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THE CLASSIFICATION OF INFORMATION TECHNOLOGIES AND CONTROL SYSTEMS

Summary. *The paper conducted a systematic analysis and implementation of classification of information systems and automated control systems. Established contradiction between modern needs for effective management of the production of fertilizers and insufficient development of methods to create a simulation, energy saving methods based on solving optimization problems of information protection, automated process control production of mineral fertilizers. Therefore justified the need for the establishment of information technology for optimal process control the production of mineral fertilizers.*

Keywords: *information technologies, control systems, optimal control, simulation, information systems.*

Introduction

Lately, approach to managing an industrial enterprise have experienced quality changes. First of all, it is related to the deeper understanding of the information technologies role in the realization of control processes.

Objective statement

In accordance with character of data processing in the information systems on the different levels of control (operative, tactical and strategical) the next types of the information systems are distinguished:

– electronic data processing (EDP);
– control information system (CIS);
– decision support system (DSS).

The electronic data processing (EDP) are intended for an account and operative adjusting of economic operations, preparation of standard documents for an environment (accounts, invoices payment orders). The horizon of operative economic processes control is between one and a few days and realizes the registration and event processing, for example, the arrangement and monitoring of performing the orders, arrival and expense of material values on the stock, maintaining the timesheet of business hours and etc. These tasks have interative, regular character and are executed by the direct performers of economic processes (by workers, storekeepers, administrators etc) and related to official registration and sending of documents in accordance with clearly defined algorithms. The results of economic operations implementation are entered into a database through the screen forms.

Control information systems (CIS) are oriented to the tactical control level: medium-term planning, analysis and organization of works during a few weeks (months), for example, analysis and planning of deliveries, sales, a compilation of production programs. Regimentation (periodic recurrence) of result documents formation and clearly defined algorithm of solving problems are typical for this class of tasks, for example, ordering for forming of the production programs and determination of the requirement for component parts and materials on the basis of the goods specificationgoods. The solving of similar tasks is intended for the managers of different enterprises services (material and technical supply and sale departments, workshops etc). The tasks are solved on the basis of the accumulated operative data.

Decision support systems (DSS) are used mainly at the top level of control (control of the enterprise) that has a strategic long-term value during a year or a few years. Forming of strategic aims, planning of resources attraction and financing sources, choice of enterprise placing etc belong to such tasks. Rarely the tasks of DSS class are decided at the tactical level, for example in the choice of suppliers or in the conclusion about contracts with clients. The DSS tasks have usually an irregular character.

Insufficiency of present information, its contradiction and unclearness, the prevalence of quality aims and limitations estimations, weak formalization of decision algorithms are typical for the DSS tasks. The tools of compilation analytical free-form reports, methods of statistical analysis, expert estimations and mathematical and simulation modeling systems are frequently used as generalization instruments. Herewith the generalized information bases, information storages, knowledge bases of rules and models of making a decision are used.

An information system is considered ideal when it includes all three types of the listed information system.

The main material research

Depending on the coverage of functions and control levels, the integrated and local information systems are distinguished:

– Integrated information system automatizes all functions of control at all the control levels. Such IS are multiuser and function in the distributed computer network.
– Local information system automatizes certain functions of control at the certain management levels. Such IS can be single user and function in some departments of control system [1].

Also, a main factor for the information system classification is a measure of how one or the other system influences on the enterprise production. From this point of view, four types of control system can be distinguished. The types of control system are presented in the table 1 [2].

Type A system is not enterprise control system and is included in the classification for completeness. The accounting system is an example of such system.

Type B systems provide the information control process but contain no components for practical realization of this process. Everything that is related to the control is done beyond these systems. The system that serves storage and trading floor of the retail shop can be used as an example of the type B system.

Type C systems are composed of control components and tools of work rules determination allowing the selection of one or the other scheme. Such systems support all control cycle: planning, activity organization, implementation and analysis of results. However, during the change in the external business environment or new tasks appearance, the relevant business — charts realization can be absent. The examples of such systems are quality control systems, human resources control, sales service, distribution control etc.

Type D systems allow dynamically change economic schemes without stopping the entire system. Starting the process by the one scheme, it is possible to complete it by the new one, which was developed under conditions that changed.

As classic examples of the type A systems can be the following:

SCADA — Supervisory Control And Data Acquisition;

DCS — Distributed Control Systems;

ATPCS — Automated Technological Process Control Systems.

The next step of material accounting improvement was marked by the planning systems of productive or material (depending on the direction of organization activity) resources, they are referred to the type B.

The classic examples of the type B systems can be considered:

MES — Manufacturing Execution Systems;

MRP — Material Requirements Planning;

MRP II — Manufacturing Resource Planning.

One of the reasons of such systems appearance is a necessity to distinguish certain control tasks at the level of technological enterprise department.

Basic principles, that are formed the basis of MRP standard systems, include the following:

– description of productive activity as the stream of related orders;
– account of resources limitation during executing the orders;
– minimization of productive cycles and stock;
– formation of supplies orders and production on the basis of orders of realization and production schedules.

There are known the other functions of MRP: planning of technological processing cycle, planning of equipment loading etc.

Nowadays, the most popular new type of the information systems are the ERP standard systems — Enterprise Resource Planning. It is the type C systems. Firstly, it is the information system for the identification and planning of all of the enterprise resources, that are needed for sales implementation, production, purchases and account

Table 1

The types of control system

Type	Influence on the production	Abstraction level	The tasks, that are solving	Typical example
A	Data control	Data (atomic facts)	Fixation of economic facts	Data input systems
B	Information control	Information (data and interrelations)	Coordinated work of employees and departments	Complex operational level systems
C	Process control	Knowledge (process description)	An achievement of economic results within fixed schemes	Control systems of economic processes
D	Control of operations	Application and development of knowledge (adaptively changeable rules, that are executed by a system)	An achievement of necessary results, solution of the determined task	Control system of the production in general

in the process of executing the client orders. Secondly, (in more general context) it is the effective planning methodology and all of the enterprise resources control, that are needed for sales implementation, production, purchases and account in the process of executing the client orders in the production, distribution and providing services spheres.

In the circle of tasks, that are solved by this class systems, can be included:

– analysis of the enterprise activity on the data and information basis, that comes from the class B systems;
– planning of the enterprise activity;
– regulation of global parameters of enterprise work;
– planning and distribution of the enterprise resources;
– preparation of production tasks and their implementation control;
– a presence of co-operating with the managing subject (personnel), during the performing of their tasks;
– the information processing interactivity.

The classic names of the type C system can be considered:

– ERP — Enterprise Resource Planning;
– IRP — Intelligent Resource Planning;
– APCS (Automated process control systems) [2].

From the point of view of the enterprise ACS (Automated control systems) construction of mineral fertilizers production, it is possible to distinguish three levels such as [3–8]:

– ATPCS (Automated Technological Process Control Systems);
– AOCS (Automated Operative Control Systems);
– AECS (Automated Enterprise Control Systems).

At first, ATPCS level in the system can be the following:

– minor automated units, where elements of grassroots automation in part of control, technical and economic calculations (TEC) and automated workplaces (AW) of economist, storekeeper and timekeeper are presented;
– departments that have automated regulation systems (ARS) and control of technological processes, with workplaces of the foreman, economist, storekeeper and timekeeper;
– highly automated units that have ATPCS with modern controllers and SCADA systems, AWs of the foreman, technologist, power engineer, mechanic, CMI (control measuring instruments) master, economist, storekeeper and timekeeper.

There is AOCS at the second level, where such subsystems are presented:

– subsystems that provide gathering, presentation of information about the technological process state, equipment, finished products quality indexes in the real-time to dispatching service of enterprise, production department and enterprise control of the information and communication network and modem connection of remote objects;
– subsystems that provide gathering of the integrated data according to UNS (Ukraine National Standard) from the account units and ATPCS to the account groups of the technical and economic calculations and material streams of the main metrologist department, main power engineer department, in the economic planning and analytical departments with their further balancing and production expenses accounting in the zones of their appearance.

At third level –AECS — there are realized economic and financial systems and business activity of enterprise that solve the tasks of financial and economic block:

– purchases and sales management,
– money and material resources movement,
– accounting,
– HR management.

Integration of the top and bottom ACS levels in all cases is implemented due to general information platform. Exactly this integration will provide solving the tasks of production expenses operative accounting, ie management and production tasks.

All of the following tasks are solved with the use of the integrated information technology [9–14].

1. Computer networks of departments can provide:

– operative information about the technological processes state, the deviations from the mode standards, account and management of material and feedstock streams, products production and shipment, operative component at cost price, operative (management) account as a part of dispatching information control and management system;
– integrated operative information about the financial and economic activity state, sales, supplies, labor and salary, personnel etc as a part of tasks that are solved by automated enterprise control system (AECS);
– information about communication services, tariffing and communication expenses.

2. Support departments automation; for example, energy heat supply, to the power supply department and water supply and sewage system department, neutralization and cleaning of industrial sewage, a gas supplying department, motor departments and social development service.

3. Reconstruction of existing ATPCS and local CMI of basic productions.

4. Replacement of the depreciated equipment.

5. ACS development and certain automated workplaces for the plant management departments and services.

6. Integration of all the ACS and automated workplaces to the complex integrated control system.

Solving the automatization and mechanization problem, it is necessary for enterprise management to define the "weak spots" in technical and control processes to reduce its laboriousness and production costs, leading out the personnel from the dangerous and especially dangerous areas of production.

The reduction of production costs usually is achieved due to:

– the changes in the attendants structure;
– implementation of the new technologies and equipment;
– the raising of automatization and mechanization level;
– reconstruction of existing equipment;
– reduction of the equipment downtime as a factor of its productivity-raising.

Cost control allows to estimate the possible methods of the production costs reduction, to predict the production costs and, therefore, to make a control decision on the obtained data basis.

Summary

Nowadays, there are no quite effective methods of construction and determination of the control information technologies implementation efficiency and it restrains its implementation largely. Examined control information systems don't take into account the problems of information security providing, that is processed in computer networks, the development of the technological processes mathematical design methods, identification of mathematical models parameters and optimization of the mineral fertilizers production processes.

At the current stage the necessity of creation of integrated information technology of mineral fertilizers production control grew up in the chemical industry enterprises. It became obviously, that the effective production control process can be implemented only with such technology use in the common information space presence and, if it's possible, in real time.

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