THE PLACE AND ROLE OF INFORMATION TECHNOLOGY IN AN INDUSTRIAL ORGANIZATION IN THE FIELD OF NONCONVENTIONAL TECHNOLOGIES

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ABSTRACT: The scientific paper proposes a pragmatic perspective of presenting some theoretical and practical aspects regarding the place and role of information technology in an industrial organization that uses processing with nonconventional technologies, more precisely processing by electrical erosion. The implementation of an information system within the organization allows the acquisition, access, storage, and transmission of information more and more easily. Properly implemented computerization comes with two benefits in the organization's activities: it increases the quality of services and reduces costs. For an overview, general aspects of nonconventional technologies were also presented, focusing on electrical erosion processing. The point of view presented is only a small part of the possibilities of implementing information technology, an information system, so improvements can be obtained in the production process by processing by electrical erosion.

KEYWORDS: information technology, information system, nonconventional technologies, electrical erosion.

1. INTRODUCTION

The society in which we live is no longer based only on the principles of a typical industrial society in which mechanization and later robotization were the main orientation. Although they are also developing at an accelerated pace, information technology is the new principle needed for economic and social development. The computerization of modern organizations that use nonconventional processing technologies, comes as a current necessity. Information technology is becoming an important tool in industrial organizations.

Materials processing technologies using nonconventional technologies, namely the process of processing by electrical erosion, appeared in the early 1940s (spouses Boris and Natalia Lazarenko). These types of processing have emerged as a need to obtain finished parts by processing materials, especially metal, by nonconventional processing methods such as electro-erosion processing (EDM), chemical erosion, plasma processing, laser. At present, the conventional - nonconventional delimitation of processing with this type of technology is no longer the same as a few years ago, erosion processing being an example in this regard, being increasingly found as a technological processing procedure in modern organizations, used mainly in the processing of parts made of very hard materials, of refractory steel parts, of certain tools, in the processing of parts having surfaces with complex shapes, and in microdimensional processing such as slots and holes.

2. INFORMATION TECHNOLOGY VERSUS NONCONVENTIONAL TECHNOLOGY

The development of society, the increasing complexity of activities and work processes have led to increased volume and complexity as well as the diversification of information. The more complex the activities, the more likely the decision-making system to become blocked. In this case, IT is the one that unlocks and streamlines the information system and the decision system. Informatics takes over the tasks of the economic and social system to develop models, methods, techniques, concepts, studies, and systems for efficient information processing in various fields. Thus, we can say that computer science is the science that, with the help of automatic computer systems, deals with the study and development of methods of information processing.

Within an organization, the operation of an information system involves the performance of activities of collection, processing, transmission, storage of data, and information. To order to carry out these activities, it is necessary to use means of information transmission, processing, and storage. Also, specialized personnel is required for the use of these means.

Through the increasing use of computing systems, the efficiency of organizations has increased. Through the software implemented at the level of organizations, the activities within the organization could be structured and organized more efficiently, the efficiency of the entire organization increasing.
Many of the activities of organizations are carried out with the help of the computer. In most cases, performing the activities of collecting, processing, transmitting, storing data, and information of an information system involves the use of computing techniques. In this case, we can say that we have a computer system.
The computer system is a subsystem of the information system. To ensure the three functions of the information system: the documentation function, the decision-making function, and the operational function, the computer system uses computing techniques (computers, servers, etc.) and specialized software applications. The notion of a computer system is related to the computerization of the organization's activity, to the organization and administration of information using computer resources.
Within an information system of an organization, there may be several information systems that operate in parallel and collaborate to meet the objectives of the information system (for accounting, materials management, personnel records, etc.).
It is not mandatory for an information system to be based on computers, but there may be situations when due to the complexity of interdependence with other activities, certain tasks can no longer be performed efficiently and without error only with the manual system, then using computers can solve this problem.
The computer system, by its nature, deals with the collection, transmission, and processing with the help of automated means of information. The information system is much more comprehensive. The development of the performances of the computing technique led to an increase in its use and the increase of the role of the information system in the whole information system. In high-performing organizations, in developed economies, the information system occupies a very significant share of the total information system. A major role in the quality of the information system and the management system is played by the human component.
The current trend is for more and more activities to be taken over by computers. On the other hand, they can complement and support human activity, increasing productivity, and efficiency. The human resource has a very important role, the human component plays a major role in the quality of the information system.

INFORMATION SYSTEM

We can consider the information system as a set of material and human resources that are part of an organization to take over and process data to obtain information that will be used by all levels of management, control, and decision making of the organization. In other words, the information system can be seen as the totality of data, information, information flows and circuits, information processing procedures, and their means of application, for the design, development, and implementation of the organization's objectives.
The information system through its structure ensures the collection of data and information, their processing, their transport through an upward or horizontal flow. Following this data and information, decisions are made which are distributed in a horizontal or downward flow.
An information system, to function efficiently, consists of several components: data, information, information circuits, information flows, information procedures, means of processing information.

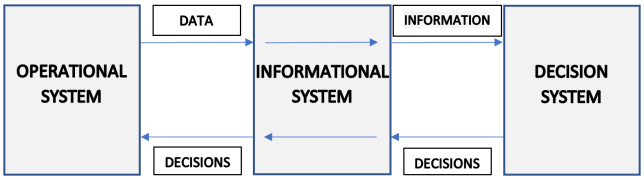

Fig. 1 Information system in an organization

The need to apply an information system in an organization is found in the support it provides in development, by providing support for activities and operational processes, for decision-making within the organization, for the implementation of strategies in the competitive market.
The computer system is an essential component of the information system. With the help of computer systems, the computer system takes over the tasks of collecting, processing, transmitting, and storing data. The computer system includes all the resources, methods, and techniques that ensure the automatic processing of data.
The resources used by the computer system are all hardware equipment, data and information transmission systems, software programs used, databases, and human resources - the staff that uses the components of the computer system.
In an information system, the process of automatic data processing involves the data being collected, processed, transmitted, and stored. By collecting the

data is meant their identification and notification to the places where they are generated, then their transposition on supports suitable for automatic processing. These data are primary. The data transmission ensures the transport of the primary data from the sources that generated them, to the automatic processing systems as well as the results of the data processing. The data storage process consists of storing and storing, archiving them, on memory media, for further consultation and processing.

The computer system is an essential component of the information system. The notion of a computer system is related to the computerization of the organization's activity, to the use of computer resources for organizing and managing information.

NONCONVENTIONAL TECHNOLOGY

By nonconventional processing of materials, we mean the processing of materials by special processes. These processes use different principles from conventional processing processes.

We define nonconventional processing as processing processes that meet at least one of the conditions:

- materials with special properties such as high hardness, or brittle, are processed efficiently;
- it is possible to obtain with great precision special surfaces such as shape, dimensions, roughness;
- are used in special environments such as ionized environment, at high pressures or vacuum.

In processing with nonconventional technologies, most processes are based on the removal from the processed part of pieces of material measuring tenths to thousands of mm, as a result of erosion phenomena.

For processing, an erosive agent is used, which can be a complex physicochemical system, capable of yielding energy directly to the surface to be processed, or to the working environment. The energy used and transferred can be of several types: electrical, electrochemical, electromagnetic, chemical, thermal, or mechanical. This energy is used to change the integrity of the material to be processed until it reaches the desired dimensions and quality of the workpiece surfaces.

These types of processing by nonconventional technologies can have several types of applications:
- complex dies and molds; - cams from automatic lathes, cams for the radial penetration mechanism of the planning machines;
- templates with different complex contours;
- metal coatings;
- engraving of complex profiles;
- cutting very precise contours
- the processing of extra hard or brittle materials;
- making extremely fine metal parts such as filters and sieves;
- extraction of broken tools or fasteners from parts;
- parts with a complex profile, made of hard materials, which do not allow the use of classical mechanical processing procedures.

If we classify nonconventional technologies according to the type of energy used to remove material, its effect on the processed surface, and technological parameters we have: processing by electro-erosion, electrochemical processing, anode-mechanical processing, chemical processing, electron beam processing, laser processing, plasma processing, ultrasonic processing.

Electro-erosion processing is a method of processing materials with concentrated energies, in which the removal of excess material is done based on complex erosive effects, discontinuous and localized, of electric discharges in impulse, primed repeatedly between the object to be processed and an object. transfer called electrode - tool respecting certain physical conditions, for the existence of discharges, location of effects, and non-interruption of the erosive process.

Electrochemical processing is a method of processing based on the anodic dissolution of a metal, in an electrically conductive solution when the electric current passes.

Anode-mechanical processing is a processing method based on the development, simultaneously in time, but differentiated in space, of processes for taking material from semi-finished material, electrochemically and by electrical erosion.

Chemical erosion processing is a method of processing based on the attack with a chemically active substance of the surface to be processed.

Electron beam processing is a method of processing based on the thermal effect generated in the impact zone with the blank (usually) by a high-energy electron beam, directed and focused towards this area, using electromagnetic or electrostatic systems.

Laser beam processing is a method of processing based on the effects generated on contact with the surface of the blank or with a substance in the vicinity of the blank of a laser beam having adequate energy and spatial-temporal characteristics, the beam directed and focused using a lens system and optical mirrors.

Plasma processing is a method of processing based on the thermal or chemical effects produced at the contact areas between the plasma and the accessible surfaces of the blank.

Electro-erosion processing

The classification of machining by electrical erosion can be done taking into account the method of priming, the duration and shape of the electrical discharges in the impulse as well as the shape of the tool electrode used.

From the point of view of the method of priming the electric discharges, the processing by electrical erosion is classified:

- Processing by electrical erosion with contact rupture - with impulses primed by breaking electrical microcontacts. In this type of processing, the electric discharges are initiated by breaking the electrical contacts traversed by the current, established temporarily between the tool electrode and the object to be processed and between which there must be a relative movement. Contact pressure is exerted between the two objects (the object being processed and the tool electrode);
- Electrical erosion processing with discharges primed by penetrating an electrical environment. In this type of processing, no direct contact is used between the processed object and the tool electrode.

The size of the space between the two (corrosive gap) is given mainly by the impulse priming voltage and the machining advance.

A classification taking into account the shape of the tool electrode used in electrical erosion machining with piercing priming discharges is:

- electrical erosion with a massive electrode - the processing is done by copying the conjugate form made at the level of the tool electrode;
- electrical erosion with a filiform electrode - with a diameter below 0.5 mm which by axial movement is used on a certain contour that can be programmed by computer. This contour can have forms of great complexity.

Machining by electrical erosion with pulses primed by piercing the space between the processed object and the electrode tool depending on the duration of the pulses can be machining with electric discharges by spark, characterized by the duration of current pulses $t_{ti} = 10^{-4}...10^{-7}$ and machining with electric discharges in an arc, characterized by pulses $t_{ti} = 10^{-4}...10^{-7}$.

The principle of operation of machining by electrical erosion is presented in Figure 2. The tool electrode (3) is made of conjugate shape of the final part (4) with dimensions of 1 - 3 mm smaller. During machining, both the electrode - the tool and the machining surface of the workpiece must be in a dielectric medium (10). The electrode - tool and the machined part are connected to a pulse generator (1). The distance between the electrode - tool and the machined part is 0.01 - 0.5 mm (gap), in this space is dielectric. The electric discharges through the spark or the electric discharges in the spring, produce a very fast heating, until melting, or even vaporizations, of the processing area, leading to the removal of particles of material from the part. In order not to interrupt the process of electric discharges by spark or electric discharges in the arc and to avoid blocking the space between the electrode - tool and part, these particles resulting from the processing must be removed. They are removed using a dielectric. The dielectric recirculates after being filtered (6) and cooled (8). In addition to the role of the dielectric to remove particles resulting from processing, it also has the role of cooling the electrode - tool but also to concentrate and locate electrical discharges.

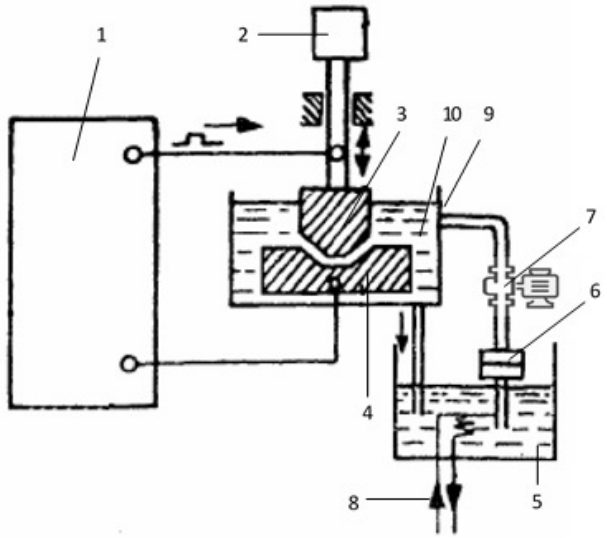

Fig. 2 Schematic diagram of an electrical erosion processing machine
1 - pulse generator; 2 - advance regulator; 3 - electrode - tool; 4 - workpiece; 5 - dielectric tank; 6 - filter; 7 - pump; 8 - cooling system; 9 - dielectric tank; 10 – dielectric

Erosion processing is applied to electrically conductive materials. Due to the economic aspects, this type of processing is used for materials that cannot be processed by conventional methods.

Erosion processing is used to process parts of very high hardness materials such as metal carbide dies and dies, refractory steel parts, certain tools. Another application of these processes is the processing of parts that have surfaces with complex shapes, and microdimensional processing such as slots and holes.

3. IMPLEMENTATION OF INFORMATION TECHNOLOGY IN AN INDUSTRIAL ORGANIZATION IN THE FIELD OF NONCONVENTIONAL TECHNOLOGIES

The need to apply an information system in an organization is found in the support it provides in providing support for activities and operational processes, for decision making, for the implementation of strategies in the competitive market.

The information system within an organization helps to collect data and process it into information, transport it, through the upstream or horizontal flow, and after decisions and instructions are developed, they are transmitted through the downstream flow.

A possible structure of an information system within an organization can be divided as follows:

- Human resources management in which the analysis of salaries, personnel skills, analysis of the workforce, management of data on employees, estimation of staff needs, analysis of staff training and development is pursued;

- Accounting in which operations are verified, invoicing and accounts, budgetary, analytical and fiscal accounting, payments;

- Finances with investment budgeting, treasury and credit management, financial forecasts, analysis of financing needs, profitability analysis;

- Marketing in which it is done, market research, advertising and promotion, marketing management, product management, sales forecasting and targeting, order processing;

- Production with computer-aided design, computer-aided manufacturing, inventory management, material planning, supply, industrial automation.

The current competitive environment requires that industrial organizations, especially those with nonconventional electrical erosion processing technologies, impose increased quality and productivity standards and the quality-price ratio be fair.

These desiderata require more and more obviously, in a knowledge-based industrial organization, the implementation of an integrated computer system - ERP software (Enterprise Resource Planning).

ERP has the meaning of complex application that integrates economic processes, optimizes the organization's resources, and at the same time is a multi-modular computer system, designed to streamline the activities of an organization.

Integrated ERP systems come with the following features:
- facilitates the integration of all departmental processes of the organization;
- operates in real-time;
- have a common database for all applications;
- they consist of a set of modules that can work independently;
- addresses all types of organizations.

For industrial production organizations, ERP solutions improve inventory management, automate workflows, and correlate production activities with orders placed by customers on the same platform.

Figure 3 shows a segment of existing IT flows within an industrial organization with production activity.

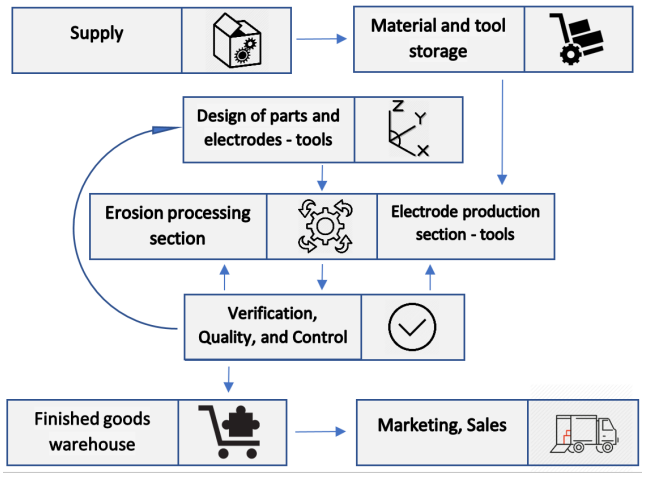

Fig. 3. Information flows

The implementation of an information system in an industrial organization with production activity is a necessity. Management of materials, inputs, and outputs in digital format imposed by the advantages it brings. The situation of stocks in real-time, various reports according to needs, the elimination of unnecessary stocks, the possibility of planning purchases according to needs, are part of the advantages.

Designing, making drawings, can only be conceived to be done on a computer. The projects made on computers in CAD type programs arrive directly on the machine that does the processing. The automatic production lines can have verification and control components, the parts produced coming out finished, ready for sale.

Nonconventional technologies involve high staff qualifications. The use of machining by electrical erosion is done on complex parts, the design process performed on computers is of a high level.

Information technology also helps to protect intellectual property, which is a necessity. Establishing an IT network between departments, the production department, warehouses of materials, and finished products with a high level of security and differentiated access of users can help to avoid accidental or intentional data loss.

An important aspect is a protection against the possibility of viruses or cyber-attacks by using antivirus software products, using a network server with a domain in the local network, firewall hardware devices.

Last but not least, an important aspect is the existence of data backup solutions to recover the data in case of their loss.

4. CONCLUSIONS

The use of nonconventional technologies has overcome the stage of uncertainty, the dimensional processing by electrical erosion being a representative process.

Erosion processing is increasingly found as a technological processing procedure in modern organizations, used mainly in the processing of parts of very high hardness materials, refractory steel parts, certain tools, in the processing of parts with complex shapes, and for microdimensional processing such as slots and holes.

Advantages of using nonconventional technologies:

- use in areas where conventional technologies such as cutting, plastic deformation, or other technologies cannot be applied;

- the technologies are fully automated, so the quality of the products is ensured by the design;

- productivity is high;

- they are technically and economically efficient for large series production.

Processing with nonconventional technologies also has some drawbacks: they use complex installations, they need special working environments (high pressures, or vacuum, or special ionization environments), the staff must be highly qualified, the cost of processing is higher than to processing by conventional processes (can be reduced by mass production).

It is obvious that due to research and technological developments in recent years, the achievement of qualitatively and quantitatively superior results the barrier between conventional and nonconventional is no longer very clearly delimited.

In modern industrial organizations, the emphasis is increasingly on integrated management systems in which the management of service and product quality is a necessity imposed by an increasingly competitive market. Environmental management becomes a duty for a more harmonious relationship with society and occupational safety and health management is an obligation for employees and the community. In integrated management systems, the information system has a definite role. A basic component of the information system is the computer system.

Computerization, if properly planned and conducted, comes with two benefits in the organization's activities: it increases the quality of services and reduces costs.

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