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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 technologiesrole 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 processescontrolisbetween 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 definedalgorithms. 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, acompilation of production programs. Regimentation (periodic recurrence) of result documents formation and clearly defined algorithm of solving problemsare 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 saledepartments, 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 thetasks of DSS class are decided at the tactical level, for example in the choice of suppliers or in the conclusion about contracts with clients. TheDSS tasks haveusually an irregular character.

Insufficiency of present information, its contradiction and unclearness, the prevalence of quality aims and limitations estimations, weakformalization of

decisionalgorithms aretypical for the DSS tasks. The tools of compilation analytical free-form reports, methods of statistical analysis, expert estimations and mathematical and simulation modeling systems arefrequently used as generalization instruments. Herewith thegeneralized information bases, information storages,knowledge bases of rules and models of making a decision are used.

An information system is consideredideal when it includes all three types of the listedinformation 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 controlat all thecontrollevels. Such IS are multiuser and functionin thedistributed computer network.

- Localinformation system automatizescertainfunctions of controlat the certain management levels. Such IS can be single user and function in some departments of control system [1].

Also, a main factor for theinformation system classification is a measure of how one or the other system influences on theenterprise 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].

**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 inputsystems |
| 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 systemsof economic processes |
| D | Control of | Application and | An achievement | Control |

| | operations | development of knowledge (adaptively changeable rules, that are executed by a system) | of necessary results, solution of the determinedtask | system of the production in general |
|---|---|---|---|---|

TypeA system is not enterprisecontrol system and is included in the classification for completeness. The accounting system is an example of such system.

TypeB systems provide the information controlprocess 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 controletc.

Type D systems allow dynamically change economic schemeswithout stopping the entire system. Starting the process by the one scheme, it is possible to complete itby 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 stepof material accounting improvement was marked by the planning systemsof 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 MRPstandardsystems, includethe following:

- description of productive activity as the stream of related orders;

- account ofresources limitation duringexecuting 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 processingcycle, planning ofequipment loading etc.

Nowadays, the most popular new type of the information systems are theERP standard systems - Enterprise Resource Planning. It is the type C systems. Firstly, it is the information system for theidentification and planning of all of the enterprise resources, that are needed for salesimplementation, production, purchases and account in the process of executing the client orders.Secondly, (in more general context) it is the effective planning methodology andall of the enterprise resources control, that are needed for salesimplementation, production, purchases and account in the process of executing the client orders in the production, distribution and providing servicesspheres.

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

- analysis of theenterpriseactivity on the data and information basis, that comes from theclass B systems;

- planning of theenterpriseactivity;

- regulation of global parameters of enterprise work;

- planning and distribution oftheenterprise resources;

- preparation of production tasks andtheir 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 systemcan be considered:

- ERP - Enterprise Resource Planning;

- IRP - Intelligent Resource Planning;

- APCS (Automated process control systems) [2].

From the point of view of theenterprise 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 bethe 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;

- departmentsthat have automatedregulationsystems (ARS) and control of technological processes, with workplacesof 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 (controlmeasuring 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 inthe real-time to dispatching service of enterprise, production department and enterprise controlof 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 ATPCSto the account groups of the technical and economic calculations and material streams of the main metrologist department, mainpower engineerdepartment, 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 ofenterprise that solve thetasks of financial and economic block:

- purchases and sales management,
- money and material resourcesmovement,
- accounting,
- HR management.

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

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 processesstate, the deviations from the modestandards, account and management of material and feedstock streams,productsproduction and shipment, operative component at cost price, operative (management) accountas 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 etcas a part of tasks that are solved byautomated enterprise control system(AECS);
- information about communication services, tariffing and communication expenses.

2. Support departmentsautomation; for example, energy heatsupply, to the power supply department and watersupply and sewage systemdepartment,

neutralization and cleaning of industrial sewage, a gassupplyingdepartment,motor departments and social development service.

3. Reconstruction of existingATPCS and local CMI of basic productions.

4. Replacement of the depreciated equipment.

5. ACSdevelopmentand certain automated workplaces for theplant management departments and services.

6 . Integration of all theACS and automated workplacesto the complex integrated control system.

Solving the automatization and mechanization problem, it is necessary for enterprisemanagement 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 theattendantsstructure;

- implementation of the new technologies and equipment;

- the raising of automatization and mechanization level;

- reconstruction of existing equipment;

- reduction of theequipmentdowntime as a factor of its productivity-raising.

Cost control allows to estimate the possible methods of theproduction costsreduction, to predicttheproduction costsand, therefore, to make acontrol decision on theobtained data basis.

## Summary

Nowadays, there are noquite effective methodsof construction and determination of the controlinformation technologiesimplementationefficiencyand it restrains itsimplementation largely.Examinedcontrol information systems don'ttake into account the problems of information security providing, that is processed in computer networks, the development of the technological processes mathematical designmethods, identification ofmathematical models parameters and optimization of the mineral fertilizers productionprocesses.

At the current stage the necessity of creation of integrated information technology of mineral fertilizers productioncontrolgrew up in the chemical industry

enterprises. It became obviously, that the effectiveproductioncontrol process can be implemented only with such technology use in the common information space presence and, if it's possible,in realtime.

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