

SAP Production Management Solutions

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Abstract: *the article considers the need for ERP-systems in the management structure of a modern organization. In the course of the work, the main features of the ERP system, the specifics of its implementation, are disclosed, as well as the German SAP ERP system are substantively examined. The author draws attention to the SAP module: PP, which implies production management. The article reveals the main differences and capabilities of SAP in the management of a manufacturing company, as well as presents the frequently used functions of the PP module. In addition, the author considered the availability of combining the PP module with other program modules to achieve the most effective managerial control of production processes. In the second part of the article, the differences in the functioning of food production in the market are highlighted and the requirements that the ERP system must meet are controllability, variability, and automation of the management process. In the conclusion of the article, the main problems that the head of the enterprise is faced with when implementing an ERP system are highlighted.*

Keywords: ERP, implementation, improvement, computerization, automation, food industry.

I. INTRODUCTION

During the organized commercial activities of the enterprise there are daily situations happening in which the manager must make decisions from several possible options, while the value of the decision made can be increasingly great in conditions of high competition. There is a high instability and uncertainty in the economic behavior of market entities in a market economy, which makes the methods of forward-looking analysis extremely important, which make it possible to make decisions based on a forecast of possible situations, as well as a choice of several acceptable scenarios.

The development and adoption of adequate management decisions is one of the most significant prerequisites for ensuring and maintaining the level of competitiveness of the company and its product in the market, the formation of the most effective structure of the enterprise, the efficiency of all areas of its activities and the implementation of reasonable personnel policies.

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In order to choose the right decision at a particular moment, it is necessary to conduct a comprehensive analysis of the economic, technical, informational, legal and other aspects of the organization. Continuous improvement of these aspects is the key to the successful development of the company in a market environment. Positive transformations should be directed both at the object and at the management entity. In this case, it is necessary to adjust the goals set for the company from time to time, taking into account changes in the internal and external environment of the organization.

In many cases, changes in the activities of the company entail numerous improvements in organizational management structures. An enterprise's readiness for changes involves a complex process, especially psychologically. Often the internal conservative environment, going behind the requirements of the external environment doesn't allow you to quickly make the necessary adjustments.

Management decisions can be called a kind of milestone between the old stage and the new, demonstrating the oncoming changes. Its effectiveness directly depends on the implementation and correlation of the functions of the managerial decision, both during the implementation phase and during its preparation.

The technology of making managerial decisions is a process of transforming the data available to the head of the manager on the current problem and the set goal into a formulated and confirmed managerial decision that informs in detail all the performers about their tasks.

Thus, management decisions are a means of constant impact of the management system on the managed subsystem, the influence of the subject of management on the management object, which leads to the achievement of the enterprise goals. In this regard, we can say that at the moment, ERP systems (Enterprise Central Component) are one of the most effective means of making and implementing competent management decisions, which, being modern modifications of the equipment, determine the level of enterprise competitiveness in the digital economy.

II. LITERATURE REVIEW

Current problems and features of the introduction of automated control systems were studied by such specialists as: Addows [23], Gordeev [8], Ashmarova [2], Balabanov [3].

The work of Abdikeyev "Network-centric management methods", co-authored by him, addresses the need to improve management methods, taking into account modern information and digitalization trends [1].

In the monograph by Yakovlev, "Production management: planning and dispatching," issues of managing production processes at an enterprise are disclosed.

The work provides an opportunity to consider the situations that managers face daily: how to reduce the time for manufacturing products, organize the coordinated work of performers, and increase the return on the use of equipment. Particular attention in the monograph is paid to practical issues of planning and dispatching production processes: the consolidation of production needs within the production program, the organization of interaction between units for the product manufacturing, and workshop management [21].

A book by Bobrovnikov "Financial Planning and Budgeting" presents questions of the theory and practice of financial planning and budgeting in commercial organizations. Automation of the budgeting process and treasury functions are illustrated in the example of domestic ERP systems [6].

The monograph "Electronic document management systems" by Stepanova allows you to get acquainted with the leading principles of electronic document management systems and enterprise management [17].

Meanwhile, Tugov, Sergeev and Sharov in the work "Designing automated control systems" considered the design of electronic control systems from the technical side. The manual describes in detail the capabilities of the system, programming languages, programmable logic controllers [18].

III. METHODOLOGY

When working on the article, the author was guided by his own experience and relied on materials obtained as a result of the analysis of scientific literature on the problem. Modern innovative challenges and the need for the implementation of information systems in business processes are considered on the basis of sources «Information management technologies» by Bastrikova and Ponamareva [4], articles by Karminskiy and "Information technology business" by Nesterov [10].

The innovative implementation methodology of the ERP system was considered with the help of scientific works "Quality management" by Masur [13], "Corporate document management" by Sutton [15], "Electronic document management systems" by Chernov [20].

Specificity and problems of ERP technology implementation are disclosed with the use of scientific material from researchers Yakovlev "Production planning and dispatching" [21], Kuperstein "Modern information technologies in office work and management" [11].

The areas of concern of the implementation of ERP systems are disclosed based on the material of Bakhtizin "Software development technology" [5] and a monograph by the authors team edited by Tugov "Design of automated control systems" [18].

IV. RESULTS AND DISCUSSION

Nowadays the improvement of the corporate management system can be considered one of the leading strategic tasks at enterprises of any level and stage of development. Due to the fact that extensive ways to improve management systems are already ineffective and limited, the use of intensive methods of managerial work becomes an effective

way to ensure the survivability of a company on the market. Information technology of corporate management through the introduction of new information technologies, in particular EPR systems, is a productive opportunity to increase the company's competitiveness [12].

"Enterprise Resource Planning" (ERP) is a management strategy for the integration of production and administrative processes, control over human and financial resources, asset management, which is based on comprehensive continuous optimization and harmonization of the ratio of company resources using an integrated software application package [25]. Such systems ensure the full functioning of all operations and processes in the enterprise for all activity areas. The leading goal of introducing an ERP system should be considered the achievement of the highest possible efficiency in managing the organization, which is based on the choice and implementation of a development strategy [7]. In order to achieve this goal, a single integrated information platform is used, uniting under its auspices all business processes of the company, which uses innovative management and information technologies. The SAP system (Systems, Applications and Products) discussed in the article is one of such information products, a type of ERP systems that has spread widely throughout the world and allowed manufacturing enterprises to carry out productive modern management [19].

SAP is a company and a product of the same name that provides management of organizational resilience. The areas that SAP can control include [25]:

- production;
- trading;
- finances;
- warehouse;
- staff;
- accounting.

The adapted system is suitable for implementation in various countries, taking into account their legal context. In addition to implementing innovative software, SAP provides EPR implementation and control services using the ValueSAP (ASAP) methodology.

The main characteristics of the SAP system [9]:

- flexibility of application of the system at all organizational management levels;
- possibility of expanding the functionality, as well as increasing the functional modules at each organizational and managerial level;
- scalability according to initial and changing data: taking into account the growth of managerial facilities and an increase in the number of user places;
- possibility of carrying out applied refinement of the system in case of economic, legislative, financial changes;
- ability to integrate with other comprehensive information technologies in the field of finance and economics;
- closed functionality to ensure centralized planning and implementation of all modifications of software and technology and limit the possibility of unauthorized access and changes that conflict with the general principles;

- ability to build system elements.

The basic modules of the SAP ERP system are:

- project management (PS);
- basic system (BS);
- finance and control (Fi-Co);
- fixed assets management (AM);
- production planning (PP);
- material management (MM);
- maintenance and repair (PM);
- human resources (HR);
- sales and distribution (SD);
- quality management (QM);
- industry products (IS);
- workflow management (WF).

The topic of the article is the implementation of the production planning module (PP), therefore, we will consider this module down below. Production Planning (PP) demonstrates a number of competitive advantages of a system that is integrated and process-oriented, and which operates in real time. Receiving and summarizing information from various functions, PP forms an algorithm for rational and quick management decision-making, which significantly increases the efficiency of production logistics.

PP determines the formation of a unified methodology: material requirements planning (MRP) and the need for customer orientation along with maintaining the quality of production. Those consumer requirements that are crucial are analyzed and interpreted in demand management are the basis for production planning. Whereas Master Production Schedule (MPS) is fixed according to a sample capacity plan.

MRP-cycle allows you to automatically generate a production system and create orders for raw materials and supplies. After that, production orders are sent to be processed, the order is confirmed and closed [14]. All stages of production are recorded in real time, and accounting information is recorded for the financial and supervisory module. PP creates the system by introducing into it all the main logistics business processes, including continuous, mass, mass production and custom assembly. Moreover, the module supports the variability of these processes: in particular, manufacturing or designing customized order.

Special characteristics of the PP module include:

- 1) The ability to integrate several work items that provide maximum productivity into one system: sales and distribution, production planning, quality management, maintenance and repair. These modules make it possible to provide a deep sales forecast and, therefore, initiate the process of generating the production schedule.
- 2) The integrated planning in the table of product and material groups.
- 3) The ability to use a sales plan as the basis for demand management.
- 4) The development of a sales plan manually in the sales information system using profitability analysis and forecast for the near future based on materials.
- 5) Sales plan maintenance using flexible tables and data comparing forecasts of various segments of consumption and the general forecast for materials.

- 6) Development of an approximate capacity planning, confirming the compatibility of the sales plan with production capabilities, taking into account the existing bottlenecks and suspected difficult situations with resources, which makes it possible to prevent deviations from the production plan. The resource requirement is calculated in accordance with the deadlines, that is, one day before running out of resources.
- 7) Ensuring independent preparation of the demand program for all types of raw materials separately, taking into account the volume and dates. In view of the fact that demand management is a connecting element between MRP and forecasting tools, which is manually or automatically divided into small time periods to facilitate the implementation of MPS functions.
- 8) Planning flexibility at the level of product groups that can be organized into various hierarchical structures, while one structure can be included in another. SAP supports the feature of creating a planning hierarchy in various sales departments, which makes it possible to fix the implementation for various means of accounting for consumption.
- 9) The ability to develop production plans manually, based on a sales plan, while the leading goal of the plan may be to empty warehouses and achieve a specific inventory level or produce a daily product rate.
- 10) The development of large-scale, but achievable production schedules using information on demand, resource accounting status and properties of production processes. The MPS methodology can be applied only at one level of the list of raw materials, while MRP can be considered at all levels of the list of materials.
- 11) SAP provides expenditure and deterministic MRP plans, while the expenditure version of MRP is based on past information or forecast information about the estimated level of consumption, while deterministic is based on accurate data collected from a list of materials.
- 12) The implementation of MRP and MPS cycles in an integrated mode at any time, and for specific materials in online mode. Such cycles can be modified and supplemented to radically change all planned production orders, as well as only for certain orders, using information obtained in the latest MRP and MPS cycles.
- 13) Looping MRP and MPS cycles, supplemented by the ability to delay the closing dates of the order, as well as redo the schedule based on new data on closing the order.
- 14) The ability of the program to reflect changes in supplies, material accounting, or demand for materials directly in the inventory requirements list.
- 15) The module supports several types of planned orders: non-fixed and fixed, ability to adjust them manually and also allows you to maintain fixed scheduled orders for a specific number of days before the due date of the production schedule.

- 16) The program allows you to generate factory orders, both separately and series, based on data on planned orders from a list of materials and routing information. Thus, the generation of orders is based on a set of features allocated by the control system itself: the number of the purchase order, the number of materials, and the latest or earliest date. If required, the program checks the availability of the necessary elements.
- 17) The module offers the serial or individual release of factory orders to initiate specific production, while the outgoing order automatically checks for the availability of material. Work orders and each production process include a general list of necessary materials, as well as an algorithm for working with routing data.
- 18) Work centers planning capacity and their subsequent analysis is carried out depending on the power groups: labor, equipment, and contains the means of manual process control to stabilize the capacities in order to avoid overloads.
- 19) The program provides feedback, that is, the signal goes through different levels and determines the presence of several control points at the launch of production: listing, scheduling. Feedback and confirmation includes data on the number of manufactured, tested, transformed and disposed products. The feedback also contains data on the costs of work time, computer time; moreover, you can set confirmations as check lines with the feedback, after which the production won't proceed until the end of the previous stage.

Next, you need to consider the interaction of the production module with other SAP modules. Integrated system engagement is carried out in the following areas:

- factory orders, production changes, production and work in progress (finance and control module);
- forecasting and checking the availability of products (sales and distribution module);
- list of requirements for stocks and scheduling production, shipment confirmation, as well as factory orders (materials management module);
- quality control during the production process (quality management model);
- monitoring the employees' presence, working hours, the formation of payouts, incentive payments (staff management);
- repair and maintenance of production equipment, drawing up a maintenance plan, maintenance schedules, creating a list of necessary tools and templates (repair and maintenance module).

The use of the PP module of the SAP system allows you to facilitate and organize the management work of the heads of production departments, as well as employees who are responsible for management accounting. The introduction of the production planning module determines the complete automation of management processes in production.

Thanks to the use of the production planning module, effective planning and monitoring of each production stage is determined, starting from the receipt of the order into the system, product manufacturing, shipping, to the formation of management and financial reporting. During the resource planning, existing limitations of production capacities must be taken into account, which makes it possible to create a

procurement plan for materials. The application of the module allows you to store information about manufactured products, current defects and additional manufacturing products.

The PP module helps to create effective forecasts when identifying future costs; thus, the calculation of the actual and target prime cost of production produces a competitive and correct price for the product.

At the same time, the information base of the program module guarantees full transparency of intra-company communication, which allows efficient synchronization of work for all departments of the company, whereas the management cell makes it possible to quickly make management decisions based on the latest and most up-to-date information that comes in real time.

Koltsova considers the food industry not only as the largest worldwide, but also as the one that has the highest level of market competition [24]. The key trend of food companies is a further increase in large enterprises and a decrease in small enterprises, both in size and quantity. This is due to the small amount of resources in small and medium enterprises, which means less ability to withstand market challenges and environmental changes. All actions of food enterprises are based on the principle of cost reduction while maintaining the consumer value of products. Thus, it is necessary to carry out actions in three directions simultaneously:

- increase the level of service for customers;
- reduce the expenses on production, delivery and sale of products;
- develop operational activities, which are based on the preservation of transaction costs that are valuable to the client.

Now it's clear that the full implementation of the above areas, which means survival and prosperity in the modern market in the field of food production, requires the introduction of innovative information products. As previously reported, they include the ERP system, in particular, the SAP product.

Due to the fact that food industry enterprises do not have sub-sectors, each of them, despite common features, possess unique characteristics. So, for example, companies producing bakery, meat, dairy, fish products have distribution channels that are significantly different from each other:

- food manufacturing companies;
- food trading companies;
- companies that operate in the field of catering.

Podval'niy emphasizes the fact that SAP can be used for the food industry as a comprehensive solution of the ERP system, which is suitable for the simultaneous management of all areas of the food industry (large holdings like Miratorg), and can be used modularly, depending from the availability of existing systems and setting management tasks [16].

Despite the fact that the introduction of an ERP system is currently a virtually necessary step for food production, and also taking into account the general pace of computer automation and digitalization of the Russian economy, it should be noted that ERP systems are not widespread. This is due to a number of reasons: technological, technical and psychological, which is exacerbated by factors that create obstacles to the widespread adoption and productive use of electronic control systems in companies. These includes:

- insufficient level of staff qualification in the field of information technology;
- poor development of information technology in the managerial environment;
- negativity and the difficulty of adapting personnel to such changes in society;
- pretty high cost of implementation and maintenance of the ERP system.

All these reasons require a comprehensive and multilevel research, both from the state and from the management personnel of each individual company. According to Vasevich, after the enterprise decides on the need to implement an ERP system, the following process of organizing the automation of the system is initiated by the manager [9]:

1) Making management decisions about the need to automate the management system in the company.

This stage determines the execution of the order of the head, who draws up the order taking into account the structural unit or the employee responsible for the implementation of the decision and limits the execution of the order to specific dates.

The order comprises of a plan of measures for the proposed automation, indicating clear deadlines for the start and end of each process.

2) Market research of the proposed software options/conducting an open tender among electronic system suppliers.

This stage can comprise of two processes or one of them. Market research is carried out both by employees of the customer company and by an independent outsource analytical organization, which helps to choose the most preferable option.

3) Development of technical specifications for the AS system design

The supplier of the system is involved in this, but if there is an open tender, then the proposed technical specifications are provided by the suppliers when applying for participation.

4) Discussion of technical specifications.

Besides, the assignment is also coordinated with state authorities and oversight committees and other interested units during this stage. The coordination does not exceed two weeks.

5) Conclusion of treaty obligations of the customer and supplier.

6) Designing the system.

When designing, suppliers rely on “GOST 34.601-90 Information Technology. Set of standards for automated systems. Automated systems. The stages of development.”

7) Test implementation and operation of the system in the company.

8) Improving the system and correcting comments.

9) Customer approval of the system and confirmation of commissioning.

10) Commissioning.

Staff training on how to operate with the system should be carried out by employees of the supplier company with the support of the staff service of the customer company. Lists of staff who will be trained are compiled by the heads of departments and sent for approval to the heads of the company. Training must be monitored by subsequent certification.

The technical assignment for an automated system is a document that is drawn up in the defined order, fixing the main goals and objectives of implementing an automated system, all the requirements for it and the initial data important for its development; moreover, this also includes a schedule for the development of an automated system.

The technical assignment for the design of an automated system is considered the main document determining the time and procedure for its creation, improvement or development, on which technical specialists rely at the time of its development and further acceptance.

The technical assignment can be developed by means of:

- software;
- information media;
- hardware and software components and hardware complexes;
- completely entire automated system, which is intended for independent operation or is included in another system;
- one of the elements of an automated system, such as: complexes of tasks of a system, subsystem.

The technical assignment necessarily includes the following points:

- primary information;
- goals and purpose of the automated system;
- requirements for the implemented system;
- full description of the company where the implementation is carried out in terms of technical features;
- description and content of the work required to create an automated system;
- procedure for monitoring and acceptance of an automated system;
- sources of system development.

Acceptance documentation for an automated system includes data that signals the readiness of the implemented system for operation, and its full compliance with regulatory requirements.

The documentation for the acceptance of an automated system includes the following documents:

- act of completion of the implementation of the automated system;
- act of acceptance of the finished system into initial operation;
- certificate of acceptance of the finished system into commercial operation;

- order to launch test operation of the automated system;
- order to launch commercial operation of the automated system;
- order on members of the acceptance committee;
- system tests protocol;
- general approval protocol.

A real example of SAP implementation in the food industry is the introduction of the system in the X5 Retail Group (Pyaterochka, Perekrestok and Karusel) [25]. At the time of implementation, the GC managed 5,483 stores with leading positions in Moscow, St. Petersburg and a significant presence in the European part of Russia.

The implementation took place in 2014-2015; a unified management information system was created, characterized by high performance. During the implementation the following was done:

- standardization of leading business processes was carried out, supporting high growth rates of the company's business;
- increased transparency of operations;
- a tool to optimize the procurement process was developed;
- a tool that reduces costs and allows for an effective assortment policy was developed;
- a technological platform for the automatic receipt of consolidated management reporting was formed;
- a team for the implementation and subsequent support of the system was created.

The achievements of the program implementation were:

- 8% improvement in compliance with the plan when integrating delivery deadlines with data on material availability and production conditions in real time;
- 28% reduction in inventory turnover period;
- significant cost reduction (information is treated with confidentiality).

If an organization constantly undergoes any structural changes, then the consequence of this is an insufficient formalization of all business processes [22: 2016].

V. CONCLUSIONS

ERP systems, despite the slow formation in Russia, are becoming increasingly popular, as their effect is evaluated not only by direct savings in funds and resources, but also by an increase in the productivity of the company's staff and, ultimately, by an increase in the efficiency of the enterprise as a whole. This matter is especially relevant in companies operating in the food industry, which has a high competition.

Choosing ERP system itself and the methods of working with it are determined by the specific characteristics of the company. Each electronic system developer makes an effort to make his product the most effective and different from competitors' products. But at the same time, the organization of company management should be based on one main system, with the possibility of installing additional modules and expanding functionality.

SAP Company, which released the product of the same name, has gained wide popularity both in Russia and abroad, becoming a synonym for reliability and stability. The advantages of the product are not only the quality and ability

to adapt to the operating conditions of a particular organization, but also a wide differentiation depending on the area of activity of customers. SAP has released a significant number of ERP-modules that match the needs of specific areas of production: food products, retail, high-tech industries, etc. Thus, we can say that SAP was and remains an effective ERP product in the Russian market, and its PP module is able to coordinate production work, reduce costs and reduce time costs for the supply of raw materials, which positively affects the overall manageability of the enterprise from the position of senior management decisions.

Finally, it is necessary to cite the main problems and tasks that often arise when implementing the process of automation of management systems:

Often arising need to change the organizational structure of the company.

The introduction of a new, almost always successful and more efficient ERP system of the company leads to the need to change the structure of departments. And if we are talking about introducing an automation system for the entire management structure, and not its separate module, then the company may need drastic changes.

Mandatory change of the rules and procedures for working with information.

When switching to a new system, there is often a threat of interruption of the necessary managerial staff and the overall functioning of the bookkeeping. This happens if the informational relationships were not formalized, remaining beyond the attention of technical specialists.

A short-term increase in work load of company staff.

During the implementation of the electronic system, it often happens that employees will be forced to double the number of work processes, which occurs because of the need to assimilate and process old and new information flows. In addition, staff will need to make efforts to recognize new technology (and the amount of these changes can be very large and depends on the class of the system used, the level of complexity of the software module).

Defining the implementation method.

The head of the company has to choose: either to leave the obligation to implement the system to his technical specialists or to invite hired employees. Both of these solutions have their advantages and disadvantages, and the correct choice is determined by the specific situation and its accompanying factors.

Staff are showing their opposition to innovation and dissatisfaction.

The human factor is also an extremely important element in the implementation of electronic systems. Researchers believe that this psychological phenomenon occurs with any significant changes in the company, as a reaction of employees to problems arising from innovation.

According to psychologists, this situation is complex, requiring the attention of the staff department and management of the organization. The most common causes of such behavior are:

- training difficulties;

- poorly developed training process for company employees;
- lack of understanding of the flow of information in the organization;
- leadership factor;
- constant structural changes in the company.

One of the most important points is considered to be the quality of work of the management team, which is reflected in all the processes of implementing an electronic system. The worst that can happen in case of poor management is refusing to introduce the system or introducing its functionality with serious errors.

To prevent the resistance of staff, which, as we see, is a serious problem, it is necessary to carefully study the corporate culture of the company and how it affects the distribution of work, the direction and dynamics of information flows. Supervision of the implementation procedure should be carried out not only at the level of the head of the IT department, but also at the level of senior management, to form a high priority for transformations, give them a systematic approach, affecting the widest possible range of production and organizational processes.

Thus, the existing stages of the implementation of the ERP system are accompanied by a number of problems that are not insoluble, but require compliance with specific recommendations that make it possible to properly automate management structures.

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