Concept of Methodological Approach to the Info Systems Design

Jacinta GRBAVAC [1]
Mario PLENKOVIĆ [1]
Vitomir GRBAVAC [2(✉)]

Summary

This paper deals with the approach to integral information systems (IIS) from the view of: concept, strategy and info-methodology. Business-motivation aspect is important in establishing the informatization strategy and IIS design determining the areas and expected effects of informatization. From the info-technology view, the above mentioned factors should provide more efficient support to management as well as modernization of Croatia's economy. Business operations are the main ground in defining strategy of the economy informatization both in the world and at home. This paper analyses a concept as a basis defining the essence of development strategy of info-methodology suitable for the transitional period of our economy development. The paper also introduces new components of the system integrity based on the integrity analysis, both vertically and horizontally, contributing to a new concept of strategic and information methodological (CSIM) approach, making it more efficient under given conditions than the others, which are applied today in traditional info-methodological approach in our transitionally determined economy. After the analysis, the next step determines the model of current business activity, which from the view of the concept, is naturally joined to the CSIM approach. Based on the CSIM approach, the paper deals with info-function correlation applying comparative analysis with regard to the relation between data and information resources. Finally, the paper puts forward new possibilities created by introducing the classification in making prototypes of the CSIM approach implementation.

Key words

info systems, design, informatization, CSIM

[1] Croatian Communication Association, Zagreb, Croatia
[2] University of Zagreb, Faculty of Agriculture, Svetošimunska 25, 10000 Zagreb, Croatia
✉ e-mail: grbavac@agr.hr

Received: February 2, 2007 | Accepted: January 4, 2008

Introduction

Starting from the axiom that informatization is a strategic element of the economy development in Croatia, it is necessary to study thoroughly and analyse the methods generating it. Regarding good standing resources potential and orientation to the domestic and international market, all relevant info-achievements and knowledge must be available to Croatia's modern economy in order to provide its long-term development through wise business strategy. In this context, business management of our firms must be based on information-communication technology to achieve the goals efficiently.

However, informatization of typical management structure in Croatia's economy will enable development of overall business activities, achieving much better results within the existing resources and identifying objective directions and goals of further development. Since the informatization means relevant info-system design which significantly describes transactions in the economy and its available resources, market and external effects, showing real situation with regard to making proper decisions to achieve the defined goals, a conclusion can be made that the goals of the management structures in Croatia's economy can be seen through optimal exploitation of domestic resources, identification of drawbacks and through use of domestic and foreign capital available in the fashion which enables optimal growth and development.

Business reasons for informatizaton strategy formulation

Introduction of the market mechanisms and private property to Croatia's economy has created new business opportunities which can be successfully taken only if it's based on modern business management applying current info-technology. As the most powerful, most efficient and the cheapest instrument in modern business management, powerful world economies have applied modern info-achievements and relevant knowledge through building relevant integral info-systems as integrated units joining the following systems: data and information processing and communication systems.

Areas and effects of informatization

In the forthcoming period, our economy must be a sort of a business subject offering good quality products and market programs for which the info-resources implementation will provide better conditions to do business through the following: manufacturing programs management in domestic segment of highly comparative advantage, domestic and international market processing, capital market and financial arrangements, resources management (particularly reserves), profit maximising along with financial reliability in business, optimisation of substructure and management structures to reduce the business costs and increase efficiency and modernisation of the technical support system in integrated economy.

Within this context, the economy informatization should be seen as a necessary stage of the development aimed at transformation of our economy into the modern 21st century economy.

Info-technology for management and modernisation of the economy

New info-technology enables simple and easy management of very big and complex economies, shortening the distance and time to location of the communication centre.

Since our economy is being transformed, we have to accept such info-systems to enable the management to get the entire insight into the business and bring fast decision based on the estimate of the effects of particular alternative, so the informatization in economy is a necessary stage to be carried out during the process of modernisation. Also, info-resources to be applied in info-system design and development in economy are getting more powerful and cheaper including following: computers of all sizes networking through the concept of future National Communication System with similar environment in the country and abroad; communication resources and standards within the economy integration in one de-centralised, physically distributed but logically integrated, homogeneous information entity with optimal management of the capacities available and application tools with new info-methodologies for info-system design. Starting from the mentioned info-resources, it is possible to build segmented systems through a number of smaller applications under condition of hierarchically managed operations with comparatively fast achieved additional effects but also systematic design of de-centralised but homogeneous info-system in economy.

Business activities in defining informatization strategy

The management of a firm could be expected to base and define its managing activities through the managing information. Such defined information resources require internal and external information sources and the information processing system to be established along with parallel development of the data and communication processing system.

Therefore, info processing is expected to be conceived as a prototype approach including following: to catalogue

information for business management in order to establish the system providing external information while internal information will be collected by data processing along with possible reorganisation of applications; to set up the business documents flow and provide insight in business information in accordance with the person's authorisation; wireless computers with the built-in communication equipment will ensure information and data transmission from dislocated and mobile sub-systems, i.e. future mobile info-systems; establishment of the communication centres is to be expected, especially in complex economy segments, and modification of the existing education system aimed at getting better quality education in info-domain. Accordingly, the conclusion can be made that by accepting informatization, our economy in this transitional period will have the opportunity to take more complex manufacturing projects and systematically integrate its own potential as well as the potential from the environment within the set-up goals to be achieved. In this way, most segments of the economy can enter entirely new forms of info-integrations on a very flexible basis and achieve new values, much higher than the profit itself or the basic value of the economy capital because Croatia will, in this manner, get powerful and financially reliable economy capable of achieving the goals in more and more complex market competition. This will bring numerous improvements in manufacturing and business process. The result is in scientific analysis that brought about a concept with the basic characteristics which must be included in the methodology aimed at efficient resolving of strategic info-problems in current transitional conditions. Starting from scientifically based theses, the following sections of this paper structure an integral and as a concept improved methodical approach called the concept of strategic information methodological (CSIM) approach.

Concept of strategic and information methodology approach (CSIM)

Ideal situation for a firm is to have one united data basis. It offers various advantages - there is no surplus data storage, no transmission among different systems, there is a possibility to combine the data coming from different functional areas and search them easily.

Unfortunately, this ideal situation is not possible to achieve for the following reasons:

Design and implementation of the united data basis system should be as enormous as the „big bang" (all at once). United databases can be so complex that it could take too much time to design and construct them. Big data bases are hard to maintain because their complexity makes the system hard to understand, and there are technological obstacles to create very big and complex databases, e.g. the size of the main matrix, disc capacity, DMBS limits and the processing time. To understand the basic definition of the task ahead us, it is necessary to specify basic scientific-professional rules defining the concept of strategic and information methodology (CSIM) approach. Application of the CSIM approach should resolve the first three problems. However, technological obstacles are still there and should be taken into account when studying the implementation areas of such systems.

Traditional approach to the system design, implied separation of organisational information processing into simple units called „application systems" such as e.g. received bills, paid bills, inventory check, etc. Such application systems have three basic characteristics, each of them imposing major limitations to the overall system: artificial limits, data surplus, and limited integration of the system. CSIM must support a concept of one, completely integrated information system (IIS), not a number of different partial application systems semantically interfaced below the standard.

Imagine that you were a wholesale distributor performing a number of activities including: purchasing goods from a merchant, storing the goods in a warehouse, paying the merchant, selling the goods to a consumer, taking out the goods from the warehouse, packing and forwarding, consumer's payment, buying another product from a merchant. Traditionally, this process implies three separate partial applications. Yet, logically, this is one circular process. There are data (details on a product) registered from the beginning to the end and information (following of the product) needed from the very beginning to the end. In terms of the data processing those are „three applications". In terms of business it is „a single system."

This example shows that an ordinary data is used all the way. However, if the process is divided into three different partial applications, we will maintain three separate groups of the same data. Beside the obvious loss of time and means to maintain the duplicated bases, the main problem that arises is the questionable integrity of the databases. If the same data is stored in many databases, probability for the databases to remain synchronised is little. In this manner, data processing provides many different answers to the same question. It results in bringing business decisions based on unchecked information.

By separating one business system into three separate applications, it becomes hard or even impossible to create any level of the systematic integrity. Regardless of the fashion in which it is separated, a firm's data processing must achieve integrity of some degree. In the past, it might be necessary only once a year when making annual data balance, but today's business demands urge for permanent (daily) integrity. Integral system can be connected with one integral solution if all individual applications are in-

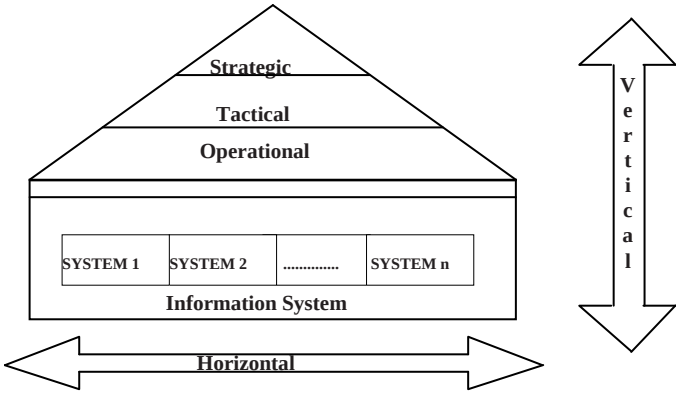

Figure 1. CSIM approach-based info-integrity

terconnected. CSIM approach must allow integral information systems design by removing the limits that caused the need to make separate applications. CSIM-based information systems can be maintained like one or more data bases each of them treated as a part of the integrated whole. Key to the success is that the data are input and stored once and then shared by all that have the access to them regardless of location. CSIM ensures automatic maintenance of the data integrity. We suggest the CSIM approach be set up at two levels, see Fig. 1.

Vertical integrity ensures that the integrated information system meets the demands of a firm at all levels: operational, tactical and strategic. At the operational level, the data precisely show business activity on daily basis. At tactical level, information helps in guiding and managing of the daily activity. At the strategic level, information helps in strategic decision making for a firm as a whole.

Horizontal integrity ensures that a single information system provides support to the organisational information structure. Data can be stored at one location and called back when needed. Characteristics and attributes of the data can be also stored at one of the locations and called back by the software-generated processes while designing any part of the information system. That is the reason why integral system should be designed and based on the principle of classic data basis. Ideal system should be found within real limits such as current technology limits of software for handling the data basis system, of hardware and capacity and quality of the data transmission that can make the set ideal unreal. For example, if the data number exceeds maximum size of the data basis of a particular machine, or if business demands integral solution or, most often, when the data basis with which newly designed system will steadily and integrally function already exists. The latter is applied when moving the existing application to a complete new project solution.

Model of current business activity

CSIM must be conceived to allow designers and users to focus on the system integrity reflecting the current business situation. Development of applications in conventional languages lasted so long that the users' future demands should be foreseen while designing.

By the time of their use, these foreseen demands could become current demands, unless the management of information system development wrongly estimated the demands. CSIM-based info-system development must keep pace with volatile business activities offering a chance for a fast response to changes as they are coming up and not to foresee what might happen in future. Change should be evolution not revolution!

Traditional life cycle of the data system development tries for the first time to create a perfect data model. The reason: if the data model is good, all that should be done to influence the changes is to modify the program referring to that data model. Change of the data model itself has always been risky and often impossible to make. Due to the risk in changing of the data model, the management of the info-system development often put conditions to what the user is allowed to do with his data. If the changes were expected, the management of the info-system development would try to guess the future. All this often became a methodology itself instead of exercise in informatization of organisation.

CSIM must be in the function of physical data model automation that is built in as a design of the data basis connecting it with the processing check built in as a program or logical design. This is the key to the CSIM creative process.

Correlation within info-function with regard to the data-information relation

CSIM design philosophy promotes a concept of storing the raw data not the information.

The data can be regarded as „raw data" or „input" which forms the information system bases. The details refer to the facts collected during the business activities and represent correlation with business infrastructure support. The detail about a data is the smallest, simple denominator and cannot be excluded from any other part of a detail about the fact. The detail about the data has just a minor meaning in itself. However, the data is of „universal use" because it can be processed in many different manners to produce information for various purposes. Information can be regarded as „final product" or „output" of the integral information system while the data is processed to be useful in decision making process.

Data	Information
Birthday	Age = Current year minus the year of birth
	Voting population = All the people who have birthday on the same day or the previous day – 18

Traditional methodological approaches tend to store information versus data, e.g. by adding up to the main database and storing of transaction data basis which supplemented it.

The results are great limits caused by this approach regarding fast response and flexibility of the system. To understand this, have a look at the steps of the data processing with traditional methodological approach: At time of input: input raw data into the system, validate the data, process data into information, and store the information. At time of output: waiting for the need for information, and output the required information.

Basic course of this sequence is that the data is processed at the very moment of its input and the output information is being prepared. It means that the decision is to be made at the time of the data input regardless of the need for information that should appear in future. Unfortunately, there could be some time between the data input and the need for information. During that time, business opportunities are changed as well as the demand for information. When the system is full of predetermined information, it is hard to respond to new demands.

Change, which we propose by CSIM-based integral information system design, has the following basic steps: At time of input: input raw data into the system, validate the data, and store the data in the system. At time of output: waiting for the need to get the information, processing of data into information, output the requested information. The difference between traditional order and this one is that CSIM system does not need to store the data which are not processed into information as long as it is not needed, as illustrated in Fig. 2.

Advantages of CSIM approach are as follows: data, not information storage means storing the raw material; the only part of information processing which has „universal usefulness", data is processed into information when needed and known what information is required, current business activities are built in such a way as they are today, storing only the known facts while the system is defined in a way that designers are focused on the data to be stored, not on the information that will or will not be needed in future. CSIM approach to information systems puts stress on storage of data not the information. This approach recognises reality, i.e. data is relatively stable. If data is stored, information can be obtained when and if needed.

Such approach offers strong possibilities of adaptability, speed and easy use.

An example of flexibility is information on marketing. If monthly and annual figures are stored what happens when marketing demands figures including the past six weeks, or when you are asked to apply promotional scheme based on figures referring to the past two weeks. If information is stored, raw material was probably destroyed so the demands cannot be met. Again, this is initial position that stands for ideal. The ideal may have to be a compromise because of technical reasons. For example, in a bank, balance might be stored taking into account the time of response, not to waste the time to make balance on each demand.

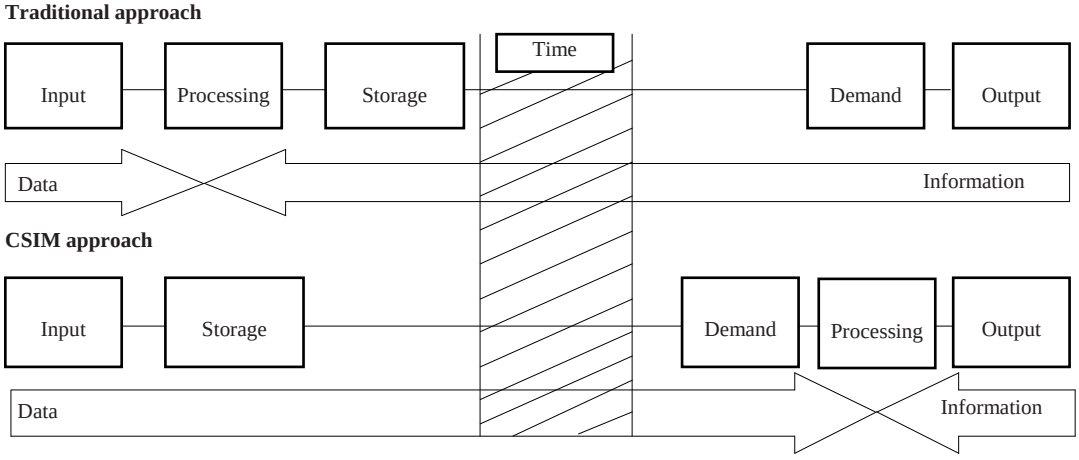

Figure 2. Different concepts (from the time component view) of data processing of the CSIM data resources in relation to traditional approach

Prototype in function of the CSIM implementation

The prototype has the following values: it is hard to make everything function perfectly at the first try, the more complex the system is, the more difficult is to achieve

perfect functioning; it is often easier to correct or improve than to remake things out of waste, especially if correct project basis is in its place; understanding is a gradual process and it is often the easiest to learn on a concrete example by approaching concrete info-systems; info-systems are always good until they are used, and the users cannot take their view unless they have the experience working with concrete info-system. Prototype design has numerous advantages offering the chances of fastened development of the system demanded by users which operates the way they want it.

Therefore, CSIM determines the use of the following three classes of prototypes: illustration, technical and evolutionary.
Illustration prototype - to demonstrate the main function aimed at confirming the way it functions with minimum logic. This prototype should be designed as soon as possible in the project. Illustration prototypes can be rejected being the lost effort after the prototype is finished but more often, they become evolutionary part of the development used as a basis of further development.

Technical prototype - for testing specific technical functions of the system to be designed. Examples of technical prototypes include communication and support of non-standard equipment. A designer specialist should make these prototypes because they often include a section of more complex algorithm than usual. Technical prototypes can also evolve into the final design of the system.

Evolutionary prototype must allow the users to develop information system, until it is functionally accomplished. Although called „prototype systems", they are virtually operational information systems which simply become „more complete" as the time is passing. All the CSIM-based systems should be developed in this fashion since it is one of the basic characteristics we want to inaugurate by the CSIM approach.

Special challenge is in the prototype structuring process because uncontrolled prototype can end in endless developing circle with no way out for the developing team. CSIM approach check would be achieved by the following: defining the aims, limiting the time scale, limiting the size, and measuring the results.
CSIM approach would make the structure prototypes development easier which are controlled and can be developed into manufacturing integrated information system.

CSIM should be applied in designing the approach to the overall solution with the aim to give efficient transformation means between business problems and business information solutions.

CSIM approach is aimed at reducing the need for widespread language and technical experts by enabling designers to focus on understanding and solving organisational and information problems, not to end in complicated and mysterious understanding of business solution technique. CSIM approach stresses understanding of the problem, not understanding the implementation of the problem from the view of the user's concrete software tools.

Conclusion

The paper determines the basic business motives in formulating the informatization strategy that initially must be recognisable and acceptable to the decision-making factors conducting strategic development of Croatia's economy. The next step is defining the area and effects of informatization taking into account up-to-date achievements regarding info-methodology for management and modernisation of economy in general. Defined in this way, conditions in the environment impose the need to structure business activities in defining informatization strategy. The first part of the paper analyses the situation determining it from the view of clear structuring of guidelines and characteristics needed to obtain new concept of strategic and information methodological (CSIM) approach to info-system design. CSIM approach must incorporate new information forms, vertical and horizontal aspect of integration such as conceived and elaborated in the analysis. Starting from the model of current business activity, the paper explores correlation within info-function from the view of the data-information relation, analysing the need to revise the time determination of information based on traditional approach in relation to the proposed design principle introduced by CSIM approach. Introduction of classification within the prototype concept, including illustration, technological and evolutionary determination is methodologically new concept dealt with in this paper. Aim of this paper is also to ensure, by introducing new CSIM approach in info-system design in Croatia's economy that the changes in info-sphere brought about by transition transformation which we are going through, are of evolutionary not revolutionary character.

References

Andrzej Lasota, Michael C. MacKey (1994). Chaos, Fractals, and Noise: Stochastic Aspects of Dynamics

Antoliš K. et al (1998). Modular philosophy of expert system implementation, Informatologija, Zagreb.

Antoliš K. et al (1998). Transitional dynamics implication in methodology of integral information system design, Informatologija, Zagreb.

Antoliš K. et al (1998). Development of infosystems and artificial intelligence in a traffic medicine, 6th international scientific consolidation "Traffic techniques and logistics", Opatija.

Antoliš K. et al (1997). Modular philosophy of building an expert systems and implementation, Informatologija 29/30, pp. 89-97

Antoliš K. et al (1997). Methodology of planning and managing development of the expert systems, Business system management - UPS '97. Mostar.

Arthur M. Langer (1997). The Art of Analysis.8. Coad, P. Yourdon E. (1990). Object-oriented analysis, Prentice Hall, Englewood Cliffs, N.J.

David R. C. Hill (1996). Object-Oriented Analysis and Simulation Modelling.

Edward Yourdon, Carl A. Argila (1996). Case Studies in Object-Oriented Analysis and Design (Yourdon Press Computing Series).

Grbavac, V. (1991). Information system analysis and implementation, školska knjiga, Zagreb.

Grbavac V. et al (1998). The concept of info function model in complex organisational system, Informatologija, 29/30, pp. 115-125.

Grbavac V. et al (1996). Expert systems in a traffic development function, IESP '96. Ljubljana.

Hugh Beyer, Karen Holtzblatt (1997). Contextual Design: A Customer-Centered Approach to Systems Designs.

Jeffrey A. Hoffer, et al (1996). Modern Systems Analysis and Design.

Martin Fowler / Analysis Patterns (1996). Reusable Object Models (Addison-Wesley Object Technology: Addison-Wesley Object Technology Series).

Martin, J. (1990). Information engineering Book I Introduction, Prentice Hall, College Technical and Reference Division Englewood Chliffs.

Martin, J. (1990). Information engineering Book III Design and Construction, Prentice Hall, College Technical and Reference Division Englewood Chliffs.

Merle, P., Martin, J. (1991). Analysis and Design of Business Information systems, Maxwell Macmillan International Publishing Group, Singapore.

Methods Jeffrey L. Whitten, et al (1997). Systems Analysis and Design.

P. Coad, E. Yourdon (1991). Object Oriented Design (Yourdon Press Computing Series).

Richard A. Layton (1998). Principles of Analytical System Dynamics (Mechanical Engineering Series).

Robert B. Angus, et al (1997). Planning, Performing, and Controlling Projects: Principles and Applications.

Ronald J. Norman (1996). Object-Oriented Systems Analysis and Design (Prentice Hall Series in Information Management).

Yourdon, E. (1989). Modern Structured Analysis, Yourdon Press/ Prentice Hall, N.J.

---

acs73_10