

Cognitive Technologies Of Information Managements Of Business Processes Of The Digital Enterprises

Dr. I. Brusakova
Dr., prof./State Electrotechnical University "LETI",
Saint-Petersburg, Russia

Abstract - In article cognitive technologies of information management of business processes of the hi-tech productions of the digital enterprises as technologies of management of complex events are considered. The architecture of the digital enterprise as IT architecture of corporate management is given by process model. The necessary structure of corporate knowledges of the digital enterprise for formation of the IT solution on efficiency of activity of the digital enterprise is formalized.

Index terms - information management of innovations, process (technological) innovations, business processes of the hi-tech enterprise, corporate knowledge, IT infrastructure, IT solution, architecture of the high-tech enterprise, digital enterprises.

I. INTRODUCTION

Problems of information management of the hi-tech productions are connected first of all with insufficiently effective engineering of innovations, complexity of acquisition of knowledge of the hi-tech production, complexity of introduction and development of tools of management of knowledge, complexity of processes of a metrization of business solutions.

A. Purposes of Information Management

The purpose of any information management is ensuring management of business processes of the enterprise within a common information space, uniform IT infrastructure. Information management is based on the concept of creation of a common information space of management of business processes at various levels of management. At a stage of modern informatization of production the solution of such tasks remained in the past, and from a stage of production tasks moved to formation of conditions of development.

B. The Concept of "Increment of knowledge"

The concept of "an increment of knowledge" - the key concept of development of the digital enterprise. For implementation of the concept of "an increment of knowledge" it is necessary to introduce technologies of management of corporate knowledge (Knowledge Management) in procedures of information management.

The special role is got at this stage of development of the digital enterprise by technological innovations.

II. RELATED WORK

Information management of the main (production) and auxiliary (financial, logistic, material, monetary, information, personnel, etc.) business processes of the enterprise is carried out by means of business applications, IT services at various levels of management [1-4]. Informatization of management of various resources is that other, as process of creation, introductions, uses of technological innovations on a set of resources of the enterprise. Thus, it is possible to consider technological innovations on production management, technological innovations on management of social resources the personnel, technological innovations on management of material resources, logistics, etc. [5-7].

Use of BPM information management systems efficiency of business is considered as one of consecutive steps of work with difficult events. The difficult event is meant as transactions which activation happens in procedures of adoption of administrative decisions. Activation (performance, service of an event, intensity of service) happens by results of monitoring in a concrete timepoint of all key indicators of efficiency (metrics) of all business processes of the enterprise and their interrelations (so-called, "force of events" of David Luhema [6]).

Grid is considered as uniform connection of infrastructure and technologies of granting resources and standards [3]. The infrastructure of a grid consists of hardware-software means, infokommunikation, services of ensuring sharing of resources. Ensuring standardization of stages of exchange of information between support services and users – a necessary condition of successful work of grid. In this case at design and introduction of the IT services provided by services special significance is attached to standardization and a metrization. Grid-structures, grid-Wednesdays arose from the distributed calculations complicated by opportunity to operate with distributed computing capacities of processors. Business applications are realized with use of an e-business intelligence (Business Intelligence), managements of efficiency of business

(Performance Management), automation of material resources, control systems of the relations with consumers, clients (Customer Relationship Management, CRM), control systems of chains of suppliers (Supply Chain Management, SCM), ensuring synchronization in a data control (Data Migration Synchroization); The EIM module realizes integration of data (Data Integration, Data Federation) with possibility of quality control of data (DataQuality), management of metadata (Metadata Management), the analysis of texts (Text Analyzer), Master Data Management; possibility of work as with the structured data (Structured Data) with use of OLAP-technologies, databases (DW-Data Warehousing), RDBMS - given in ERP, and with unstructured data (Unstructured Data) with use of the data transferred by e-mail (email), the mobile phone, Internet resources (Web, Docs, Notes) [1, 4].

III. PERPOSES OF INFORMATION MANAGEMENT FOR DIGITAL ENTERPRISIS

The technological innovation of the digital enterprise is understood as process of introduction of technologies of management of corporate knowledge (IT solutions) of the main, auxiliary, through business processes for increase of efficiency of adoption of the administrative decision by means of knowledge transmissions.

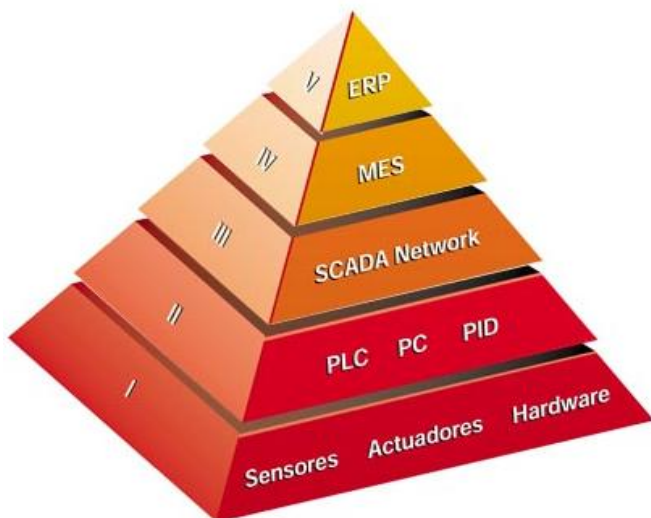


Fig. 1. Information infrastructure of management of manufacturing enterprise of resources of the hi-tech enterprise.

In fig. 1 the traditional concept of automation of the hi-tech production which purpose is creation of a common information space of management of corporate resources of the hi-tech enterprise is submitted.

In fig. 1 are designated: ERP (Enterprise Resources Planning) – corporate information system of planning and resource management of the enterprise (ERP); production executive systems (MES — Manufacturing Execution Systems); SCADA system (Supervisory Control And Data Acquisition) - management of shop automation; PLC, PC, PID, PLM (Product Life-cycle Management) - modules of management of life cycle of a product; hardware-software levels of perception of data (Hardware).

The corporate information system (ERP) is a kernel of automation and informatization of process business management and represents a set of the interconnected modules of resource management of the enterprise integrated into a uniform technological platform. Introduction of ERP represents a necessary condition of realization of strategy of creation of the knowledge-intensive production. The set of the ERP technological platforms allows to create information infrastructure of the enterprise (fig. 1).

Information infrastructure of the enterprise (IT infrastructure) (infrastructure of information technologies and systems of the enterprise) – set of the information technologies providing joint access to information resources and devices in the enterprise. The main components of information infrastructure of the enterprise are: software, means of data storage, infocommunication technologies, computer networks [4].

Information infrastructure of the hi-tech enterprise - the interconnected set of processes of transformation of aprioristic economic information to corporate knowledge.

IV. KNOWLEDGE REPRESENTATION OF BUSINESS PROCESSES

Process management is based on parallel engineering of resources of the enterprise. Concepts of engineering and reengineering of resources of the knowledge-intensive enterprise are integral parts of modernization of the enterprises of high-tech industries of economy. The economy based on knowledge – cognitive economy – gives the chance the manager of various levels to use the accumulated corporate knowledge for increase of efficiency of activity of the enterprises [1].

Knowledge of architecture, functioning and environment of the enterprise in defined period is called as corporate knowledge of time. The data necessary for formation of corporate knowledge contain in information on difficult events. A difficult event – information on a state all business processes of the enterprise at a given time. Structurization of knowledge is a process of transformation of the formalized knowledge to data for processing for the purpose of acceleration of search and perception by the person of this knowledge when using computer technologies of storage and information processing. Now IT service often "needs" the data containing in the territorial distributed storages. It is already not enough to realize IT service as the WEB moved product. World information resources are required for it for feed. Grid technologies come to the rescue.

For realization of service-oriented approach (SOA) to the organization and use of corporate architecture of ERP (ensuring display of business strategy of corporation within architecture of SOA) for the purpose of rapid response to changes of activity of corporation when using IT services, i.e. finally ensuring management of efficiency of activity of corporation, it is necessary to provide realization within ERP the information technology focused on corporate knowledge

which consists, for example, in consecutive realization of the following stages:

- representation of the making corporate knowledge (CK) in the form of the operating content (the linked hierarchically ordered nominal sign) received, for example, with use of ontologic approach and interpreting components of corporate knowledge in a look

$$CK = CK_{int_BP} \& CK_{ext_BP} \& CK_{between_BP} \& CK_{cond} \& CK_{business_function} \& CK_{M_efficient} \quad \square, (1)$$

where - CK_{int_BP} - corporate knowledge of internal business-processes; CK_{ext_BP} - corporate knowledge of external business processes; $CK_{between_BP}$ - corporate knowledge of features of the organization of through business processes (changes of sequence of performance of functions, emergence new and elimination of old functions, reorganization of separate divisions); $CK_{business_function}$ - corporate knowledge of features of business functions (possible changes in document flow of corporation - the standard and earlier not used documents of the company, change the property man of structure of documents, change of a place of storage of documents; possible changes in responsible for performance of functions, changes of owners of business processes, changes of the course of performance of functions); CK_{cond} - corporate knowledge of change of models of conditions of realization of activity of corporation (a choice of other SOA architecture, other services, other bank, other virtual kernel, change of a configuration of communication networks, reorientation to other customer and the consumer, other made product, other production technology, etc.); $CK_{M_efficient}$ - corporate knowledge about traditionally used and to attraction of new metrics of management of efficiency of business (system of the balanced indicators, KPI, BSC, etc.);

- definition of corporate knowledge in the form of the statement (1) as vectors in set-theoretic information space of signs which coordinates are defined by concrete values of properties of the making corporate knowledge that will allow to apply OLAP-technology, technology of multidimensional cubes to intellectual processing;

- representation by the linked hierarchically ordered values of properties of the necessary structure of corporate knowledge used for ensuring quality according to TQM standards of activity of corporation;

- formation for these hierarchically ordered signs of set-theoretic multidimensional information space linked nominal which dimension is defined, proceeding from dimension of the generalized relational form formed thus;

- the description of an integrated indicator of efficiency of activity of corporation in the form of content of the operating information as a set of trains of key indicators

of efficiency of the interconnected business processes with definition of metric spaces of adoption of administrative decisions [1-4].

The architecture of the enterprise (Enterprise Architecture) unites corporate IT architecture of scale of the enterprise with business architecture and allows to provide achievement of strategic objectives of the enterprise.

V. COGNITIVE TECHNOLOGIES AS KNOWLEDGE TRANSMISSIONS

Cognitive technologies of information management of business processes of the digital enterprises are understood as the set of technologies of a data control and knowledge of business processes of the digital enterprises integrated into IT infrastructure of the digital enterprise. The IT infrastructure of the digital enterprise contains in the structure besides traditional tool, hardware-software, technical means (fig. 1), modern infocommunication means: grid-expansions, smart grid technological decisions, clouds, Big Data storages. Processes of "merging" of traditional IT infrastructures of the modern hi-tech enterprises with modern means of processing and data storage (Big Data) on the basis of use of service-oriented corporate information systems, (for example, HANA technologies), allows to organize processes of adoption of administrative decisions at qualitatively new level, to provide the demanded completeness, consistency, to overcome "information failure" between data on activity of the hi-tech enterprise and risks of environment.

In fig. 2 components of cognitive technologies of information management of business processes of the digital enterprises are presented

Information infrastructure of the modern hi-tech enterprise surely provides maintenance of processes of adoption of administrative decisions in which are included, besides automation levels according to fig. 1, modules of a control system of efficiency of the BPM enterprise (Business Performance Management), intellectual technologies of methods of adoption of administrative decisions at various levels of management of BI (Business Intelligent) are widely applied, there are modules management of corporate knowledge at various levels of management of KM (Knowledge Management), modules of systems of automatic design on the basis of CAD/CAE – technologies. All business processes support tools of modeling and the analysis of business processes: UML, EPC, SADT, DFD, ARIS ARENA, All Fusion [3 - 5]; DW (Data Waerhousing) with HANA technology of ERP SOA.

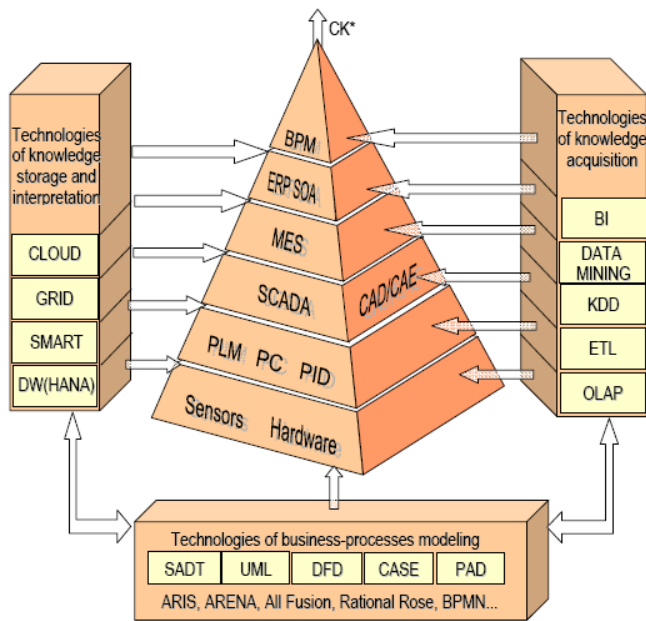


Fig 2. Cognitive technologies and knowledge transmissions

The concept of control systems of efficiency of activity of the enterprise (BPM) consists in use of set of the integrated cyclic management processes and the analysis, application of the appropriate technologies concerning both to financial and to operating activities of the enterprise; it is used for definition of strategic objectives, an assessment of efficiency of activity, to operate process of their achievement; includes financial and operational planning, consolidation of the reporting, modeling, the analysis and monitoring of key indicators of efficiency (KPI) [4]; CK^* - knowledge transmissions for strategic solution.

Such "assembly" of information long careful work of business analysts on identification of key indicators of efficiency of business processes and their interrelations of all levels of management – from operational to strategic precedes. Instruments of processing of difficult events (Complex Event Processing, CEP) - IT services - allow to operate the enterprise in real time. Business management in real time in the presence of service-oriented architecture (SOA) by corporate information system (ERP) allows to provide transition of the knowledge-intensive enterprise to a form of "digital".

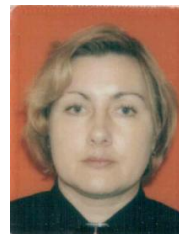
Existence of large volumes of information, work in the conditions of Big Data – one of signs of the tsiforvy enterprise. Application of cloudy technologies allows to operate and store for service-oriented structure of ERP data out of uniform storage, and "on clouds", configuring and reconfiguring administrative decisions.

Now for ensuring simultaneity of work in the conditions of Big Data and possibility of "intellectual management" of object so-called GRID-SMART, SMART, in article definition of cognitive technologies for the digital enterprise as mergings technologies of information technologies of management of knowledge of a difficult

event (content of the operating information) with information technologies of storage, registration, data presentation in the conditions of service-oriented area of ERP is given.

References

- [1.] Brusakova I. Formation of business solutions of cognitive economics/Proceedings of Int.Conf. SCM2015 Soft Computings and Measurements, Spb., SPbGETU LETI, 23-25 of May, 2015. –PP.251-255.
- [2.] Brusakova I. Instruments of Systems Analysis of efficiently of digital Enterprises/Proceedings of XIX Int. Conf. Systems Analysis in Desier and Management.. 1-3 July 2015 года, Part 2. – SPb.: Publ. of Polytechnical University. 2015. -PP.16-22.
- [3.] Brusakova I. Metrization of Business Solutions of Cognitive Economics. – Spb.: Publ. of Polytechnical University, 2010.
- [4.] Brusakova I., Fomin V.I., Kosuchina M.A., Panin S.N. Research of tendencies of development of information management in modern conditions - Spb. Publ. of Spb University of Economics and Management, 2014
- [5.] Process Management/ Bekker J.- M.: EKSMO, 2007.
- [6.] David Lukcham The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems. Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA ,2001.
- [7.] Krcmar H: Informationmanagement. Berlin: Springer-Verlag, 2010.



Authors Profile

I. Brusakova the professor degree in Information and Measurement Technologies from Saint-Petersburg State Electrotechnical University “LETI”, Saint-Petersburg, Russia. Her research interest includes knowledge management, measuring applications in economics, information management of ERP, BPM, Data Mining approaches.