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Framework for Strategic Planning of Information Systems

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Abstract

The usage of modern information technologies will be succesful only if information system development is aligned with business system development strategy. This way we can maximize support to business proceses. Such approach is usually regarded as strategic planning of information system (SPIS). There is no unified methodology which could be applied while performing SPIS. We have several methods, techniques and templates that should be inventivly integrated to develop optimal approach to IS development for each particular business system. This paper presents how this integration could be performed to obtain consistent methodology. Such methodology has been applied to six large scale projects in very different business systems. This way theoretical approach was confirmed and extended by new experiences presented in this article.

Keywords: Strategic planning, information systems, development methodology

Present State of SPIS Methodologies

Strategic planning of information systems has become very challenging subject for scientists and practitioners in recent years. Researches conducted by Berndt and Morrison (Berndt and Morrison 1990) show that investment in information technologies (IT) gives much lower ROI than initially expected. Therefore, information system (IS) planning and appliance of modern IT can not be exclusively performed by IT experts but becomes fundamental problem of enterprise management.

In early nineties Earl (Earl 1989, Earl 1993) determined certain rules in IS/IT planning and presented them as five phased evolution model. Different authors (Daniels 1994, Griffiths 1994, Peppard 1993) explained problems related to useful usage of IT and IS planning in enterprises. Therefore it might be concluded that till 1995th the problem of efficient IT usage was recognized, and published papers presented techniques, methods and directions which might be used during process of IS planning. However we didn't have consistent methodology for strategic planning of information systems.

Another approach to boost up overall efficiency of business systems appears in second half of nineties with famous Hammer's book (Hammer and Champy 1994) that introduced Business Process Reengineering (BPR). Soon after, another authors (Ward and Griffiths 1996) emphasized relationship between business strategic planning and information system development. At the same time several methods and techniques were published (Robson 1997, Ward 1996, Willcocks 1997) to enhance successful IS/IT planning in enterprises that have strategic vision of their development (Johnson 1993, Mintzberg 1991). These methods might be grouped in three groups. *First group* presents methods that were dedicated to specific problems related to IS planning such as BSP, Ends-Means analysis, CSF analysis. *Second group* of methods was already used in business planning and they were just modified for SPIS (e.g. 5F method, SWOT, BCG analysis). *Third group* of methods was based on BPR (e.g. Value Chain).

The problem of poor IT/IS efficiency was also recognized in our country. Therefore, in 1996 our faculty launched international scientific project "Strategic Planning of Information Systems Development", which was supported by the national Ministry of Science and Technology. During work on this project we conducted research which results might be briefly presented as:

- Genetic IS definition was established and used for development of new taxonomy (Brumec 1996). This way relationship between business system and corresponding IS might be explained, what leads to better understanding of SPIS.

- Empirical research was carried about current state of IS/IT planning procedure. Research was performed through questionnaires presented to 196 members of top-level management in 23 companies.
- New SPIS methodology was developed and theoretically elaborated (Brumec 1998, Brumec 1998a, Brumec 1998b).
- Six large-scale projects were conducted in order to evaluate performance of new methodology. Experiences from these projects were used to extend and improve methodology.
- Several seminars concerning SPIS methodology were presented and new subject in Ph.D. study was introduced on our faculty.

For successful implementation of new SPIS methodology exact definition of strategic planning of information system should be adopted. Based on theoretical elaboration presented in our previously mentioned works we used following definition:

Strategic planning of information system (SPIS) is long term planning of useful effects of information system and appliance of information technologies aligned with strategic planning of overall business system development. The result of this procedure should be documented project that contains:

- Organization model of existing and reengineered organization,
- Business process model
- Business data model
- Technical resources model,
- Development activity plan for new IS.

According to this definition, a new SPIS methodology was developed and theoretically elaborated. At the same time, methodology was practically implemented in various enterprises with remarkable results. A brief description of the SPIS methodology, and general characteristic of projects in which it was applied, are presented in the following sections.

SPIS Methodology Framework

A great number of methods and techniques used in planning and designing information systems are discussed theoretically and applied practically. It is important for a designer, in the process of designing a particular IS, to fully recognize the goals, characteristics and principles of business system functioning. Information system strategic planning and designing needs for proper methodology. Choosing, grouping and linking proper methods and techniques has developed in this methodology, as it is shown in the **Table I**.

The proposed SPIS methodology consists of specially chosen and specifically interrelated methods and techniques that are gradually applied to perform individual steps while modeling the entire information system. The basic SPIS methodology propositions are:

- The reason for every aspect of business reengineering is to improve system performances,
- IS development should realize the planned goals,
- The level of goal realization should be measurable.

It is impossible in this paper to discuss all the SPIS methodology steps in detail, even the parts are discussed in published papers (Brumec 1998, Brumec 1998a, Brumec 1998b). Here we want to point out only the major characteristics of SPIS methodology:

- The starting point of SPIS methodology is an analysis of the present business system and a definition of its future mission and main goals;
- The second methodology step examines the function areas where new IT could express the best contribution to the efficiency of business processes;
- Step 9 (central in relation to all the steps) presents an evaluation of the effects of the new IS on future business processes. This evaluation should be performed using the simulation model (developed from the IS conceptual model) <u>before</u> starting the long-term and complex project of maintaining the IS.
- The 16th step controls and confirms the effects of investment in the new IS/IT.

Table 1. SPIS Methodology As Connections Between Problem Solving Steps and Used Methods

Problem/step in IS design	Methods and techniques
	§ -strategic,
	  # -structured,
	    ¤ -object oriented
		Inputs and deliverables
		Inputs/Outputs
			Usability
			Very powerful
			Powerful,
			Useful

1.Description of Business System (BS)	Interviewing	*Missions and goals of current BS* / Business strategy; Business processes (BP)	

2.Evaluation of the Impact of New IT on Business System	§ Balanced Scorecard
	§ BCG-matrix
	§ 5F-model
	
	§ Value-chain model
		BP/Performances of existing BS
		Business strategy/IS development priorities
		Business strategy /Information for top-management
		BP/Basic (primary and support) business processes (BBP)
			V
			    P
			        U
			
			V

3.Redefinition of Business Processes	# BSP-decomposition # Life cycle analysis for the resources	*BBP*/New organizational units (OU) *Basic system resources*/Business processes portfolio	P P
4.Business System Reengineering	§ BPR § SWOT	*Business Processes Portfolio*/New business processes (NBP) *Business Processes Portfolio*/ SWOT analysis for NBP	P V

5.Estimation of Critical Information	§ CFS analysis (Rockart)
	  # Ends-Means analysis
		NBP/Critical information for NBP
		NBP/Information for efficiency and effectivity improvement
			P
			    U

6.Optimization of New IS Architecture	# Matrix processes-entities # Affinity analysis, Genetic algorithms	NBP/*Business process relationships* *Business processes relationships*/Clusters; Subsystems of new IS	V P

7.Modeling of New "Business Technology" (BT)	# Work flow diagram (WFD)
	# Organizational flow diagram (OFD)
	# Activity flow diagram (AFD)
		NBP/Responsibility for NBP
		
		New OU/Flows between new OU
		
		NBP/Activities for NBP
			V
			
			    P
			
			        U

8.Modeling of New Business Processes, Supported by IT	# Data flow diagram (DFD) # Action diagram (AD)	*NBP*/NBP supported by IT (IS processes); Data flows; Business Data *IS processes*/Internal logic of IS processes	V P
9. Evaluation of New IS Effects	# Simulation modeling	*IS processes*/Guidelines for BP improvements	U

10. Business Data Modeling	# ERA-model
	  ¤ Object-model
		Business Data/ERA model
		Business data/Objects model
			V
			    P

11. Software Design	# HIPO- diagram
	
	  ¤ Transition diagram
		IS processes/Logical design of program procedures (SW)
		Data flows/Events and transactions
			V
			
			    P

12. Detail Design of Programs and Procedures	# Action diagram ¤ Object scenario	*Logical design of program procedures (SW)*/Model of program logic *Object model; Events and Transactions*/Objects behavior	P P
13. Data Model Development	# Relational model; Normalization	*ERA model*/Relational model	V
14. Software Development	#CASE tools and 4GL ¤ OO-CASE tools	*Model of program logic; Relational model*/Programs and procedures *Object behavior*/OO-procedures	P P
15. Implementation of New IS	Case-study; Business games	*Programs and procedures*/Performances of new IS	P
16. Evaluation of New BS Performances	# Balanced scorecard	*Performances of existing BS; Performances of new IS*/Measure for success	V

During the second step, *Evaluation of the impact of new IT on BS*, system performances and an evaluation of the IT influence on the improvement of business processes are derived, together with the information needed for the top-management in order to realize of business goals. These issues are the basis for the redefinition of business processes supported by modern IT.

The 9th step (*Evaluation of new IS effects)* presents measurement of the satisfaction of the effects of the proposed IS conceptual model and generates the guidelines for the improvement of business processes. If the new IT increases the effectivity of the business system sufficiently, then the project of choosing or developing the new IS could start.

The first item of *Implementation of new IS* stage (step 16, *Implementation of new IS*) deals with the implementation of a specially developed new IS or chosen standard software package of a known SW producer. So, the previous stage *Detail design of IS* could be performed or avoided by choosing a proper standard software package during its implementation, as explained e.g. for ERP in (Holland 1999). The validation of new IS effects will resolve the dilemma: if we did, or did not, perform the proper action to reach necessary improvements.

The second item of the last stage (step 16, *Evaluation of new BS performances*) deals with the measuring of the performances of the new business system and assess the effects of IS/IT investments. The performances of the new business system are measured after the implementation of the new IS/IT and compared to the business system performances that existed before investments in BPR and implementation of new IS/IT.

SPIS Methodology Meta-Model

The activities described in **Table 1** form four characteristic stages, which are:

- Formalization of business model,
- Conceptual Design of IS Model,
- Detail Design of IS and
- Implementation of new IS.

Picture 1describe the content of these stages (their activities, inputs, deliverables and interrelationships, performing sequence) and represents the so-called SPIS Meta-Model.

The stage *Formalization of business model* deals with the redefinition and reengineering of the business processes based on a new business strategy and modern IT solutions, and are essential steps in strategically IS/IS planing. To support the redefined **business system** (as a main stage issue) with the new IS (as a main task at this stage) it is necessary to develop a **conceptual model,** which will be done in the following stage – *Conceptual design of IS.* This stage is critical for the further planning of the IS and will offer proper support in providing business processes in both cases: organization's own IS development or in the case of buying it as a standard program package. The quality of the conceptual model of the new IS depends on the quality of performing activities in the earlier stage.

The new **IS software** is a result of *Detail design of IS*. The activities in this stage could be avoided if the previously decision about how to achieve the proper software favors buying rather than the independent development. For both alternatives, the earlier modeled business system and conceptual IS model are the basis for measuring software performances. Appropriate performances of **new IS** could be reached in the *Implementation of new IS* stage, only if its functions were specified in an earlier modeled and redefined business system and in its IS conceptual model.

The critical points of the above process, i.e. those to which computer experts usually pay too little attention or disregard completely, are steps 2, 3, 6 and 9. Additional difficulties arise from the fact that entities and concepts in different methods are not the same. For example, a business technology matrix works with data classes, DFDs with data flows and storage, an ERA-model works with objects and relations, a relational model with relational schemes and keys, and an object scheme works with classes. These constructs are interrelated, but their characteristics and meanings are different. It is, therefore, impossible to formalize the transfer from one concept to another. An IS designer should have the necessary knowledge, experience and inventiveness. It is precisely for this reason that we still do not have a complex CASE tool that fully covers the strategic planning of IS. We believe that our proposed SPIS methodology could be the frame for the development of such functions of ICASE.
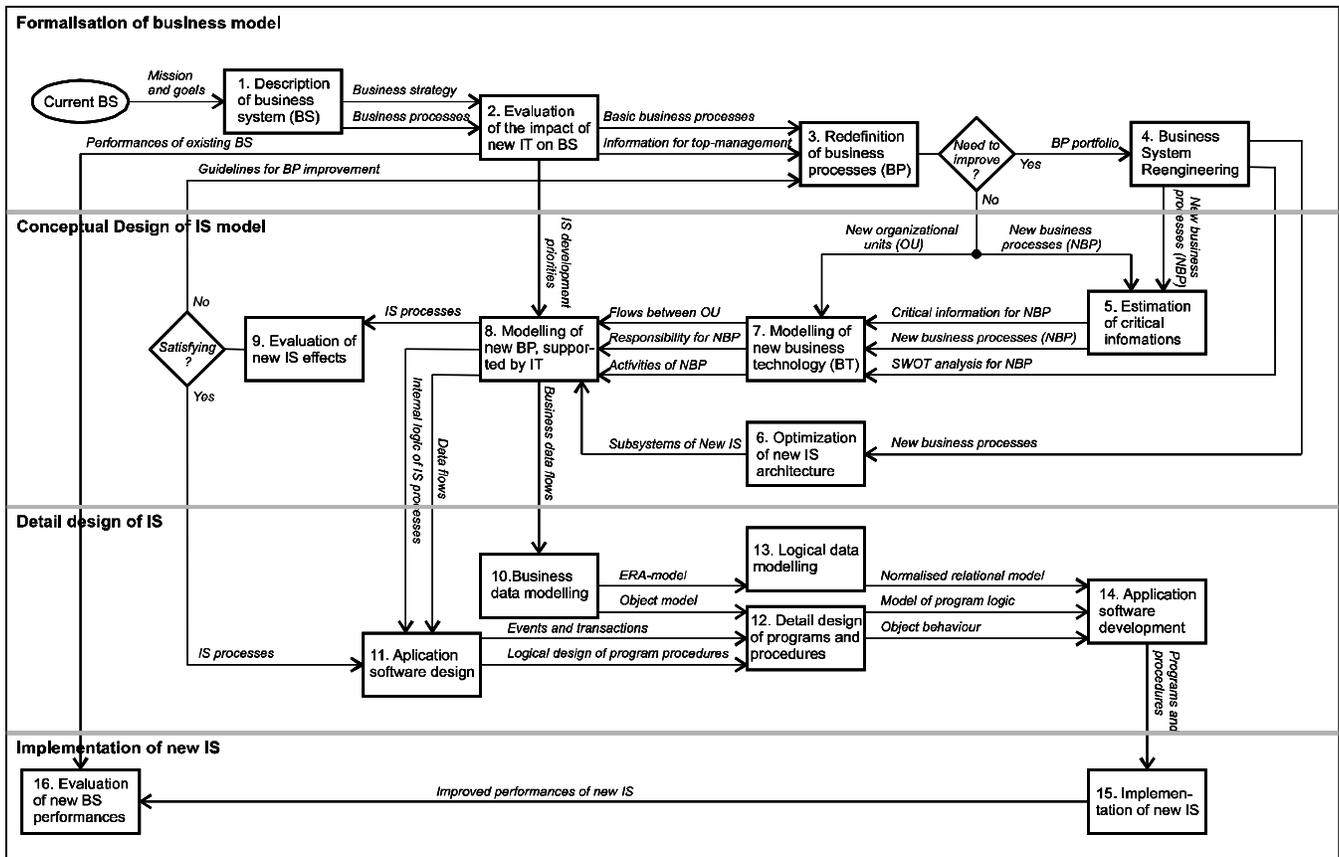
Picture 1. SPIS Methodology Meta-Model

Case Studies

The methodology presented in this paper has been confirmed in different projects conducted by the authors. We deliberately applied described methods and techniques to significantly different business and manufacturing systems to determine how alignment between new information system and reengineered organization can be maximized, and which methods are most effective with respect to the type of organization. Here we present short description of six most important projects:

1. Medium sized chemical and pharmaceutical industry, which presents classical example of process type continuous production of standard products. The management of this company wanted to use information technology in order to optimize supply chain management.

2. Very big glass factory, which is subsidiary of large transnational glass company. This is very specific industry that might be regarded as process type continuous production of standard products. However, close insight into production reveals that production is combination of continuous and discrete type of manufacturing. This discontinuity in production makes it very complicated to follow with information system. The management of this company wanted to use new information system to optimize and monitor production costs and support controlling functions.

3. Big international food industry, which is also continuous production of standard products. The aim of this company was to streamline production by introducing ERP system.

4. National unemployment office is governmental nonprofit institution that offers services to unemployed persons. Therefore value chain analysis does not apply here because it does not work to maximize profit margin but to satisfy various stakeholders (government, unemployed persons, companies, public opinion, etc.). The aim of this office was to use modern information technologies (Internet) to get closer to the public and to offer fast and accurate services. Secondary aim was to

reduce amount of administrative work, which occupied personnel and blocked their advisory work, which gave them negative image.

5. County administration is also governmental and nonprofit institution that is influenced by several stakeholders. They also wanted to reduce amount of administrative work in order to achieve faster response to different public requests.

6. National Railway Company, which entered heavy and long-lasting process of business transformation, from government owned nonprofit organization towards modern private and profits oriented transportation services company. Their management wanted to use information technology to make this transition easier and more effective.

Despite the fact that there are great differences among presented systems, the results of our methodology leads to conclusion that successful information system should be tightly aligned with business system and its strategy. This can not be achieved without fundamental rethinking of all business processes, their streamlining and changing in order to reach strategy goals. The best results are achieved with clear sheet approach in which we have to determine adequate use of information technology without balance of so called legacy information systems. Those systems are not oriented towards future reengineered organization, and in most cases present obstacle to project success.

Summary

The usage of modern information technologies will be successful only if information system development is aligned with business system development strategy. In order to succeed in IS/IT implementation, the companies have to change the perception they have of IT as a way by which old processes might be automated. The real approach is to perform strategic planning of the information system and to streamline the usage of IT with the business strategy. The whole business system must be analyzed and reengineered to synchronize the information system and business processes. To achieve such a highly targeted performance, significant efforts must be introduced. The challenge is even greater if a company introduces standard application software, since its ability to change is limited.

A great number of methods and techniques used in planning and designing information systems are discussed theoretically and applied practically. However, they do not constitute consistent methodology. Our contribution in resolving this problem is presented as "Framework for SPIS Methodology". Proposed SPIS methodology consists of specially chosen and specifically interrelated methods and techniques that are gradually applied to perform individual steps while modeling the entire information system. Presented methodology has been confirmed in projects conducted by the authors in different business systems. Our final conclusion could be expressed by paraphrasing famous Churchill's sentence: "*Strategic IS development in dynamic economic environment is too serious issue to be leaven solely to the IS experts*". Top management can not avoid their responsibility in process of information system planning. We try to help them by placing framework for our methodology at their disposal.

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