum release of the employed capital due to the reduction of production reserves and acceleration of capital turnover. It allows to increase competitive advantages and economic security by improving the indicators of profitability and reducing the cost of products. Such information solutions, by increasing flexibility and eliminating bottlenecks in the production cycle, enable production of a wider range of products and faster delivery of new products to the market and closer the moment of gaining innovation. Customer relative management system can produce the products demanded specific buyer. It helps to successfully implement the company's market strategy. For example, in the automotive industry, when an individual order is executed, the buyer pays an average of 20% more. It significantly increases the manufacturer's margin, and accordingly affects economic security. Management information systems and Business intelligence systems provide an opportunity to track the life cycle of each manufactured product. This approach allows to evaluate in which segment the enterprise receives the highest profit, on what the product is worth to focus and what to outsource. Supply chain management systems through the creation of a common interface with suppliers and systems of internal electronic trading platforms contribute to reducing the cost of purchased materials both at the expense of reducing the price and cheaper the procurement processes.

## III MODERNIZATION OF AUTOMATED CONTROL SYSTEM FOR ORDER CALCULATION

Today, the vector of orders for the machine-building enterprises is aimed at reducing the batches of products, increasing the range and a long way from finding potential customers to the actual order. These conditions require an operational calculation of the cost of production depending on the quantity involved materials, components, delivery terms, payment terms, etc.

Modernization of ASC for machine-building enterprises is a cyclical process. In this process updating and improving of one area inevitably requires or allows subsequent upgrading.

Any order cannot be calculated without calculating the production of components and materials. Therefore, when forming the document "Order calculation" sales staff actually forms the technological map. This document is a task for the production site, procurement department, planning department.

Taking into account mentioned above information, we propose to start modernization of any existing ACS or to create a new from forming of electronic document "Order calculation". This document can be adjusted many times by the different parameters that affect the cost of production, until the optimal solution and agreement with the potential customer will be reached, then the order will be transferred to production.

The structure of the "Order Calculation" document should include both general data such as name, quantity, type of product, size, delivery terms, payment terms, etc., as well as an individual set of production units necessary for manufacturing, which respectively include the parameters that refer directly to these production units: the types of expended materials, units of the required processing, etc.

The modular concept of this document allows to flexibly change any order components and instantly receive new calculation results. In practice, the customer wants to receive several price offers for products that can differ in quality and, accordingly, the price of the used materials, the quantity of products in a batch, the applied technological types of processing and manufacturing of details.

When upgrading or optimizing technological sectors of industrial enterprises new data are entered into the database in respect of the production unit, such as the standard cost of materials, cost of wages, norms of resources using on processing unit.

The proposed concept of using automated calculation of order value is based on the formation of data on individual production units or sets. This concept can significantly reduce the cost of maintaining the economic planning department and reduce times for order processing and providing proposals in several times. These properties open up new opportunities for enterprise participation in tender offers and identify the most optimal offer option, instantly calculating several qualitative and price options for product manufacturing.

As a part of the automation of the control system it is possible to extend the functions of the electronic document "Order calculation" to the automated formation of a commercial proposal, an account, etc.

Thus, we can create a sales department with matching to the international standards for the speed response to changes in the market situation, rapid processing service on offer to customers and able to find options for making competitive products in harsh conditions and highly competitive on world markets. Certainly, the operative work of sales department will positively influence to the relationship with existing customers and industrial enterprises and increase competitiveness of manufacturers on the domestic market.

It is necessary to ensure the possibility of forming the calculation of the production cost in several variants, with the changing of using with the same type of production units. It allows to analyze and identify "weaknesses" in the company. This way it is possible to understand which production units are not optimal for use and unnecessarily increase costs [4]. These production units should be put in a plan to upgrade the material and technical base of the enterprise.

For the base unit of the cost calculation for each technological operation we propose to take the cost of work on each production unit, for example machine tool, production line, the team (with manual operations) etc.

To determine the production costs of each such unit it is necessary to form an enchiridion (list) of such production units in the ACS. In this guide, for each unit, a list is created of the use of types of work and the cost of materials. It takes into account the usage factor according to the parameters of the order (products that are manufactured).

Based on the principles of maximizing the use of available data in all business processes of the enterprise, we propose to use the data from the document "Order calculation" to formulate a task for the order production. If the calculation is converted to an order, it should be supplemented with the necessary data such as the date of shipment, the number of the contract / account, etc.

Thus, the company almost immediately receives the document "Order" which includes:

- range and number of required materials;
- a list of production areas with parameters for each of them;
- the nomenclature of finished products for the further formation of documents for shipment;
- a list of additional subcontractors that need to be ordered.

The application of the modernized system of document circulation will increase the level of processes automation in the work of the procurement department of the materials and the enterprise as a whole.

#### **IV THE CONCEPT OF THE FORMATION OF CALCULATING THE COST OF PRODUCTION UNIT**

To perform the calculation of the order's cost we have proposed to automate calculation of the cost for each operation taking into account its performance.

To use the aforementioned concept of calculating the cost of using a production unit in the production process, it is necessary to form directories of operations. Such documents will contain information on the name and cost of execution (salary) for such an operation, as well as the reference parameters. They can also be supplemented by the indicative market value of such an operation. Thus, it is possible at the same time to receive not only the cost of production, but also the approximate market value of sales. This item is an integral part of the definition of the price of the product and greatly facilitates the work with the customer for the sales department of the company in providing a commercial proposal for the terms of making an order.

The concept of calculating the cost of using each production unit for making an order provides a flexible tool for company management to form an unlimited number and variety of models of technological units in an automatic control system, to complement and refine the parameters for a more precise definition of the cost of production.

Operations directories may be supplemented with a convenient tool for determining the value (wages) of such an operation, based on the valuation data and the average market wage for the involved workers.

## **V AUTOMATION OF THE MATERIAL PROCUREMENT DEPARTMENT**

For a modern machine-building enterprise, the flow of orders must be continuous. The appropriate flow of information about the materials required for production is continuously changing. New orders form a list of necessary materials to order, which are already manufactured, partially or completely issued materials from the warehouses of the enterprise. Some materials are available, some should be purchased. Efficiently handle this information cannot be realized without ACS, which connects the data of these factors.

As part of the modernization of the management system at the enterprises of mechanical engineering it is proposed to form electronic online processing of all orders that are currently in operation at the enterprise. To do it, it is necessary to carry out the analysis for each material on the factor of the required amount when placing the order, taking into account the quantity that has been extracted from the warehouses in production (or already was used) at the present time. The resulting value is correct at the time of processing. Such data should be summarized in tabular forms showing the amount of actual availability and, accordingly, the number of materials and components which are needed for the purchase. Thus, the procurement department receives information already in the processed and analyzed form, which is actually relevant for the current moment. Information for the procurement department for new orders falls in a few seconds after placing the document "Order calculation" in the document "Order", which contains information about sending the task to the work process.

Extension of the functions for the module "Acquisition of materials" is possible in the areas of automatic creation of lists (tables). They can be formed by certain types of materials or by the "supplier" parameter. Thus it is possible to get a ready-made order for the supplier, the tender platform, etc.

Such a concept of cooperation between departments of a production enterprise enables extremely fast processing and transfer of information. Efficiency on production order is absolute competitive advantage for any company or enterprise. The employees of the relevant department significantly reduce the working time to perform their functions when they receive already processed information about the materials which are required for procurement. Consequently, the management of the enterprise will be able to reduce the costs of maintaining for this department and to receive more productive work, which is extremely relevant today.

## **VI CONCLUSION**

The use of information systems at the enterprises of the machine building profile allows to achieve a number of positive results. They include reducing the cost of raw materials, more efficient inventory management, increasing the efficiency of the production process due to its continuity, the effective management of labor and capital resources, as well as increasing sales of manufactured products through the use of a "push-pull" strategy in production.

In this paper, the modernization of the order calculation using information system is proposed. For this purpose, the data system about the equipment, its use in the production process, the required consumable material is preliminarily entered into ERP-system. When an order is received, the calculation of its cost and duration of performance is automatically completed. Information about the order goes to the production department, and the procurement department receives information about the necessary materials to replenish the stock. It allows to increase the speed of order execution and reduce costs.

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