IT SYSTEMS IN THE TRANSFORMATION OF THE ORGANISATION OF PRODUCTION ENTERPRISES

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Purpose: The study aims to describe information systems applied in economic entities with particular emphasis on the changes which have taken place during the organisational development of production enterprises, especially the progress while implementing computing technologies.

Design/methodology/approach: Based on an extensive study of the literature on the subject, the author analyses the stages that IT systems have undergone to achieve their role of supporting management of production enterprises. The paper covers the whole range of computerised systems that have been utilised in this scope in economic entities.

Findings: The study includes a short analysis of the use of individual groups of issues in the description of the stages of implementing the appropriate systems. Moreover, the article also presents the definition of information as inseparably related to information systems.

Practical implications: The systems characterized in the paper cover the issues from data processing to knowledge bases support. In particular, the role of Systems of Computer Management of Organisations has been stressed with particular emphasis on practical application in enterprises. In this group systems have been characterized from the field of warehouse economy to the systems of resource management in enterprises. Moreover, the group of Information Systems of Management Support, the comprehensively integrated systems have been presented in the paper alongside the characteristics of Intelligent Systems of Decision Support. Aa a whole, the presented analysis covers the thematic scope from expert systems to multi-agent systems and can be applied in the practice of contemporary enterprises management.

Originality/value: The article presents the group of Information Management Systems which significantly influence the changes in the organisation of enterprises.

Keywords: computing technologies, information management systems, production enterprises.

Category of the paper: Conceptual paper.

1. Introduction

Information is inherently linked to information systems. In a general way, it can be concluded that information should be understood as the transmission (verbal, visual, magnetic, digital) of information, in any nature and structure of medium, which enriches our knowledge. The most common assumption is that information is knowledge of a specific state of affairs or of processes in perceived reality. Information is the transmission and reception of knowledge components.

Strategic information results from the way decisions are made with incomplete information about the environment. Most information systems strategies are the result of lengthy discussions (weeks, months) with staff from across the organisation in key management and administrative roles. This form of information management strategy development is unthinkable at the current level of information technology development (Kiełtyka, 2001). In turn, it should be stated that an information system is a system comprising all the methods and means of collecting, processing, storing and sharing information using infrastructure and information flow integrators.

Communication infrastructure is the most important component of the information technology base for any enterprise. The use of this infrastructure, especially for a multi-site enterprise, increases its creativity and competitive advantage in the marketplace.

We use the term 'information' very frequently. This concept has the character of a primary concept and it is not possible to define it strictly by means of simple concepts. Thus, all that remains is to clarify the meaning of this concept, corresponding to its intuitive understanding. It seems that such an explanation can be formulated as follows: "we call information everything that can be used for a more efficient selection of actions leading to the realisation of a certain goal" (Seidler, 1983). The association between information and purposeful action implies that the concept of information does not exist when the implementation of purposeful action is not involved. The potential nature of information is only present when, properly used, information can assist in the realisation of a certain action.

Information is an integral part of the work of everyone in an organisation, especially a manager. It encompasses all data streams within the organisation and between the organisation and the environment. The amount and forms of information flows are increasing alongside technological advances in communication. This development makes information, primarily related to the operations of the organisation, an important factor in the creation of competitive strategies and a condition for the success of the organisation. The information function, based on technical and organisational elements, is the carrier of the company's value, so information resources should be seen as a product and process.

In the literature of information and communication management, one encounters many terms for information. Most authors focus mainly on explaining the essence of information as a product, assuming that information constitutes content with a specific meaning about something, for someone and because of something, expressed by means of linguistic and/or extra-linguistic signs (Martyniak, 2000). By means of it, it is possible to describe events, states of affairs or objects in space-time. In this sense, information can be regarded as a special kind of 'product' and at the same time as a resource that is produced as a result of a specific operations. However, it is important to note that information is distinguished as a 'product' from data. According to T. Wierzbicki, data are those elements of information which, when treated separately, have no informative value on their own, which makes it impossible for us to interpret them and thus understand the described event or object. Information in the sense of a product only comes into being when data are combined in such a way as to form an "abstract model of a real object", as a result of which it is possible to communicate and understand them (Wierzbicki, 1981). In such a view, information appears as the result of a data processing process that makes sense of the data, enabling the resulting knowledge component to be used in the organisation's processes.

2. Progressively developed and applied information systems

2.1. Information management systems

Management computer systems include in their collections the management functions, which carry out procedures involving the collection and processing of information and the determination of decisions carried out by means of appropriate, adapted computer programs. By definition, a management system is an information system. The information systems implemented in it cannot function in management as isolated objects. Each of these systems is equipped with a module to improve the management process. Information systems are integrated if an adequate flow of information (data) and control signals between them is possible. What is important is the part of the system that functions in the technical environment, implemented through intelligent ICT networks (Wang et al., 2021; Zhang, 2021).

The basic management information systems also found and developed in business organisations can be presented as: SRS - sales recording systems, which mainly use data processing and collection; MIS - management information systems, which are used to find information for management; DSS - decision support system, as a process of generating and optimising decisions; CSS - communication support system, which operates a quick search for the most frequently recurring command relations; GDSS - group decision support system, which makes it possible to work out group decisions during a meeting by using mutual

interaction; KBS - system with a knowledge base, which uses artificial intelligence systems during the decision support process.

2.2. Computer-based organization management systems

The use of computerised systems for the management of organisations requires a great deal of management knowledge, as well as great skill and considerable intuition in selecting the appropriate software. Historically, the development of management information systems commenced with the computerisation of sales and procurement processes closely linked to the demand for various goods. The enormous intensity and massiveness of various information processes requires the widespread use of computer technology to improve the processing and sorting of information (Kiełtyka, Smoląg, 2000). Enterprise management systems have emerged as a result of a long evolution of theoretical assumptions and technologies offered by the computer industry.

Initially, these systems covered the area of warehouse management. The systems used there were: CIMM - computerised inventory management methods; IC - inventory control; MRP(CL) - closed-loop material requirements and capacity planning.

As the complexity of the business environment has increased due to the globalisation of sales and supply markets and developing information technology, the evolution and implementation of computer-based organisational management packages has commenced. The basic standards chronologically are as follows: MRP I - material requirements planning; MRP II - manufacturing resource planning; MRP II Plus - extension of manufacturing resource planning with extensive accounting and financial systems; ERP - enterprise resource planning; DEM - demand management; HRM - human resource management (www.sykom.pl); DMS - document management system; SCM - supply chain management system; CRM - customer relationship management system; SSM - sales and service management; PLM - product life cycle management system; ERP II - enterprise resource planning based on its components.

On the basis of the MRP II standard, new specialised systems and methods were developed, such as SRM - Supplier Relationship Management; DCS - Distributed Control System; MES - Manufacturing Execution System; BI - Business Intelligence; POTT - Production Optimisation Technology; PRM - Partner Relationship Support System; CMS - Content Management System; EDI - Electronic Data Interchange; DRP - Distribution Resource Planning.

2.3. Information systems for management support

The choice of system to support management is not a simple matter. The latest systems of this type are built as multi-purpose systems. These systems include simple, basic, developed and comprehensively integrated systems.

Simple systems do not cover the strategic areas of an organisation. Their scope includes: the management of the organisation's resources; the management of the maintenance of the organisation's resources; and the recording and accounting of the consumption of production factors (Kiełtyka, 2002).

Base systems address strategic domains and selected domains supported by simple systems. The type of additional domain depends on the nature of the operations of the organisation using the system.

Developed systems cover the basic and auxiliary production or service processes of the organisation. They cover all levels of the organisation.

Comprehensively integrated systems that, through information technology, lead to the consistency of individual computer-assisted management methods. The need for consistency in these methods has led to the use of Computer Integrated Manufacturing - CIM. The comprehensively integrated CIM system embraces a range of technologies. These technologies are presented through: CAM - computer aided manufacturing; CAD - computer aided design; CAP - computer aided planning; CAMg - computer aided management; CAQ - computer aided quality; CASE - computer aided software engineering; CAPI - computer aided production process control; CAMSD - computer aided manufacturing system design; CAPD - computer aided product design; CAA - computer aided administrative process management; CPSC - capacity planning and management system; CAPP - computer aided production process planning; CAT - computer aided training; CAE - computer aided engineering; CAL - computer assisted learning; CAO - computer aided operation of production lines; CAQC - computer aided quality management; CAPM - computer aided production management; BIS - business information system; CADD - computer aided design and drafting; PPMCS - production monitoring, control and steering system.

2.4. Intelligent decision support systems

So far, it can be stated that even the most intelligent IT management support systems do not make decisions for humans, especially in business situations. Intelligent IT systems, being information management tools, are mainly used to support decision-making in an organisation. Intelligent decision support systems are expected not only to support the manager by providing information, but also to mimic the manager's decisions in the specific situation of the organisation's operation (Rutkowski, 2007). The role of these systems is to present several options with an appropriate probability of effectiveness for solving a specific decision problem. Intelligent systems, using neural networks in their structures, are mainly intended for forecasting, diagnosis, classification and strategic planning. Currently available intelligent decision support systems are offered in the form of: ES - expert systems; IFS - intelligent forecasting systems; CWS - collaborative work systems; MAS - multi-agent systems (Niedbał, 2008); ICS - intelligent control systems, CSS - centralised settlement systems (IT in economic entities); IDSS - intelligent decision support systems; FLS - fuzzy logic systems;

IPSS - intelligent personnel selection systems; KMS - knowledge management systems, logistic systems using augmented reality (Rusek, Pniewski, 2017).

2.5. Database systems

The basic element (collection) of all information systems is the database. The skilful creation of a database is one of the most important activities used further in data processing. An information system alone cannot provide data that would fully satisfy managers. Launching systems that result in rapid access to up-to-date and reliable information enables companies to become innovative and competitive in the marketplace (Kiełtyka, 2020). Significant decision support is obtained through the creation of databases and data warehouses. The main idea behind the concept of creating a data warehouse is to combine data from different databases into one. Typically, a data warehouse is a separate IT structure, independent of transactional systems (OLTP). Data related to a single business process is referred to as a domain data warehouse or a subject data warehouse. Multidimensional databases are created to access large data sets. Today's requirements for processing large amounts of data make it necessary to provide access to data under dynamic changes. The database systems included in the management structures are presented in organisations as: ODBMS - object-oriented database management system; MDBS - mobile database systems; RDBMS - relational database management system; ORDBMS - object-relational database management system; DDBS - distributed database system (Ślusarczyk, Michalak, 2006).

3. Summary

The graphical set of issues presented in this chapter concerning information systems in the transformation of enterprise organisations is illustrated in Figure 1 in the form of progressively created structures reflecting technical, technological and IT progress during the implementation and improvement of management processes. IT support of the management process consists of automatic processing of documents arising for the implementation of process activities resulting from the nature of the information procedures used. The set of activities describing the information processes, included in the information systems, determines what documents are produced and how they will be used in specific positions.

Figure 1. The scheme of progressively built information systems used in organisational changes of production enterprises.

Source: own elaboration.

Currently, multi-agent systems are a new approach to the analysis, design and implementation of complex computer-based organisational management systems (Kierzkowski, 2004). An area of application for multi-agent - software systems is decision support for managers, based on integrated computerised management systems.

As already mentioned, the selection of decision-support IT systems when managing organisations is one of the most difficult undertakings for both institutions and business entities. When selecting IT management support solutions, one should take into account not only the immediate needs of the organisation, but also the long-term suitability of the system for complex solutions. The most important criteria for the selection of management information solutions are: interactive modularity of the system, functionality and autonomy of the system, possibility of system development, branch solutions, corporate solutions, cooperation with other systems, openness of the system and experience of the implementing organisation. An efficient information system, with appropriately selected IT procedures, makes it possible to simplify decision-making processes and facilitate access to up-to-date data. Investments in the modernisation of the ICT structure are currently often undertaken, especially at the level of large enterprises with several branches located at great distances from each other.

Important from the point of view of the transformation of enterprise organisation is the problem of assessing the impact and effectiveness of IT systems on the operation, functioning and behaviour of the organisation in the market. IT in an organisation is an essential element of its efficient management and a condition for its effective functioning. The assessment of the impact of IT systems on the functioning of an organisation should take place through the analysis of econometric models using dependent variables such as: cost of sale, sales value,

gross profit, economic added value, market value of the enterprise, return on assets, equipment efficiency, sales profitability index, level of receivables, etc. Another assessment should be to determine the level of use of information technology. This assessment should be performed according to quantities such as: cost of information technology, expenditure on computer programs for information systems, materials, etc.

An important factor in the transformation of an organisation is the IT strategy of the enterprise organisation, which can be contained in several important principles, namely: the need to introduce a new system, the conversion of pilot implementations into widespread implementations, the implementation of applications on a common database, the implementation of security policies at all levels of the organisation's structures, the provision of training using e-learning systems, the monitoring of strategic innovations in global IT products, the use of IT forecasting systems to increase the organisation's competitiveness in the market.

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