IT Strategies in Digital Economy: Selected Problems, Polish Experiences

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ABSTRACT

The object of interest of economic information technology is in research and development of information IT used in supporting modern business processes. The article methodologically focuses on highlighting this object and, particularly, the determinants that have the greatest importance in deciding about the usefulness of information technology in supporting business processes. The dominating factor is organizing commonly known definitions and their meaning. The main focus is put on information strategy as well as problems and consequences of careless designing decisions connected with it. The article is a result of theoretical and practical works of the authors performed during information technology consultancy in major financial institutions.

THE ESSENCE OF ECONOMIC INFORMATION TECHNOLOGY: ECONOMIC INFORMATION TECHNOLOGY IN COMPARISON TO DIGITAL ECONOMY

Economic information technology is an area, in which advanced information technologies and IT technologies are practically used in supporting enterprises' economic decision processes.

In the beginning it was a result of using IT technologies in solving multilayer (hierarchical) decision problems. Finally, using IT technologies led to unstoppable enterprises' virtualization processes, forming, in this way, phenomena and concepts like: virtual enterprise, digital economy, e-economics, new economy. They are all basing on network information technologies, which consist of commonly known hardware architectures and software, like internet and its derivatives: intranet and extranet.

The objects of interest of economic information technology are, among others, areas (determinants) like:

- supporting decision processes in management and projecting,
- constructing systems and information technology applications for civil service, healthcare and medicine, education, defense, space researches,
- constructing systems and information technology applications for production enterprises (especially industrial), service oriented enterprises, financial institutions (especially banks, investment trusts and insurance companies),
- research and development in the scope of database transaction processing technology,
- creating advanced domain systems (ERP module systems with elastic CRM structure, SCM, electronic exchange),
- research and development in the scope of transactional data processing in data bases,
- research and development in the scope of analytical data processing in data warehouses,
- creating advanced artificial intelligence systems as an enlargement for analytical and transactional processing,
- research and development of knowledge bases systems and knowledge management,
- using teleinformation and mobile wireless systems in supporting business processes.

CONCEPTS AND SYMBOLISM OF ECONOMIC INFORMATION TECHNOLOGY

Economic information technology and the need to build informatization strategy, based on business strategies, in some economic and also scientific circles, hardly brakes the mist of indolence and ignorance. Some economists still claim that (…) *putting interest in machines (even if they are digital computers) cannot be the content of economic sciences* (…).[1]

Information technology has its own rules not only in the scope of theoretical and technological solutions, but also in business, taking the major place in stock exchange all over the world, together with car, aerial or even oil industry through forming self and usually extremely calculated IT service market. Growing economic demand for the use of information technology caused the fact that IT is seen as individual industrial branch – at the same time it is difficult to treat it as scientific discipline, although such statements were formulated by some specialists from the field of information technology and economics.

Economic information technology is – in the most cohesive form – the connection of information technology witch economic practical use. It focuses on development of information technology appliance mainly from the point of view of (…) *possibilities of using new data processing methods in solving economic problems* (…).[2]

The most important concept of economic information technology is the concept of information system understood in the following way: (...) *Information system can be determined as multilayer structure, which enables its users to transform specific input information with particular procedures and models. Specific decisions are made as a result of getting needed information* (…).[3]

In more formal way (…) *information system is a structure of successive elements related with each other: data, data carriers and data sources, procedures and data processing and protecting technologies, models and processes of decision processes realization as well as information system model as a standard that describes all aspects of information system's functioning* (…).[4]

Due to methodology (for simplification) it is assumed that in the scope of considered information system (e.g. covering the area of enterprise) information flows in, so called, information subsystems. Information subsystems cover enterprise's business departments. The way of organizing these subsystems decides about the efficiency of particular information processes, and about productivity of the whole system through it.

Information subsystems functioning reliability in economic, technical and social systems is determined by a number of factors specific for data processing process:

- availability, distribution and presentation of data,
- speed of data transforming,
- accuracy of data transforming,
- reliability of transforming structure.

Presentation and transformation of information are two qualities of utilitarian kind. Information presentation decides about internal and external communication of all system elements effectiveness (people, computers, machines). Information transformation is led by formal and quasi-formal procedures of data processing. Presently both can be supported by suitable computer programs (databases, worksheets, OLAP tools, expert systems).

Due to substantial reasons, this paper does make a significant distinction between information systems, IT systems and computer systems (Fig. 1).

ENTERPRISE'S INFORMATION AND INFORMATION TECHNOLOGY SYSTEM

Initial conditions of building information system, especially for an enterprise, is taking into consideration the following rules, introduced mainly form empiric reasons:

- building information and information technology system is usually an organizational venture in 90% and only in 10% an information technology venture,
- before undertaking design activities the whole scope of organizational entity functioning should be given into information data and data processing procedures verification and standardization (IT audit),5
- typical feature of building large information and IT systems, is their unique complexity and multithreading (costs, threats) which usually causes that – during implementing processes – the number of opponents of new system is significantly higher than the number of people interested in implementing the new system,
- building an information technology system should be preceded by a detailed unit development strategy; information technology system should be created for future tasks – not for automation of current operations.

Typical enterprise information system (or its organizational unit) should include elements like:

- unit organization regulations (organizational and competence structure),
- conceptual management processes model,
- procedures of management functions realization (in the scope of realized activities),
- information technology system model,
- methods of gathering, processing and transferring data,
- organizational unit database (or a replica of central database fragment),
- information technology system users profiles,
- information technology system supporting management functions.

Conceptual management processes model in organizational unit should join the following elements:

- determining environment model,
- determining organizational unit strategy,
- determining realization of organizational unit's management functions model,
- determining internal units' model and their functions,
- determining model of objects, processes and their relation with data structures,
- determining data processing model.

Enterprise's management functions information technology supporting system in an ideal form should:

- be oriented towards information system objects processes operating,
- create a structure of local contractor network with corporation's network,

Table 1. Information technology specification – intensification and significance of phenomena [4]
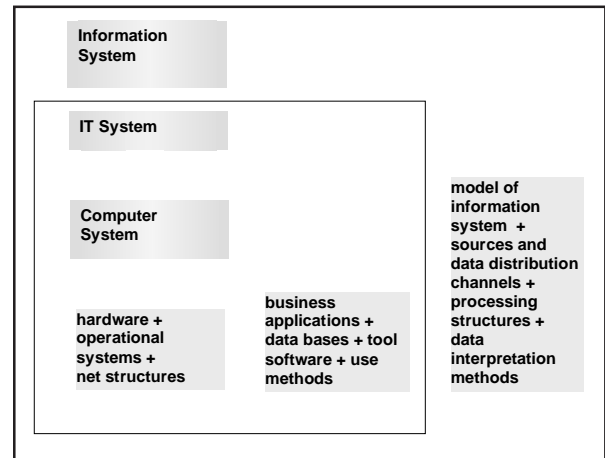
- use modern operational and hardware platform,
- be realized with the basis of professional software tools, used while projecting wide real-time application systems,
- secure, due to set standards, creating and using,
- allow to use only authorized software.

For example, information systems6 of financial institutions, like banks, insurance companies, retirement funds or investment trusts, seem to be similar to information technology systems serving production or service enterprises. In both cases we deal with similar phenomena – but their intensification and significance is different due to scale and value. The following table presents quality information technology systems and their intensification and significance in financial institutions as well as the remaining group of enterprises.

THREATS FOR INFORMATION PROCESSES IN ENTERPRISES' IT SYSTEMS

Enterprise fulfills its mission in two crossing structures (Fig. 2): in functional structure (task, process) and in organizational structure (territorial, hierarchical). This division highlights four contradiction groups:

- contradiction between diversity and information technology (decision) processes integration supported by information system,
- contradiction between dispersion and data integration in information technology system databases,
- contradiction between purchase need or information technology system modernization and the necessity of fulfilling present functions in information system,
- contradiction between safety and availability of information technology system resources.

Every information's feature is its uncertainty and its durability over time (credibility). That is why gathering and processing information directly in the source if its creation is an important aspect of information systems. This results in a possibility of constant correctness and topicality data verification. Economic or safety issues usually cause this rule not to be upheld.

The given contradictions cause that not all enterprises have current and effectively executed IT implementation strategy.7 Elaborating and maintaining IT strategy is an expensive venture and many high level managers are not properly content-related prepared and convinced to its purposefulness – due to this fact they do not work in order to develop this kind of strategies.

Table 1. Information technology specification – intensification and significance of phenomena [4]

Information technology process element	Financial institutions	Production and services enterprises
Information technology strategy	weak	weak
Information technology concept	significant	significant
Information technology process	significant	weak
System's design	significant	significant
Information technology process management	significant	weak
System implementation	significant	significant
Exploitation and development	weak	weak

Example of typical threat types for information processes:

- enterprise does not have and develop IT strategy,
- enterprise does not have a project of an information system that would integrate content-related company branches and their business activities,
- enterprise does not have and invest in a project of an integrated IT system,
- enterprise's IT staff are solving current problems – not general one, for example: conditions of exploitation existing IT infrastructure, preparing guidelines for IT system contractor, preparing new implementations, coordination of current IT projects,
- enterprise's IT staff do not have suitable support of their activities in content-related company branches.

INFORMATION SYSTEMS DESIGN PROBLEMS

Information system design should be preceded by a detailed morphological analysis of information structures, describing its functioning in categories of efficiency and rationality. This analysis should lead to the gaining of, so called, well structured project tasks, which can be solved only due to the use of suitable methods and techniques of system theory – particularly the AIDA morphological technique.[8]

Abstract system models, created on following levels of generalization, should integrate the set goals, forced limitations and expected solutions. The significant limitation that slows down the speed of system design is, in the first place, the lack of homogenous research strategy based on standard information interfaces system. For example structural and thematic diversity of databases created in the enterprise stops information flow homogeneity and, at the same time, has bad influence on creating and implementing more complex IT technologies, such as data warehouses, knowledge bases or analytical processing and expert systems.

The general problems of information systems design are:

- design of an information system is a complex activity, during which, in a certain reality named object area a new reality is developing – it is named an information system,
- in information system data processing and interpretation subsystems can be highlighted; both can have different or mutual organizational with technical layer (infrastructure) and different or mutual procedural with content-related layer,
- process of information system projecting leads to the full specification of data processing subsystem and the subsystem interpreting data to information,
- three canonical concepts differ in an information system: data[9], information[10] and knowledge,[11]
- information processing subsystem is responsible for data gathering, processing and storing processes on acceptable data carriers,
- data interpretation subsystem is responsible for conclusion and steering processes of the processed data on specific level of symbolic language information.

Computer programs (tools) play an essential role in projecting information systems, they support the system specification and construction

Figure 2. Information feedbacks and structures
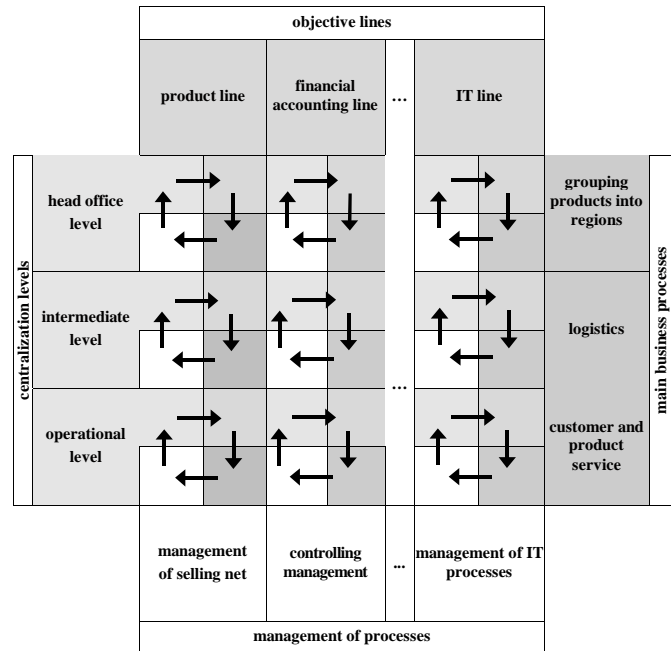
processes. This process is supposed to have assured adequate imaging of functional-structural relations typical for projected system. This relations should be imaged (mapped) in a way that would assure proper interpretation of the system's project by people and programs during their modification or expansion.

Elaborating an efficient content-related modeling method of an information system is a difficult task due to complexity of phenomena and universality of expectations.

BUSINESS STRATEGY IN RELATION TO IT IMPLEMENTATION STRATEGY

Strategy realization program is understood as „*specified assumptions consistent with strategy, carefully chosen resources, operations and processes and their realization times*". Program, as a complex organizational activity should be managed in full operation cycles, that is: planned, steered, realized, recorded and analyzed.

In case of large economic organisms like financial institutions, strategy and programs of its realization shape the practical mission and economic policy of these institutions. Financial institution's business strategy usually in the first place deals with capital or restructuring goals, reached through suitable organization and management of enterprise's structure.

Frequent example of business strategies realization programs in institutions like banks and insurance companies is developing service sales network (e.g. insurance or bank products), supported by suitable marketing operations and customer relations management activities. Named tasks are at present prepared – due to their complexity – in the form of business projects.[12] These projects, apart from significant financial expenses, require preparing suitable staff background and creating suitable IT infrastructure, necessary to support their realization. This is the reason of the necessity to formulate suitable IT implementation strategy, which would lead to creating IT infrastructure[13] that would support sales network and all supporting processes related to it.

The most commonly formulated reservations – during IT audit – to business strategies and IT strategy resulting from it:

- total lack of IT strategy or detailed programs and plans on IT implementation,
- lack of time coordination between business strategy restructuring programs and IT implementation programs,

- lack or delay in formulating demands for IT systems,
- content-related (IT) and business mistakes (warranty rules, payment rules) in specifying important order rules,
- lack of IT programs leading to elaborating and implementing infrastructures of middleware[14] type, integrating currently used information systems and promoting "utopist concept" of universal IT system[15] at the same time,
- low staff support at IT branch,
- lack of training in the scope of advanced information technologies and It projects management among IT staff.

IT STRATEGY COMPONENTS

IT strategy should be an expansion of enterprise's business strategy in the field of supporting its business programs and basic and supporting production or service processes. This point of view results in the fact that basic goal of IT strategy should be systematic and balanced hardware, software and information infrastructure development, - supporting business programs and processes, described in IT projects[16] and detailed IT strategy executing programs also known as IT programs.

IT strategy in its assumptions should unambiguously determine:

- goals that should be aimed in business and technology areas,
- indispensable resources and requirements that should be met for efficient realization strategy execution programs,
- threats, ways of counteraction and alternative solutions forecasted for protecting IT strategy execution realization conditions.

While creating IT strategy special attention should be paid to:

- differences between IT infrastructure (hardware and software) and information system (data sources, data processing procedures, organizational regulations, decision processes models),
- differences between IT and information system (databases, software tools, applications, safety and data protection procedures),
- systematical identification of informational needs inside the institution as well as in its environment,
- elaborating information system[17] model and IT system[18] model that would match it,
- necessity of following and analyzing plans and development activities of the competition as well as gathering information about information systems and technologies.

The most frequent necessary action is the diametric change of the approach towards IT implementation program. The need is caused by, on the one hand, rapid technological progress in telecommunication and computer technology, and, on the other, the change of social communication form. New tele-informational media (e.g. direct communication between cell phone and personal computer, business application and database server), trigger the creation of new product and services distribution channels and networks.

IT strategy must at the same time answer one basic question „*which functions of IT system do we realize in our own infrastructure, and which should be postponed to contractors*". Properly designed IT outsourcing[19] is an activity that can lead to significant savings. Mistakes in not enough estimated outsourcing can lead to *"colonial addiction"* effect in the scope of technology and information from the IT systems suppliers, and can end up as a serious weakening of strategic position in the area basic business activity.

Creating new or modernizing existing IT system should be preceded by detailed definition of IT concept and strategy, and next – as one of the first execution programs – a model of information system should be built, which would be a basis for the assumptions of the final IT system.

IT actions are a part of high risk activities group that is why estimating their profitability should be preceded by SWOT analysis. Benchmarking can be used in creating IT activities' business plans, if we have suitable material to compare. In evaluating IT actions it is wise to invest large funds in information system modeling, because every mistake and ambiguity found at this stage costs from 10 to 100 times less than mistakes found in the implementation process.

IT IMPLEMENTATION CONCEPT

IT implementation concept is the first and most important product of IT strategy. Assumptions written in IT concept are an exit point for design an IT system.

IT concept must include the following:

- existing and forecasted legal, organizational and staff limitations,
- presently used informational and procedural solutions as well as changes designed in this range,
- technological solutions used in current IT infrastructure and their conformity with market standards.

In the process on creating IT concept it is necessary to consider integration and eventual gradual change of existing modules of IT system with the use of middleware environment.

IT implementation concept must be based on well established, advanced information technology. If not, building an information system model and than transforming its components into functioning IT system will be a time consuming and unverifiable activity.

The assumptions of crating an IT concept should include:

- suitably position IT personnel in organizational structure, with distinguishing operating tasks from development tasks,
- demand maintaining unified applications and software tools on limited hardware and software platforms that come from a small numbers of trusted suppliers,
- assure the development of data protecting and archiving subsystems,
- anticipate the fastest creation of infrastructure that would integrate middleware-information flow, which would become a modernization ad development structure of IT system.

Technological progress and economic demands together lead to IT systems integration in a technological way (mutual IT infrastructure with central management) and to its dispersion in functional way (authorized interactive access from any place with the use of different terminals).

PRACTICAL OBSERVATIONS

Designing modern IT systems, due to changing market conditions, must have the ability for quick procedural changes (procedural flexibility resulting from the need to realize new customer handling and served products) algorithms – what leads to object technologies revision as preserving relations between data and data processing procedures in objective model. Distance between theoretical software models (e.g. in evolutionary or neurotically programming) and practice of realizing IT systems will probably not change or even expand.

IT designs are a part of complex activities, which need 2-3 years for realization and require expanses of hundreds of millions zlotys. The formal end of IT project is the moment of passing IT system to operation. Actual moment can last for many months or even years before the system will reach its operating maturity.

In the practice of IT implementation in major enterprises management of not single projects is visible, but whole steams of projects, what gives significant limitations to IT program and totality management process.

Important issues of IT strategy that relate directly to IT program and IT projects management in major industrial organizations are:

- inevitability of succeeding changes in business environment as well as IT technologies and, as a result, a necessity to introduce new IT system even in situation when the former systems is still functioning without problems,

- necessity of stopping development activities of "everlasting" local projects (applications) in order to free the staff potential from implementing activities or to elaborate new systems' specification,
- change of pilot implementing policy to growth implementing or vice versa – depending on current IT plans,
- widening the abilities of implementing new IT products in business processes modeling and information needs of managerial staff connected with it.

ENDNOTES

1   Scheer A-W. - Introduction to economic informatics. Basis for effective information management. Warsaw University Publishing, 1996, p. 7.

2   ibidem p. 8.

3   Kisielnicki J., Sroka H. - Business information systems. Informatics for management. Placet Publishing, Warsaw 2005, p. 19.

4   Krupa T. – Management of Information in Insurance Companies. Chapter 12. in Foundations of Insurance, vol. III – Insurance Company (edited by J. Monkiewicz). Poltext Publishing, Warsaw 2003.

5   IT audit, is an activity, which leads to performing objective benchmarking, measurement of information and information technology system in all of its aspects important for evaluation of the systems usefulness in reaching goals set in business strategy; the scope of an audit as well as researches accuracy scale should be adjusted to assumed needs and requirements.

6   Information system is a part of economic unit's informational system. It consists of computer hardware and software (computers and network hardware, operational system, network management system, applications and instructions for applications)

7   IT implementation strategy specifies vital goals, resources and financial, informational, program and hardware limitations, which should be defined and secured in order to ensure the business strategy's viability; From the moment of its adoption, the IT implementation strategy has a time perspective, in which it should work.; obviously, works on improving this strategy should be conducted systematically.

8   Krupa T. – Morphology of information structures - AIDA technique in design tasks. In Multicriterial Decision Aided Systems (edited by T. Kasprzak). Warsaw University Publishing, Warsaw, 1992.

9   Data – character or sequence of characters organized according to fixed rules, which are used for building data and controlling its correctness. Pieces of data are stored on physical data carriers for as long as they are processed.

10   Information – the result of data processing, using algebraic and logic calculations and interpretations, that can be stored as data.

11   Knowledge – data and rules of data processing that enable obtaining and storing information in data structures.

12   Project is a functional, economic, organizational and technical description of the undertaking. Its implementation leads to obtaining effects included in this plan.

13   IT infrastructure is the communication and computer hardware, operation software and utilization management system.

14   Middleware class infrastructure is a hardware and software infrastructure that is used to integrate existing modules of IT system; also, middleware is used for present IT architecture reengineering (securing data migration in particular).

15   Universal IT system – conception of an information system, popularized in some IT users environments, which aims at projecting and introducing a total IT system that would meet any information needs and take over present systems' functions (integrating them at the same time)

16   IT project is a description of an IT undertaking, which leads to modernization of existing IT system or to an introduction of a new one.

17   Information system model – describes elements of an information system and relations between them. Information system model sets all the standards and aspects of information system's functioning.

18   IT system model - describes elements of an IT system and relations between them. IT system model sets all the standards and aspects of computer system, hardware, software and instructions for applications functioning.

19   Information Outsourcing – actions that, as a part of an agreement, lead to transferring an IT system service to another user to a certain extent.

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