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v Českých Budějovicích
University of South Bohemia
in České Budějovice

Information Systems Strategy and Management

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1 INTRODUCTION

An **enterprise information system** (**EIS**) is any kind of information system which improves the functions of enterprise business processes by integration. This means typically offering high quality of service, dealing with large volumes of data and capable of supporting some large and possibly complex organization or enterprise. An EIS must be able to be used by all parts and all levels of an enterprise (Wikipedia 2019).

Enterprise information systems provide a technology platform that enables organizations to integrate and coordinate their business processes on a robust foundation. An EIS is currently used in conjunction with customer relationship management and supply chain management to automate business processes. An enterprise information system provides a single system that is central to the organization that ensures information can be shared across all functional levels and management hierarchies (Wikipedia 2019).

An EIS can be used to increase business productivity and reduce service cycles, product development cycles and marketing life cycles. It may be used to amalgamate existing applications. Other outcomes include higher operational efficiency and cost savings (Wikipedia 2019).

For the structure and learning background of subject "Information Systems Strategy and Management" were used taken over derivated chapters of the book Voříšek, kol. (2015). Principles and models of business economy management, Prague, VŠE, supplemented by other sources.

2 BUSINESS INFORMATICS – CONCEPTS AND COMPONENTS, DEVELOPMENT STAGES, AND VARIANTS OF BUSINESS INFORMATICS SOLUTIONS

Business Informatics is a system incorporating an information system, information processes, and rules that are related to the development and operation of a business information system. The rules specify the competencies, authorities, and responsibilities associated with the planning, development, and operation of the business IS.

The mission of business informatics rests in supporting business, i.e. the business IT helps the business to achieve its planned goals, reduce costs, and eliminate risks.

The ICT Department Manager (Chief Information Officer, CIO) is the main role responsible for the business IT. However, due to the large influence of IT on the business activities, it is also advisable that other members of the company's management are involved in the business informatics management, especially with regard to setting the basic rules for the use of information technology in the business (see IT Governance in Chapter 6).

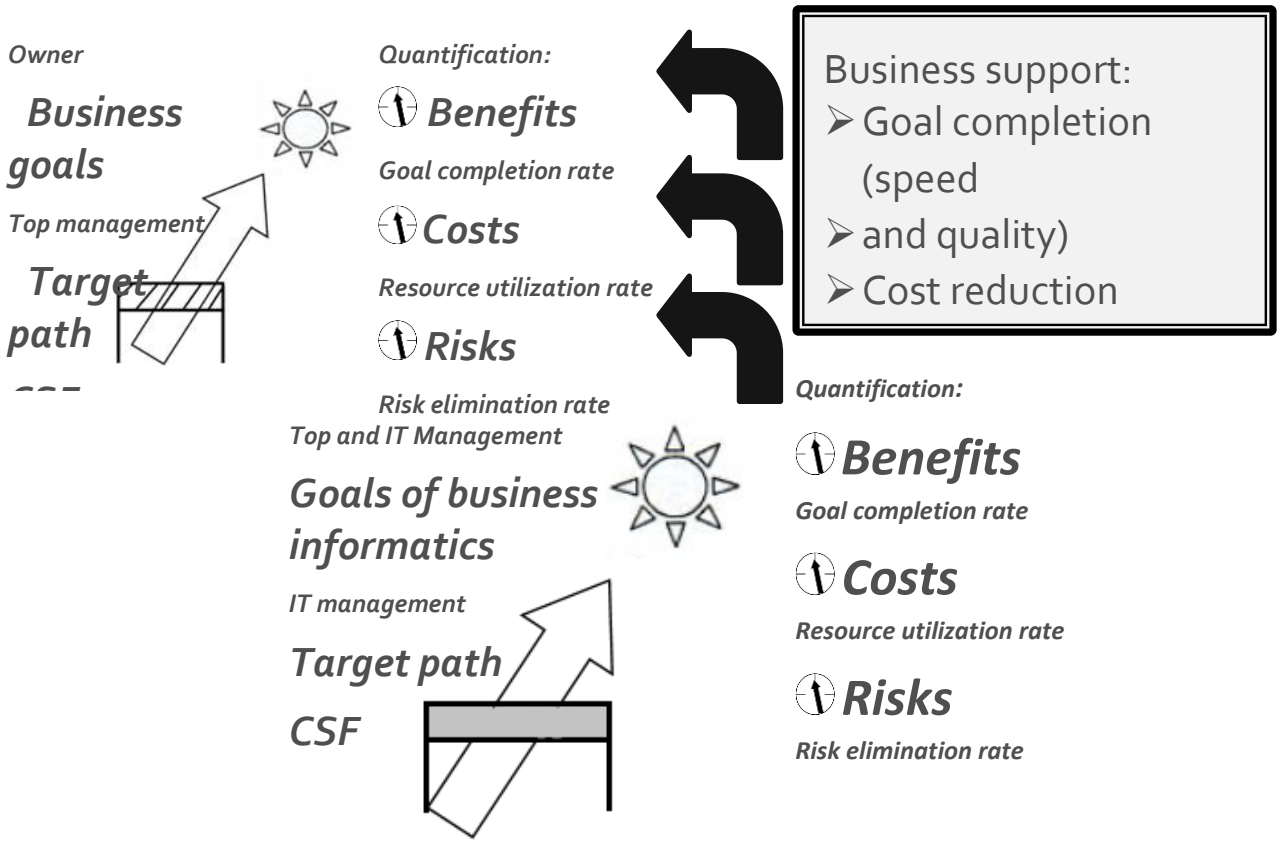


Figure 2-1 Business informatics mission - (Voříšek k. , 2015)

In order for business informatics to fulfil its mission, it has to get closely acquainted with the business goals and the strategy, and based on it, define the goals and benefits that the business will achieve by achieving ICT goals – see Figure 2-1. An example of this derived business informatics goal is: "By introducing a new CRM system and continually analysing customer needs, we will help increase the customer service quality and reduce the percentage of them switching to the competitor by 20%."

In addition, business informatics must identify the path that will lead to the goals set, calculate the cost of the path, and identify risks (Critical Success Factors, CSF) that are associated with the path. It, for example, "We will implement the CRM system by purchasing a CRM-type software application license from a specialized supplier and installing and running it on our technology infrastructure. The CRM installation and deployment project will take three months, and its budget will be two million crowns. The project critical success factors consist of the successful CRM integration with our existing ERP system and the high-quality training of all the CRM users."

Integration of business informatics with the business takes place at several levels - at the level of integration of information and business strategies, at the level of integration of the IT model with the business model, at the level of integration of business and IT goals, and at the level of integration of business and IT projects – see Figure 2-2. We will

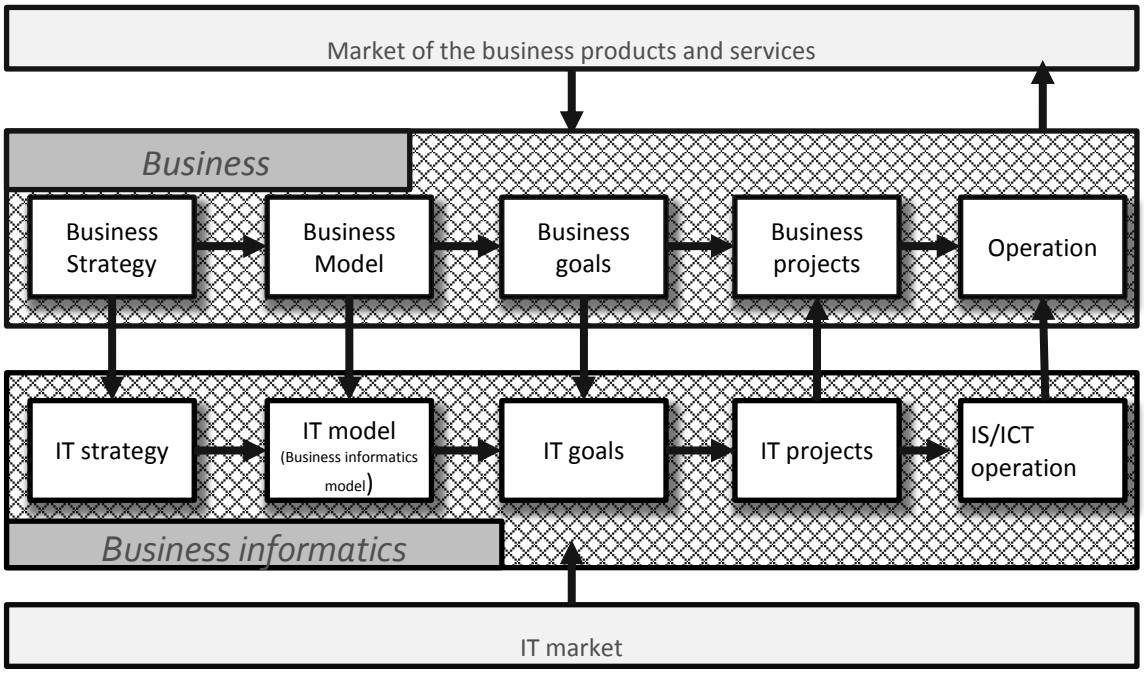


Figure 2-2 Relationship between the key areas and business and IT management tools - (Voříšek k. , 2015)

discuss these issues in more detail in chapters 6 and 10.

2.1 Business Informatics Resources

Business informatics use, consume, or value a variety of internal (in-house) and external resources. The basic business informatics resources are broken down into four categories:

- People,
- Data,
- Application software,
- Technological infrastructure for developing and running applications and for storing and transferring data.

In addition, business informatics uses other business resources (e.g. buildings, energy, finances, etc.), resources available on the ICT market (hardware and software products, information resources, and ICT services), resources of the market segment, in which the organization operates (e.g. de jure and de-facto standards), and public resources (e.g. education, law, etc.) – see Figure 2-3.

A specific combination of business informatics resources creates a unique environment that brings unique business informatics management demands. In essence, all the resources can be outsourced (displaced, moved) to an external entity, which then gives the resource to the business as a service. ICT management must make a very important decision as to which resources will be internal and which will be external; in other words, to what extent the business will use the

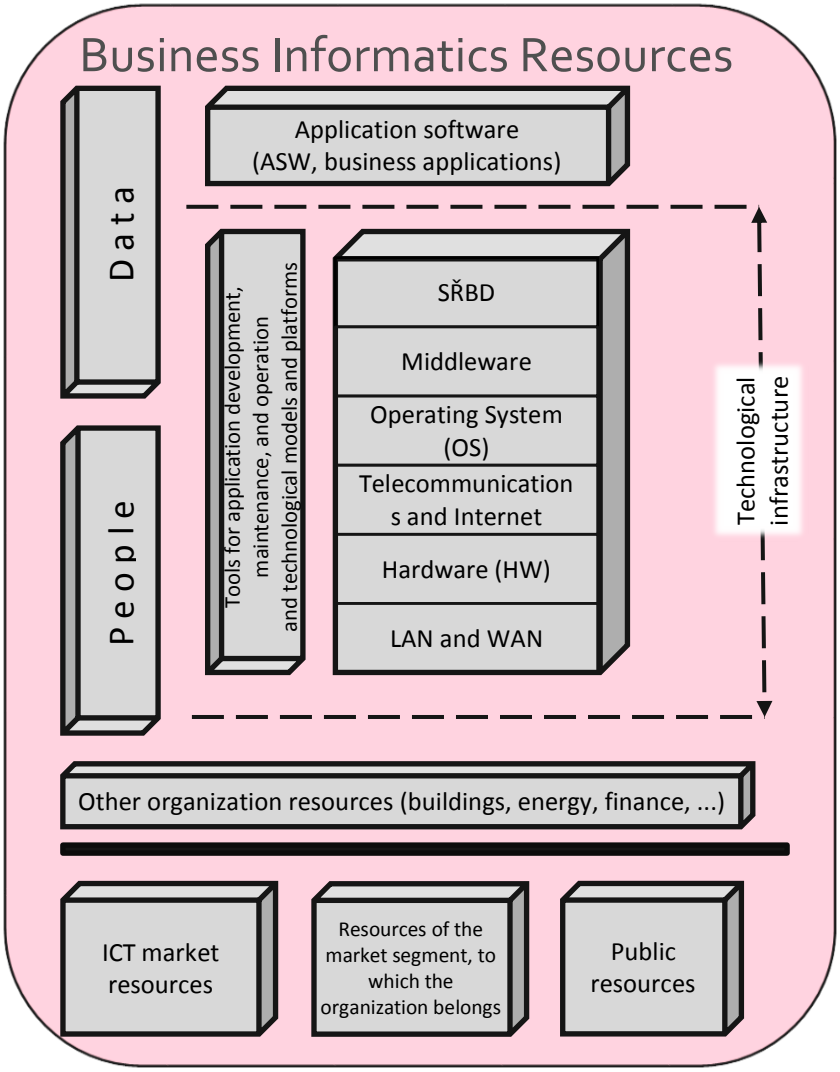


Figure 2-3 Business informatics resources - (Voříšek k. , 2015)

outsourcing of ICT resources - for details, see Chapter 0 and Chapter 12.

2.1.1 Technology Infrastructure and Human Resources

An essential part of ICT resources is the technology infrastructure, on which the business application software runs. The required ICT infrastructure characteristics rest in its ability to respond flexibly, quickly, and efficiently to changes in business and application software requirement (Byrd & Turner, 2000). The level of the technology infrastructure characteristics is unique for each business and is given by a combination of technological and human resources - see Figure 2-4.

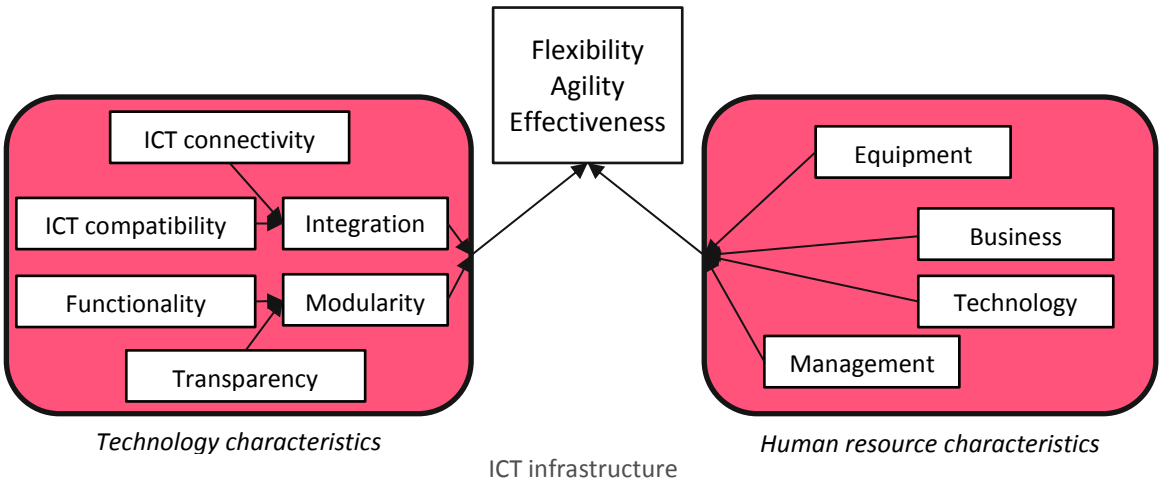


Figure 2-4 Technology infrastructure characteristics - (Voříšek k. , 2015)

For technological sources, these are:

- the ability to be integrated into a larger unit. Integration can be expressed as:
  - The ability of the technology to be interconnected with other technology, whether inside or outside of the organization, and
  - The level of compatibility (mutual compatibility and tolerance) of the integrated components
- The level of modularity of technologies, i.e. the degree of eligibility to change and extend without negative impacts on the whole. Modularity can be characterized with:
  - The functionality that the technology component offers, and
  - The extent, to which the component is transparent to other components.

In the case of Human Resources, this concerns a level of knowledge, experience, and skills in various areas, i.e.:

- Knowledge on technologies, i.e. ICT workers must be able to manage, for example, operating systems, computer networks, databases, and to program in a specific environment, etc.,
- Knowledge of where and how to deploy ICT technologies to effectively support business goals,
- Set of knowledge and experience also includes the business knowledge, ability to understand the business problem, and art of finding a suitable technical solution for it,
- Knowledge and skills in management, such as planning, organization, leadership, etc., including the ability to work in a collaborative environment.

2.2 Development Stages and Variants of Business Informatics Solutions

In general, when we understand the context of historical development, we are better able to understand the present, and we can better predict the future development of the area. The aim of the chapter is to analyse the history of the informatics solutions development in businesses, clarify the basic variants of the business informatics system development and operation, and define the circumstances that significantly influence the solution of business informatics in a specific business.

The chapter addresses the following questions:

- How did the ICT-business relationship develop over the past fifty years, which applications contributed in each

stage to increasing the business performance, which ICT professions proposed and operated the business information system, and what issues did they address?
- What are the ICT service supply models and their advantages and disadvantages?
- What are the circumstances that have a significant impact on the choice of the components, from which the business IS will be built, and which circumstances affect the business informatics management system itself?

2.3 Development of the ICT - Business Relationship and Development of the Business IS Solution

Utilization of ICT in the business practice has developed for approximately fifty years. In the course of this development, computers and their applications have penetrated deeper and deeper and in the increasing extent into the business activities and business processes, with the objective of increasing the performance of the business as a whole, increasing the efficiency of business processes and their activities, and improving the quality of outputs (products and services). The individual development stages brought new business effects, but also new problems in management of business informatics.

2.3.1 Supply Chain Support and Support of Communication with Partners

In the last stage, which started after the turn of the millennium, the ICT utilization has crossed the boundaries of individual businesses. New applications, such as EDI (Electronic Data Interchange), CRM (Customer Relationship Management), and SCM (Supply Chain Management), focused on promoting mutual collaboration and communication between businesses in supply chains, businesses with their customers, and businesses with state administration (social security and health insurance, taxes, duties, etc.) - see Figure 2-5.

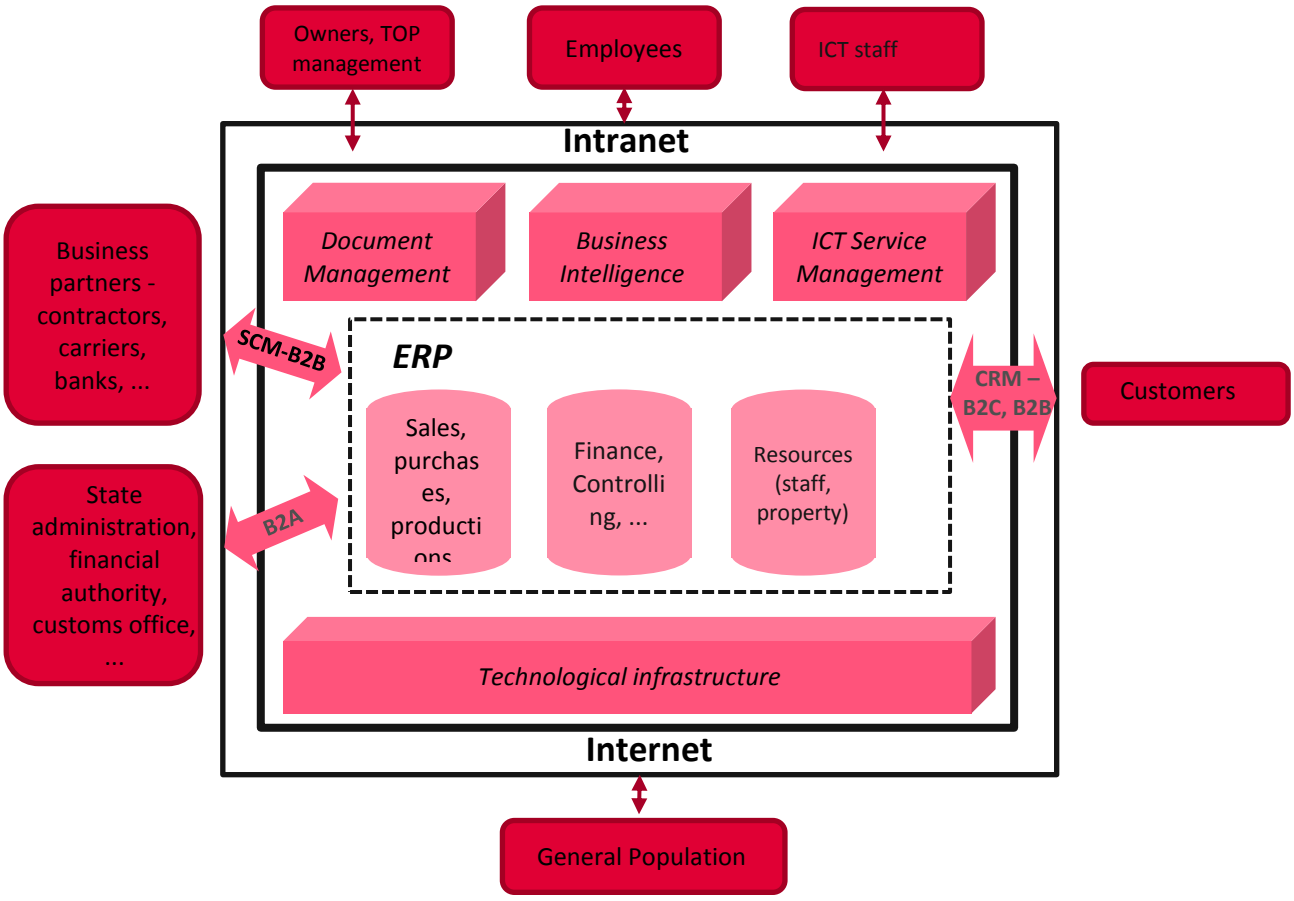


Figure 2-5 Typical structure of the current business IS - (Voříšek k. , 2015)

At this stage, numerous additional non-trivial problems were encountered, especially:

- How to enable interconnection and mutual communication of different information systems of various entities,
- How to simultaneously ensure high security and reliability of interconnected systems,
- How business applications support adequate quality and timeliness of mutual supplies.

The aforementioned development has led to the situation that the number of applications and the extent of the technological infrastructure, on which the applications were operated in the businesses, had increased sharply.

Logically, the number of specialists who were in charge of the development and operation of the business IS (the communications network administrator, web administrator, service centre staff, etc.) grew as well. While the first stage did not consider the IS management at all, in the third and especially in the fourth stage, this issue with its significance surpasses the original basic and most important activities - analysis, design, and programming.

Currently, livelihood of many organizations is dependent on the information system - for example, banks, insurance companies, or telecommunication companies. If the livelihood of a business is dependent on its IS, then IS management cannot be random and uncontrolled. Therefore, the need for a high-quality business IS system has increased with the individual development stages. The management system had to enable an efficient solution of the problems described above, and it had to ensure the reliable IS operation so as to ensure the required quality of information services and the continuity of business processes. Various methodologies, norms, and standards have been continuously developed as a methodical support for building an IS management system - see, for example, CobiT, ITIL, ISO20000, etc. These will be discussed in chapters 8 and 9.

2.4 Development of ICT Service Supply Models

Together with how the number and complexity of computer applications grew during the development, businesses were simultaneously looking for the most appropriate model for supplying ICT services to users, i.e. they were looking for the optimum way to solve the problem of *"who and how shall ensure application development and who and how should ensure application operation, or more precisely, operation of the entire business information system"*. To better understand the

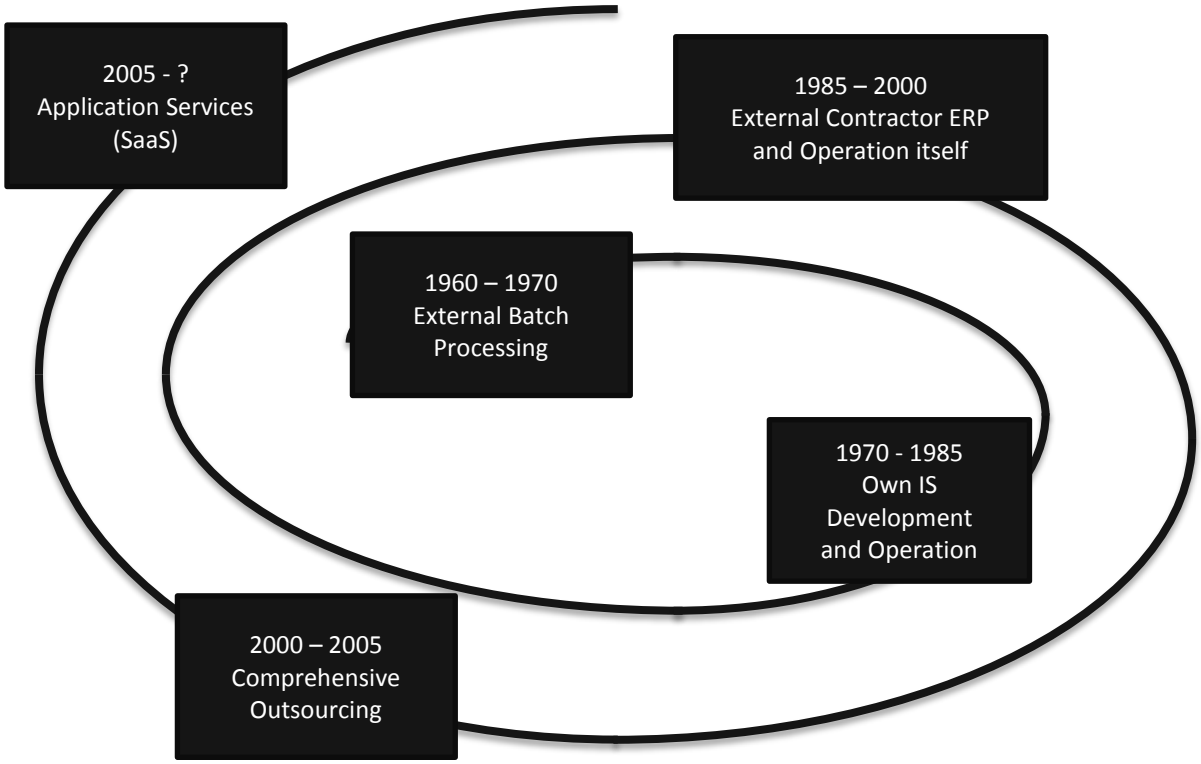


Figure 2-6 Development of ICT service supply models - (Voříšek k. , 2015)

present, we briefly look at the history of ICT again. Half a century of the development of ICT delivery models has its own internal logic. If we understand it, we can quite well estimate any further developments in this area. The development of the ICT service delivery models can be captured by a spiral in which the later models resemble some of the past

models; however, they feature substantially higher quality levels, which have enabled much greater technologies - see Figure 2-6.

2.4.1 ICT Service Supply Models - Summary

The development of the ICT services supply model represents a long way of the business on its way towards greater business informatics effectiveness. The goals of the businesses were similar at all times (close links between the IS and business, IS flexibility towards changing requirements, high quality and reliability of ICT services, and acceptable costs); however, the solution forms differ. This mainly results from these factors:

- Current technology options - for example, the SaaS model was not possible at the time when there was no Internet and high-speed communications networks,
- Current state of the ICT market - the traditional model was not possible at the time when the ERP systems did not exist; the SaaS could not have been used until there was a supply of specialized application service providers,
- Up-to-date knowledge of the IS management methods - even if the external batch processing model already referenced ICT services and their management, ICT services were only fully developed from the complex outsourcing model that gained experience with ICT SLA-based service management.

And what can we expect in the future? Numerous authors believe in the SaaS mass expansion, i.e. ICT will increasingly shift from user companies to specialized ICT service providers. In connection with this, N. G. Carr (Carr, 2005) talks about the end of ICT in user companies.

2.4.2 IASW versus TASW/OSS

When developing a new IS software component, the business management must decide on how the new application will be developed or obtained. There are two alternatives - individual application software (IASW) or type application software (TASW). A specific case of TASW is the open-source software (OSS).

When using the IASW alternative, the application is tailored to suit the needs of the business. Application functionality is designed to optimally support the business process activities for which it is designed. The disadvantage of this alternative is that this application development method is usually more costly for the business and takes more time than the other two alternatives. The advantage, on the contrary, is that a business can use the application to support its own specific processes and achieve specific market objectives. Resultantly, it can more easily overcome its competition, compared to the two other alternatives. It is clear from the benefits and disadvantage characteristics that the IASW alternative is inappropriate to choose for applications that support supportive highly standardized processes (such as e-mail or accounting).

The TASW variant is based on completely different principles; therefore, it features other benefits and disadvantages. The application is created and further developed by a specialized manufacturer by generalizing the requirements of a particular class of business - such as banks, car manufacturers etc. Although the total cost of TASW development is higher than IASW, the cost to the customer is lower because the total cost of development is dissipated among multiple customers. Another advantage is that the total application deployment time is shorter, as a finished product is installed. The disadvantage; however, is that the supported business process must be tailored to the TASW logic and capabilities. On the other hand, the TASW leading manufacturers incorporate the best practices known in the industry into the functionality of their products. By installing TASW, a less-advanced business may apply the experience and best practices of the market leaders. It becomes clear from the TASW characteristics that it is advantageous to choose this variant, especially for highly standardized applications, such as accounting or e-mail.

The TASW development resulted into activities, which are in development and whose goal is to distribute TASW from the manufacturer to its customer and adapt TASW according to the needs of the business and individual information system users.

A channel that TASW distributes from a manufacturer to its customer is implemented through a network of distributors, dealers, system integrators, and retailers. Before TASW is deployed to customers from a particular territory, it gets localized. Through its localization, the software and its functionality get adjusted per applicable legislation, national language, and cultural practices in a given territory.

When installing a localized product at a particular business, there are other adjustments made - customization and

integration. Customization is a product adjustment based on the customer's specific needs. During its customization, TASW adapts to business processes and specific user requirements. For example, data structures (e.g., accounting system), appearance of screens, and summary reports get modified.

Software product integration is a process by which a software product interconnects with other software components of a business information system (common data sharing, using the component's functionality with another component, etc.).

Another type of TASW adjustment is its personalization. Personalization can be used by individual application users to change the application's behaviour and user interface (choice of the communication language, data display method, etc.). Changes made to application personalization will only demonstrate themselves if a given application communicates with a user for whom it was personalized.

Localization, customization, and personalization are primarily accomplished by setting TASW parameter values. The development of TASW is; therefore, more difficult than the development of IASW, because when designing an application, analysts need to find out where to deploy parameters in the application.

A specific TASW case is the open-source software (OSS). Its basic features and differences from the classic TASW are as follows:

- The application is created by a virtual team of developers - volunteers (software community) who are usually not entitled to any reward,
- The application is supplied in the form of source programs, and the customer can adapt it to its needs,
- The code is free and must not be sold to any third party (specific terms vary according to the OSS license), but OSS can sell / be purchased with its accompanying services,
- There is no quality guarantee and error repairs made within any specified period of time.

It becomes clear from the OSS characteristics that OSS is particularly useful for standardized applications that are not critical to business continuity and competitiveness. Thanks to its low cost and the fact that the business is not dependent on the software producer, as in the case of TASW, this solution becomes increasingly popular. In 2008, www.SourceForge.net registered almost 200,000 OSS projects, out of which 771 projects for ERP.

2.4.3 Software Product Development Stages

Typical application software is the cornerstone of the business IS application architecture in most of the business IS alternatives. When selecting a specific TASW, the TASW functionality suitability for business processes, TASW supplier support (accompanying services, training, new releases, etc.), TASW total price (license, implementation, support, operation), and product quality are the decisive selection criteria. The software product quality and risks associated with its installation are greatly affected by the product development stage - see Figure 2-7.

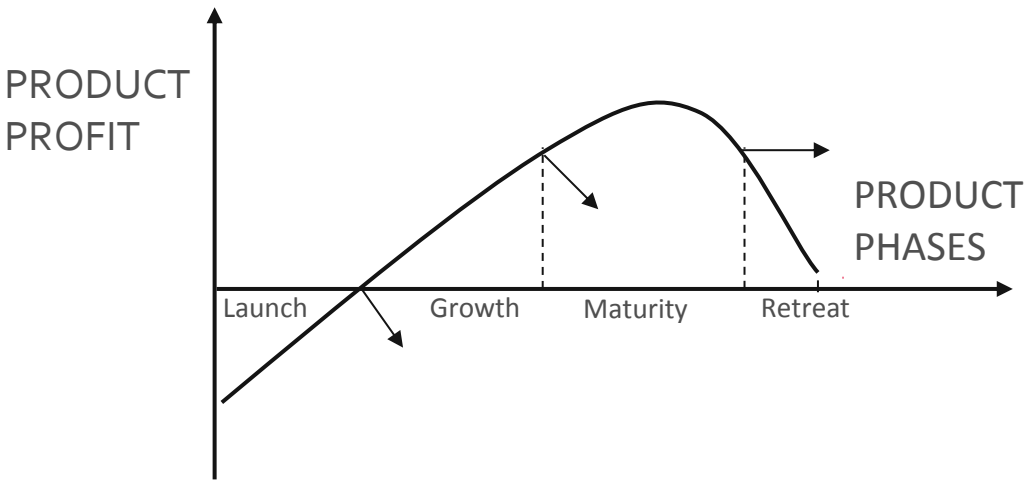


Figure 2-7 Software product development stages - (Voříšek k. , 2015)

The launch stage at the software developer is associated with significant investments in product development and marketing and with the first product installations at customers'. It is very risky to select the product at this stage for implementation of the key components of a business information system because it is not certain whether the product will remain on the market and will be supported also in the future. On the other hand, if the risks are well-managed, the use of such a product can help the business to get ahead of the competition.

In the growth stage, product development continues - the set of product functions is expanding, the amount of technology platforms, on which the product can run, is expanding, the operating characteristics are improved (user environment, response time, services offered with the product, etc.). At the same time, the number of product installs at customers' is growing. The product becomes profitable for the manufacturer. The risk factor of this stage is in the producer not being able to manage the growth (growth of staff, growth of branches, growth of distributors and dealers, etc.), resulting in poor quality of services and, in the extreme case, the fall of the product. For the customer, the product at this stage of development is significantly less risky than in the previous stage. Purchasing a product at this stage may still help to get ahead of the competition. Before the purchase, the business should assess whether the manufacturer manages the product growth well - see below.

In the product maturity stage, the manufacturer focuses mainly on its maintenance. The new product versions contain minor improvements, but no too many significant ones. The number of products installed at the customer' is starting to stagnate. Purchasing a product at this time is accompanied with the minimum risk; however, at the same time, it is not possible to expect a competitive advantage from its installation. The biggest risk rests in the fact that the product will quickly go into the regression stage.

The product is in the regression stage once competing products offer a wider and more sophisticated functional repertoire and use more modern information technologies. At the same time, the number of product installs at customers' is decreasing. Investment into purchasing a product at this stage is very problematic. The product can reach the regression stage without going through the adulthood - i.e. the growth stage. Such a situation can arise, for example, when one company acquires another one. A new owner may choose to suppress some products and end their supplies to the market.

3 INNOVATIVE ICT TRENDS AND THEIR INFLUENCE ON IT MANAGEMENT

3.1 General ICT innovative influence on the business informatics management

Business informatics management must respond appropriately to innovative ICT trends - see Figure 3-1.

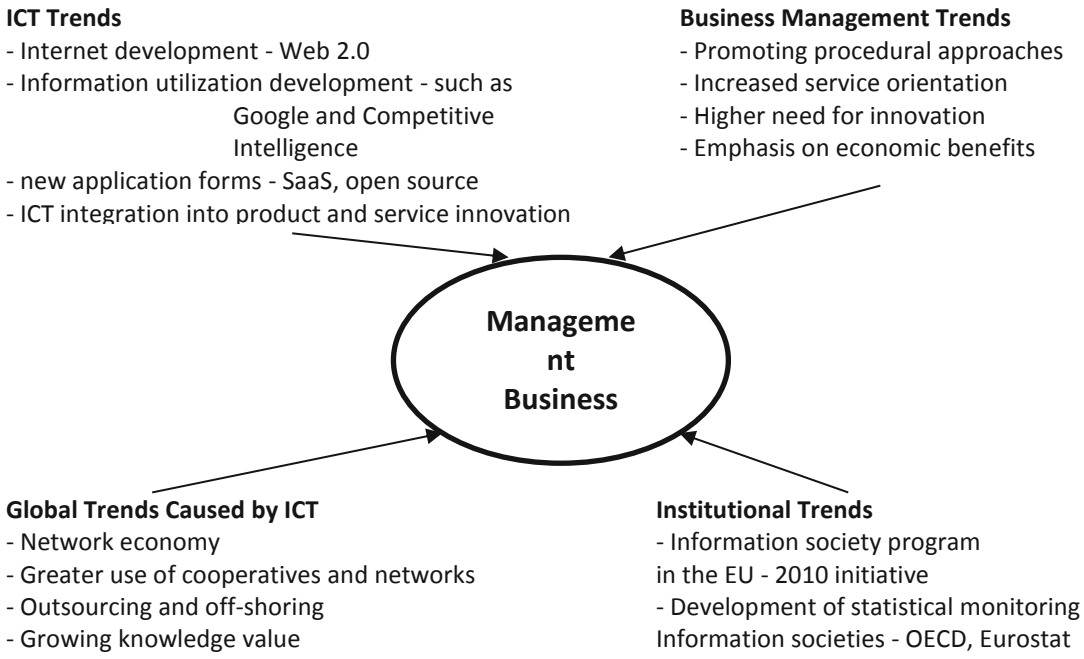


Figure 3-1 Innovative ICT trends influencing the business informatics management - (Voříšek k. , 2015)

Innovation of ICT products and services not only influences the development of business informatics, but in a number of sectors, also the development of the whole business. The impact of these innovations was particularly noticeable at the end of the last and the early part of this century when authors, such as Peter Drucker, began to identify the sixth and probably the most important today's innovation factor - knowledge. Drucker thus followed his predecessors when, in the 18th century, Adam Smith first defined three key input economic factors - land, labour, and capital, and Joseph Schumpeter subsequently added other factors at the beginning of the 20th century - technology and entrepreneurship.

We are at a time when ICT and, in particular, information and knowledge have a decisive impact on the economic performance of businesses and when informatics also affects the economies of developed countries.

3.1.1 ICT Support for Product, Service, and Process Improvements

The innovation spectrum of ICT-based products and services covers both existing and brand new products. In the case of products that have previously been offered to customers, ICT increases and extends their value.

For example, in the automotive industry, ICT brings into new cars GPS navigation, ABS and airbag control, fuel economy management, safety enhancement and collision avoidance, parking support, or car securing against theft.

More interesting examples with greater ICT benefits can be found in those sectors where the product can be fully digitized. An example includes banks that use ICT to expand and improve their services provided through Internet banking and chip cards.

ICT innovations are generally related to the development of the functionality of business information systems that use new technology platforms and technological elements. An example of new technology that has fundamentally influenced the products, services and processes of numerous businesses, is radio frequency identification (RFID). RFID

enables the development of goods with their own "intelligence" (e.g., a washing machine chooses the washing program itself according to the type and colour of inserted textile), more effective goods warehouse management, more effective billing for goods, etc.

The penetration of new technologies into business life is not uniform across the European countries. It is documented by the Eurostat survey conducted in 2008, comparing the percentage of business applying the given functionality. Business managers should use the results of such comparisons to plan the further development of ICT in their businesses.

3.1.2 Data and Information Usage Trends

The possibilities of the current ICT and especially the Internet generate new forms of emerging forms of business cooperation. At the same time, the importance of shared data in the supply chain increases. The data acquired by supply chain members supports more sophisticated analyses and recommendations for various decisions, such as new investment opportunities. The basis for this may be as follows:

- Volume of products sold at the individual retail outlets,
- History of customer purchases and the resulting changes in customer preferences,
- Mobile operators' information on the location and, if applicable, content of calls and SMS messages,
- Bank information on revenue history and account drawing,
- Website traffic monitoring,
- information on the patients' health condition for the purposes of determining their supplementary insurance amounts.

In the case of businesses, besides this information, there is also their need to mutually share their sensitive business data, including, for example, patent-protected data.

External sources of information are also important for the business. It shows:

- What the business looks like, including the development of the market on which the business operates,
- where it is heading, and what business competition deals with,
- how the business is evaluated, etc.

There is a growing impact of Google-type search engines, including Competitive Intelligence (CI) tools, which the Society of Competitive Intelligence Professionals (SCIP, www.scip.org) defined as:

Competitive Intelligence is a systematic and ethical program for acquiring, analysing, and managing external information that can impact business plans, decision-making, and its activities.

CI collects and analyses publicly available sources of information on market trends and sectoral developments that enable advanced identification of opportunities and risks.

3.2 The impact of ICT on business management

3.2.1 Changes in the behaviour of businesses

The information society's global economy creates new relationships among businesses. ICT the network model of their business activities (Kagermann, Lay, & Moore, 2007) with their new and innovative processes. Thanks to ICT, the relationships among businesses and their suppliers, partners, and customers in particular, have intensified over the last decade. The power of customers forming their new products and prices has grown. The networking allowed for the sharing of ideas and investments and their quicker realization at lower costs.

	Global company focused on "long-term existence"	Global company focused on "adaptation"
Competitive advantage	Effectiveness, stability, and attainability	Difference, adaptability, and speed
Control focus	Command and control	Communication and cooperation
Sources of innovation	Internal research and development	Cooperation-based innovation
Concentration focused on	Supply	Demand
Organization paradigm	Value chain	Alliances

Table 1 Main difference of adaptable global society (Kagermann, Lay, & Moore, 2007)

Business managers and owners must newly respond to the changed conditions of greater co-operation represented by the "adaptation"-focused model. However, investments into ICT and the creation of new models of networked businesses pose greater demands for securing:

- Proper coordination of the entire partner network, which must be able to deliver promised products and services, as if it were a single business, in addition to the corresponding volume, quality, and time,
- Ownership of the customer relationship and identifying emerging value added in the supply chain (allowing you to answer the question of how to fairly divide the revenue from your customer service)
- risk management throughout the whole network.

An integral part of these networks is also the correct identification of critical data and its consistent interpretation throughout the whole chain.

ICT expansion is linked to the four key effects that affect the operating rules of the economy: (Carayannis, 2008):

- Internal efficiency - widespread deployment of high-performance ICT in the business causes workers to process larger average amounts of data at a time. The main investment in ICT reach so-called white collar category and especially the tasks performed by the administration. Re-engineering of the processing of ICT-based documents reduces the associated overhead costs, even if sales volumes and related data volumes increase;
- Transaction costs - reducing overhead costs for business-to-business transactions is another effect of ICT deployment. For example, sales coordination, which may involve extensive negotiations and exchange of large amounts of data between partners, may be very costly. Therefore, the automating the electronic exchange of business information between businesses can eliminate a lot of documents, reduce order delays, and generally reduce the cost of doing business;
- Restructuring - it used to be cheaper to centrally hire, coordinate, and manage own employees. However, when electronic communications and network economy reduce transaction costs, it is becoming more effective for a lot of smaller and small businesses not to hire all the workers and collaborate more via clusters and networks;
- Knowledge management - at present, the value of an enterprise reflects how well processes are designed and described and how its business processes are being implemented and improved. The network environment makes it possible to share information more efficiently and quickly and to create knowledge-based competitive advantages.

3.2.2 Business Strategy in the Information Society

Thanks to globalization and creation of large supply chains, business planning has become more difficult. Therefore, it is all the more necessary to use ICT tools for the planning since they provide consolidated data contained in various information systems. The period of increased uncertainty and rapid changes can be summarized in the following list of trends (Demirdjian, 2008):

- Trends in the digital economy - greater emphasis on the knowledge capitalization and intellectual capital.

Traditional cost-cutting and "economy of scale" strategies need not necessarily be the primary management strategies;

- Trends in strategic planning - from the strategic planning aspect, the pre-emergence of globalization and Internet period was easier compared to today, as the environment was relatively stable. Dynamic changes in the economic environment (see, for example, oil price fluctuations in 2008 - when the oil price dropped from $140 to $50 a barrel over six months) require new approaches to strategic planning. The company strategies applied in the 1990s were depleted in this decade, which resulted in a reduction in the value of numerous companies;
- Trends in managerial decision-making - the success of the 1990s was largely based on a model of maximizing the value for the so-called "stakeholders". For them, this strategy had brought profits during the past decade, but numerous corrupt practices disrupted it. Today's business must operate in greater complexity and with greater transparency. In addition to the short-term effects typical of the 1990s, businesses must also focus on long-term effects and adaptability;
- Trends in competition - as a consequence of the digital economy and ICT, there is increased competition that is referred to as hyper-competition. Businesses are in such competition more dependent on new resources, such as new products, services, procedures, and especially processes. ICT tools also offer new channels for product sales, distribution, and payments. This reduces the traditional barriers for businesses to entry onto the global market and also reduces the costs of product development, implementation, and distribution. On the other hand, the pressure on price transparency and the reduction of prices is increasing due to the possibility of rapid comparison with competitive offers;
- Trends in the value orientation - one of the main strategic planning goals is in aligning business resources with the opportunities offered by the external macro-environment of the business. One of the main forces of this external environment is the value and social system of the business community. Reconciliation of the interests of business objectives and the interests of its community should be the goal of any socially responsible business and its business activities

Many firms use the unbalancing governance, such ascontractual-dominant or relational-dominant governance, which may lead to operational risks, as these unbalancing governance strategies have often downplayed the importance of the other. Based on the conservative, balancing governance strategy has a higher effect on relational performance compared to complementing governance strategy. This means that under the conditions of resource constraints (such as low IT ambidexterity), the focal firms should be following a balancing governance strategy rather than complementing governance strategy. Here, balancing governance strategy will be efficient and effective (Maomao, Jing, Joey, Yanhui, & Shanshan, 2017).

3.2.3 Management Methods in the Information Society Environment

The aforementioned changes of recent decades have also led to the emergence of new methods applied in business management. Table 2 captures the gradual evolutionary shift of business goals from the production to sales strategies, now being completed by focusing on financial indicators with increasing emphasis on added value, profit, and return on invested funds - capital.

Although the literature begins to develop efforts to formulate business management support based on one chosen method (e.g. (Matějka, 2005), (Goldratt, 2004)) that would stand above others, business practice has not yet accepted it and actively uses the full spectrum of methods. At present, an important place in the business management holds the use of Net Present Value (NPV), Economic Value Added (EVA), and Return on Investment (ROI). Other currently used methods are lean production (Jirásek, 1998), application of the Six Sigma principles (Wegdwood, 2006), Theory of Constraint (TOC) (Basl, Majer, & Šmíra, 2003), Managerial Accounting, Total Quality Management (TQM) and Total Productive Maintenance (TPM).

Higher profits supported based on	The way to achieve higher sales	Applied methods, principles, and tools
Higher production	Quality improvement	TQM (Total Quality Management) Six Sigma TPM (Total Productive

		Maintenance)
	Higher production and flexibility of the production system	CIM (Computer Integrated Manufacturing) NC (Numeric Control) controlled production facilities
Lower costs Shorter time periods Higher flexibility	Greater cost overview	Management Accounting. Business Process Management
	Lower inventories	Lean production JIT, MRP
	Reduced lead time	Concurrent Engineering
	More flexible processes	Business Process Reengineering (BPR), Balanced Scorecard (BSC)
Product innovations Process innovations	Increase in return on investment Increase in return on investment	ROI (Return on Investment) TOC (Theory of Constraint) NPV (Net Present Value)

Table 2 Basic methods used in businesses to achieve major business goals (revised based on (Matějka, 2005)) - (Voříšek k. , 2015)

4 MANAGEMENT PRINCIPLES AND BUSINESS INFORMATICS

4.1 Management Theory, Practice in Informatics

Managing the work without the support of information technology is currently practically inconceivable. However, the question is, what is the concrete impact of the dynamic development of the global economy and ICT on the informatics management, how informatics management is implemented, how and by what it is supported, and whether the business informatics management has some specifics.

In the following paragraphs, we will first define the management term based on the classical management theory. In the publication by H. Koontz and H. Weihrich, (Koontz & Weihrich, 1993) management is defined as follows:

Management is the process of creating and maintaining an environment, in which individuals work together in groups and effectively achieve selected goals.

The management theory specifies the functions that are performed within the management process. Managerial literature offers different concepts that differ in the number of functions listed. These approaches are clearly summarized in (Vodáček & Vodáčková, 2006), Koontz (Koontz & Weihrich, 1993) recommends viewing these lists of functions through the following classification:

- Planning - preparing process timetable plans to help achieve the intended goals,
- Organization - identifying the activities (management processes) leading to the achievement of the set goals and ensuring the necessary resources,
- Staffing to ensure that job positions are filled with workers with adequate knowledge, abilities, and skills.
- Leadership - motivating employees to meet planned goals,
- Control - detection of deviations between the plan and the reality, identification of their causes, and adoption of such decisions that will lead to the correspondence between the reality and the plan.

4.2 Organizational Structure Models, Informatics Position

As stated above, the organizational structure is the result of the second most important management function -

organizing. The organizational structure captures the formalized the internal organization system, from which superiority and subordination are derived, reflects the management and information flows between the organization's managerial and managed staff.

Organizational units can be created on the basis of various principles, from which various organizational structure models are developed. We will go from the classical division into stable and flexible organizational structures. The following text describes selected basic organizational structure types and the possibilities for integrating a business informatics department into these structures (the "IT department" term is used in the text and figures below).

Note: The structures shown below do not take into account the hierarchical arrangement leading to the designation of organizational units at different levels of management, such as sectors, sections, departments, subdivisions, divisions, segments, plants, factories, centres etc.

4.2.1 Stable Organization Structures

Stable organizational structures are characterized by specialization, centralization, and high formalization.

When classifying organizational structures according to the division of powers, the historically oldest organizational structure is the one with the unambiguous link between the subordinate and the superior (i.e. the subordinate always has only one superior), which is called the line organizational structure. In classification according to the grouping of activities, the most frequent principle of specialization is according to the professional orientation, which leads to the creation of a functional organizational structure. For this organizational structure, it is typical that organizational units are focused on a group of closely related activities. Its advantage rests in higher efficiency based on the joint work of experts on individual activities.

Stable organizational structures are currently represented by the most functional structures, while respecting the unambiguous links between superiority and subordination, so that they can also be labelled as line organizational structures. While adhering to these principles, the IT department is incorporated as a professionally separate organizational unit providing IS/ICT development and operation functionality - see Figure 4-1.

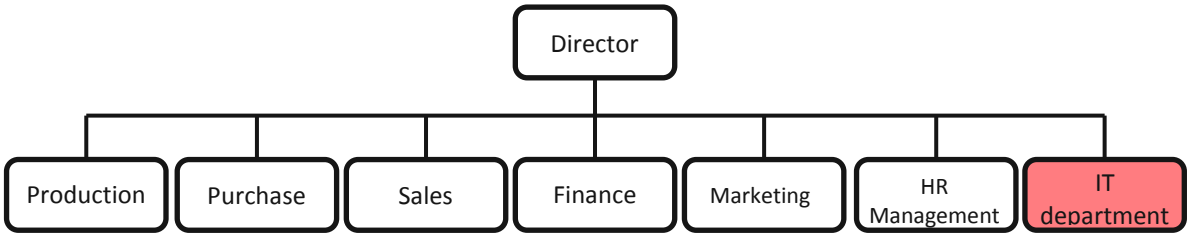


Figure 4-1 Functional organizational structure model - (Voříšek k. , 2015)

The advantage of this integration rests in the equitable status of informatics with other business units, and the disadvantage rests in the relative isolation of individual departments and their insufficient motivation to cooperate in achieving corporate goals. The IT department has difficulties to implement IS/ICT changes that require integration of activities of various departments; for example, when implementing process automation applications.

Sometimes, organizational units of a functional organizational structure are expanded by specialized "advisory" departments, the so-called staffs. This organizational structure is referred to as line-staff. The IT department often reaches the "staff" organization status, mostly at the highest hierarchical levels.

Figure 4-2 illustrates a situation where the IT department is a separate organizational unit, but at a lower organizational level, i.e. it is subordinated to another organizational unit. Most often, these are organizational units focused on financial management, operation management, technology management, or quality management. Compared to a solution where an IT department is a unit that is built on the same level as other key business departments, this solution can mean that the IT department's priorities are primarily based on the priorities of the department, in which business informatics is integrated. This can lead to uneven support of various business processes and to the preference of local goals over corporate ones.

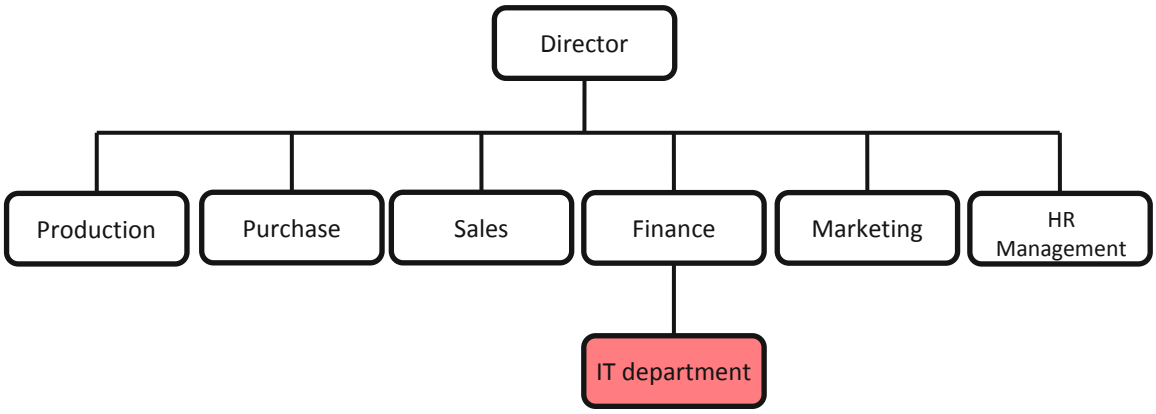


Figure 4-2 Position of the "IT department" as for the subordination to another organizational unit - (Voříšek k. , 2015)

From the aspect of informatics management, it is essential for all the aforementioned classical stable organizational structures if informatics is or is not marginal for the management and which management model is applied to business management, as it is likely that the same approach to management will be required from the middle management when managing individual organizational units. The more levels the organizational structure has, the more problematic is communication between the individual management levels and the speed of reaction to changes in the business environment.

If competition interfaces are well defined between the individual organizational units, and the tactical and strategic decision making is implemented in the cooperation of the middle and top management, the functional organizational structures allow for the easy detachment of those organizational units whose activities are inefficient and replacement by the external provider services. This also applies to the IT department, for which the complex outsourcing form, where business processes remain in the business and they are complexly provided by IS/ICT resources, is typical in these cases.

For small and possibly mid-sized businesses that have a small number of employees and, therefore, also a small number of organizational units, the operation and development of information technologies is often realized by only one or several employees who are IS/ICT specialists. We see the approach where each organizational unit has one "informatics specialist" or one or more such specialists who work relatively independently and are directly responsible for their work (see Figure 4-3), which corresponds to the aforementioned line-staff organization structure. In terms of the categorization of business informatics management styles, these two solutions correspond to the feudal style of management, so-called "business monarchy".

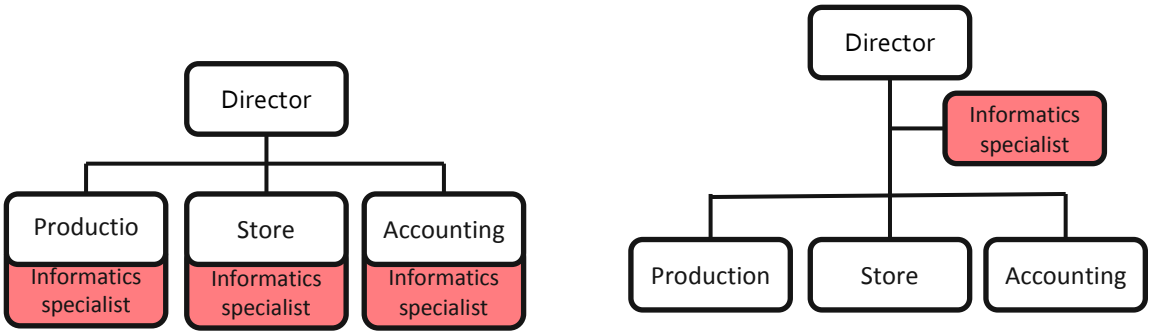


Figure 4-3 Incorporation of IT professionals into a functional organizational structure - (Voříšek k. , 2015)

From the aspect of the strategic decision making, informatics management is fully under the competence of the superior department management, or the business top management, and informatics specialists are only executive or, at most, advisory workers. The negative aspect of this relatively often applied model rests in the fact that management usually does not have such a level of IT knowledge to make an informed decision about IT management and, on the other hand, IT specialists in this model usually do not have adequate knowledge of business goals and priorities and, therefore, usually are not initiators of changes that would lead to their support by IS/ICT.

The professional scope of these IT specialists is usually very wide, as they have to take up a whole range of IT expertise. The rapid development of information technology is constantly pushing for the expansion of IT skills and knowledge, which is problematic to carry out with the wide range of activities and, therefore, work activities of these IT specialists are being replaced by some form of outsourcing. The highly specialized IT experts of an external ICT service provider can better draw on their experience and show greater efficiency within the services provided.

For large businesses, multinational corporations, etc., the so-called strategic IT department is at the company management level, and the individual "business units" have their own IT departments. In these cases, a division of competences between the strategic IT department and others (for example, when defining the priorities of projects, IT standards, etc.) is the key for informatics management.

4.3 IT Department Structure

In Chapter 4.2, we have introduced several possible ways of integrating the IT department into the organizational structure of the business. Another organizational task rests in designing the internal structure of the IT department and to define job positions and their responsibilities. Solution of this task depends on a lot of factors.

For example, with a large number of employees or a complex IS/ICT architecture, it could be assumed that a separate organizational unit will be created; however, it may be, due to other factors, completely replaced by an external ICT provider. Similarly, the decentralization of the organization requires not only the centralized management of informatics operations and development, but also the support in the individual branches, which can be solved in various ways - from separate IT workplaces to an "IT specialist" to outsourcing of ICT services.

The aforementioned factors do not influence the integration of informatics into the organizational structure only, but also the number of employees in this organizational unit. The higher the number, the more their substitutability is increased, but the demands on management are changing, the requirements for coordination of activities and communication grow, the processes have to be described in more detail, the activities have to be more formalized, etc.

With a larger number of informatics specialists, the organization can afford their narrower specialization that reflects higher levels of expertise and quality of work in the field of specialization, as well as higher IT management requirements. On the contrary, a small number of informatics specialists require merging of the activities of various informatics professions and puts greater demands on the extent of knowledge, but on lower demands on management.

That is why specific structures of IT professions and their job descriptions vary greatly from one organization to another. The IS / ICT outsourcing has the greatest impact on the size of the IT department and its profession structures. Virtually, any department profession can be completely eliminated through the outsourcing of its activities.

Figure Figure 4-4 shows a general model of information roles, based on which one can construct the required profession structures that will correspond to the requirements for achieving the planned goals of the business and its informatics.

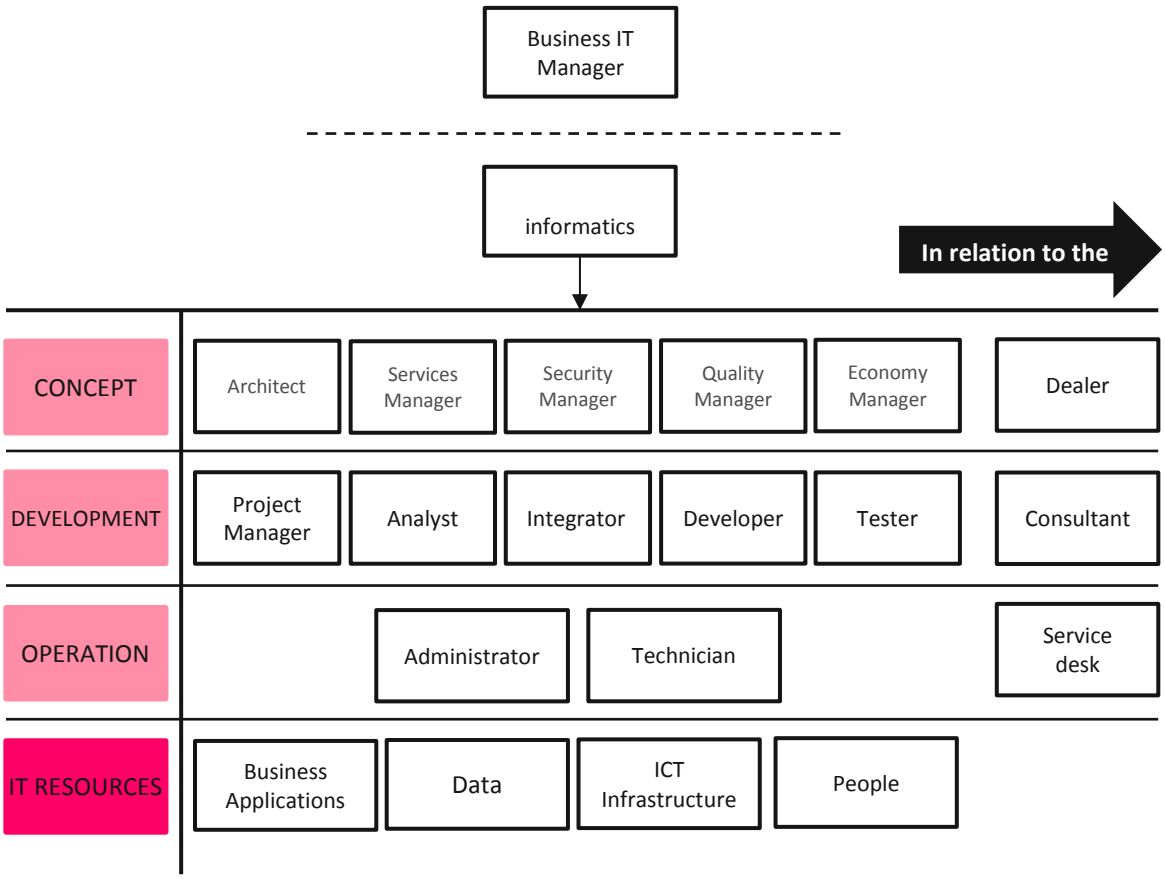


Figure 4-4 Informatics Roles Model - (Voříšek k. , 2015)

At the top of the figure, there are two of the aforementioned leading management roles:

- "Business IT Manager", so-called CEO, Chief Executive Officer, who is in charge of managing the entire organization (in this case an organizations doing business in informatics)
- "Business Informatics Manager", so-called CIO, Chief information Officer, who leads his organizational unit set up to manage business informatics. The CIO must be in contact with the top management of his organization. He must understand not only the IT issues, but business issues as well. At small organizations with no separate organizational units for informatics management, this role is taken over by the organization's chief management worker or manager of some of the existing organizational units (see chapter 4.2.1).

The bottom of the figure shows the subject of management, i.e. Informatics resources: business applications, data, technology infrastructure, and people (end-users). In the middle, there is an overview of the IT roles, represented by specific informatics professions to whom jobs get assigned. Their layout corresponds to the three-level management requirement - operational, tactical, and strategic. On the right-hand side, there are the roles acting on the communication line between informatics and its customer, either external or internal one.

If we start at the operational management level, then, unless there is some form of outsourcing, organizations usually features these types of professions:

- Application administrator, database administrator, LAN/WAN administrator, operating system administrator, security administrator, server administrator, operator, system administrator, and user account administrator,
    - Sometimes, these roles are defined even in more detail, e.g. SAP administrator, EDI administrator, Unix operating system administrator; or, contrary to that, very generally, e.g., IT administrator,
- terminal station technician, computer network technician, configuration administrator, service technician, PC technician,
- service-desk, hotline, IT support, issue management, and change management.

Workers holding these professions usually have technology-oriented education, knowledge of how to acquire, maintain, operate, and deploy the individual components of IT infrastructure, how to dimension and scale the infrastructure, and how to maintain technical resources. Workers addressing user issues must be seamlessly communicative, patient, systematic, and they should have analytical skills.

The IS/ICT development is a matter for analysts, integrators and, last but not least, developers and testers. There are these professions, for example:

- Business process analyst, system analyst, user interface analyst, business requirements analyst, database system analyst, security analyst,
- business process designer, service designer,
- IS/ICT designer, system integrator, IT auditor, IS auditor, capacity planner,
- SQL programmer, 3D animation / Java / C / C ++ / .Net etc. programmer, encoder, implementer,
- webmaster, web designer, graphic designer,
- tester, SAP tester, business application tester, and web application tester.

For most of these professions, it is important for employees to have both IT and business knowledge because they have to both analyse, model, and develop processes, applications, or services, making sure they support business operations with the maximum potential effect.

The managers of the individual areas are assigned to their supervisory positions. These positions may be as follows:

- IT resource manager, infrastructure manager, application manager, development manager, operation manager, service-desk manager, business manager, IT finance manager, project manager;

- The roles identified in Figure 4-4 at the highest level (architect, security manager, service manager, quality manager, economics manager) can either be represented by independent professions, or (in the case of small and medium-sized organizations), or they are featured by the informatics manager or non-informatics professions (typically, the quality manager, compliance manager, or security manager).

The supervisory position workers are expected to know the global and local ICT markets in terms of products, services, as well as partners and competitors, management, legislation, economics, business, and marketing. They must be people with communication and presentation skills, good organizers and problem solvers with the ability to systematically assign and control tasks.

Informatics executives (CIO, CEO) are expected to know both IT issues and business. They are expected to have a strong sense of responsibility and willingness to take personal responsibility, problem solving initiative, consistency, self-confidence, ability to positively influence others' behaviour, and be prepared to endure stress from interpersonal relationships. Discussions with the heads of other departments are their important activities. Their task is to understand the role IT plays in the creation of value added of their business, and manage the work of the IT department, so that this value added is further increased through IT. If the CIO is in contact with the heads of other departments, then he has access to their knowledge and, on the other hand, he shares his knowledge of the IS/ICT development trends and supports potential knowledge transfers to business specialists.

The ICT products and services dealer's profession or IS/ICT consultant are mainly found at informatics companies that offer their IS/ICT products and services. In a decentralized organizational structure, they can also act on the internal interface with other organizational units. Employees in these professions must be well-oriented in their IT business, must be able to respond flexibly to changes, address non-standard situations, be aware of and able to apply best verified practices in combination with the knowledge of their local conditions.

The organizational structure of the informatics department will always be unique, as is unique the environment in which it is embedded. As already stated above, its configuration must respect the management system. Given that the current informatics management is oriented on the provision of ICT services, the informatics department organizational structure should be derived from its provided services.

Applying a service-oriented architecture to the organizational structure intuitively leads to the viewing of the individual structural units as services. Every team provides its specific service and is specialized in supporting all the activities it involves. Service teams are managed by their service managers who coordinate the implementation of services, their purchase/sale, and continuous improvement. Since the requirements for the individual services derive from business requirements, this organizational structure can quickly adapt to any new opportunities and compete well.

5 ARCHITECTURES IN BUSINESS INFORMATICS

One of the factors that significantly impact the efficiency and flexibility of business informatics is the information system architecture of the business. The design and development of the IS architecture is; therefore, one of the key tasks of the IT department management.

The goal of this chapter is to state the basic principles of the system architecture, as they are formulated in the accepted standards, and then to apply them in business informatics

The chapter addresses the following questions:

- How is the system architecture defined?
- How did the business informatics architecture contents develop?
- What is Enterprise Architecture and what does it support?
- What other architectures can we find in business informatics?

5.1 Essence, principles, and system architecture design and description purpose

In today's highly competitive environment, there the IS/ICT environment is a critical factor that affects the organization's success. If IS/ICT is to fully support business processes and realize their potential, a number of aspects and links need to be respected during its building. A system architecture is precisely the means by which these relationships can be captured and clearly described for different roles both on the IT side and business side. The reflection of the current interest in system architecture is the emergence and use of the language for describing architecture, architectural methods, frames, models, patterns, and techniques for architecture analysis and assessment.

There is a professional community consensus on the importance of architecture in the system's life cycle, but there has long been no consensus on the precise definition of the system architecture and how the architecture should be described. Therefore, in 2000, IEEE adopted a standard that formulates procedures recommended for system architecture description - IEEE-Std-1471-2000. This standard was adopted by the ISO organization and became the basis of ISO/IEC 42010:2007 standard. The goal of the standard is to standardize the architecture description elements and practices to facilitate the expression, communication, and verification of architectures and enhance their quality.

The following text explains the basic concepts and principles related to the system architecture and its description per this standard. Figure 5-1 shows the architecture in the context of a system that is influenced by its environment and fulfils a certain mission formulated by involved parties.

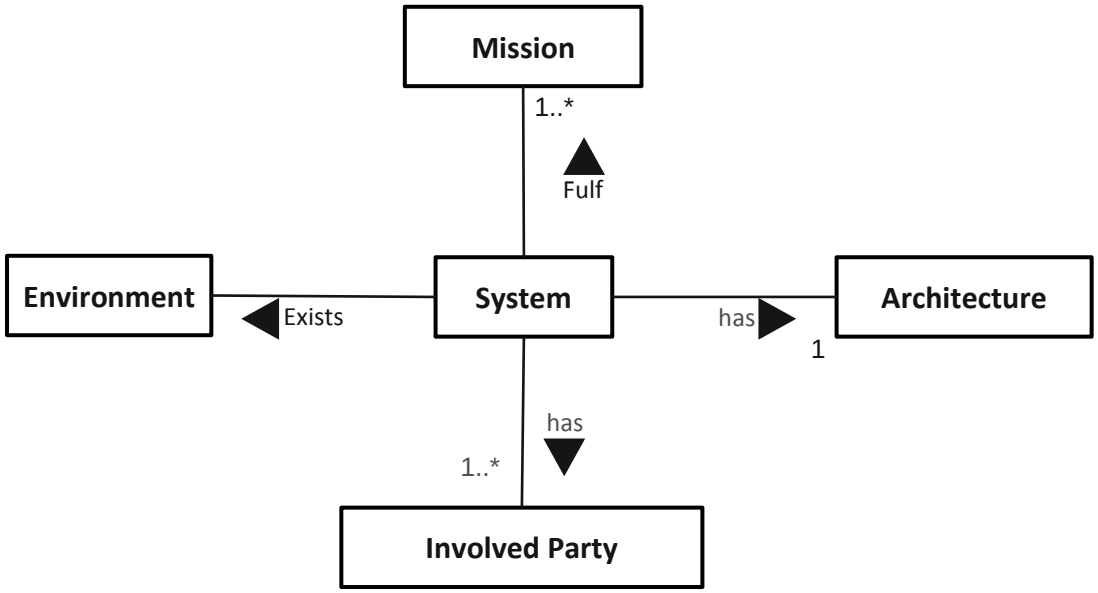


Figure 5-1 Conceptual model of the system and its architecture per (ISO42010, 2007) - (Voříšek k. , 2015)

The system is defined as a set of components purposefully organised to achieve a particular objective or group of

objectives. This is either a general system or software-intense system. (ISO42010, 2007)

The system's environment is a context that determines the setting and circumstances of developmental, operational, political, regulatory, social, and other critical influences on the system. The environment affects the system, and the system affects the environment. Within the environment, there are involved parties (Stakeholders). They are individuals, teams, or organizations that are interested in the system or are in some relation to the system. Examples of involved parties include: customer, user, developer, business manager, service provider, vendor, and others. The system exists to carry out its mission.

Architecture is the "fundamental arrangement of a system made of components and relationships among them, including their relationship to the environment, and the principles governing its design and development." (ISO42010, 2007)

A system architecture is documented via its architectural description. The standard distinguishes between system architecture (concept) and architectural description (specific information artefacts).

The developing contents of business informatics changes the understanding and definition of this term. Currently, we can see a number of definitions, for example:

- The IS architecture determines the core IS components and their mutual links. It further defines the principles of IS design and development, which aim to achieve certain system features (Voříšek J. , 2007). The various types of architectures in business informatics (architecture of services, software architecture, hardware architecture, data architecture, etc.) are formulated as an analogy to the field of construction (zoning plan, house architectural plan, plan of the individual floors, electrical installation plan, etc.);
- The business informatics architecture represents information assets that characterize the organization's mission, necessary information and information technology enabling the mission fulfilment, including the procedures of implementing new technology in response to any mission change (FEAF, 2001),
- The business informatics architecture is a holistic expression of key business strategies (business, information, application, and technological strategies) that impact business functions and processes. It focuses on such a view of business processes and informatics resources that allows one to manage business process implementation (Meta Group in (Kaczmarek, 2003))

The business informatics architecture (EA) is an approach, concept, tool, and instrument that we use to express the fundamental arrangement of the relationship between business and its information system that leads to the fulfilment of the organization's mission, while respecting the surrounding environment and consistently adhering to the principles of the system's design and development.

The grand challenge for today's enterprises is the continuous alignment of business and IT in a rapidly changing environment. Enterprises are facing a new era of enterprise IT, the 'digitalization' era, "a period characterized by deep innovation beyond process optimization, exploitation of a broader universe of digital technology and information, more-integrated business and IT innovation, and a need for much faster and more agile capability". In order to deal with this grand challenge an approach is proposed, which uses model-based engineering as visualized in Fig 5-2 . The approach builds on the principles of model-driven enterprise engineering and is supplemented with innovative and challenging developments (Hinkelmann, a další, 2016).

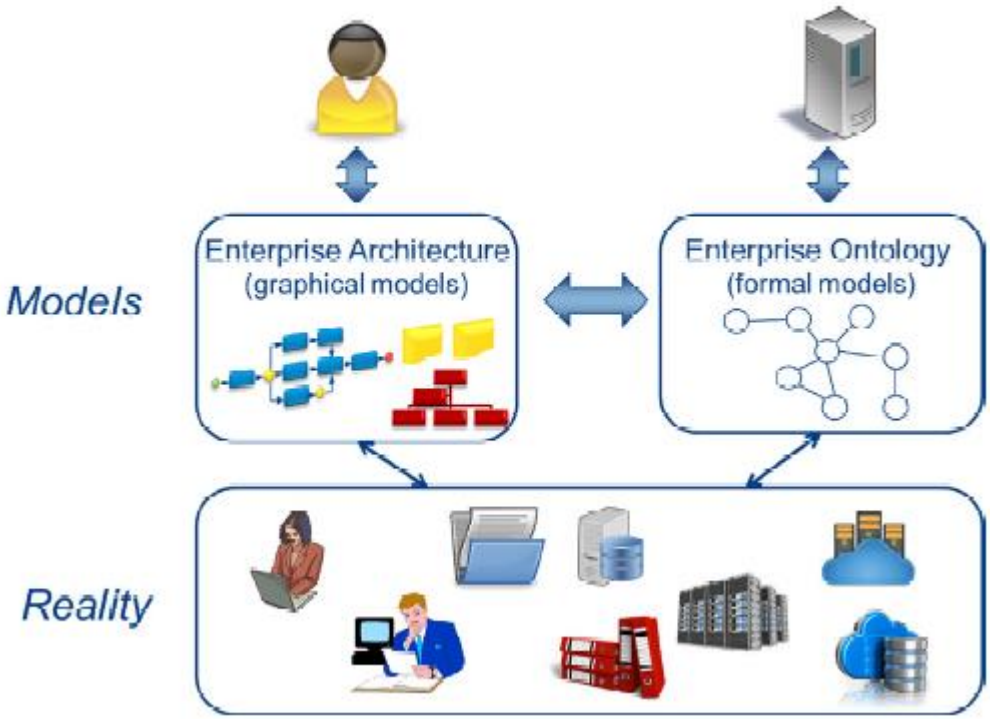


Fig 5-2 -- model-based engineering (Hinkelmann, a další, 2016)

5.1.1 Architectural Frameworks

Designing, describing, and using architecture, while managing business informatics, are challenging tasks. Therefore, various architectural frameworks have been created that represent the type of approaches to architecture designing and implementing. They are often supported by software tools. In this chapter, these frameworks are categorized and characterized. However, we must realize that the architectural framework is only a tool and as such will not solve the issue of the architecture complexity and implementation difficulty. We have to cope with the fact that describing a business and its information system on all the necessary levels, taking into account all the key processes, information flows, and other aspects, is time consuming. Some frames are so sophisticated that their practical application is very difficult. In addition, with the current dynamics of businesses and their surroundings, the architecture needs to be continually updated.

The architectural framework is a set of interests, stakeholders, redefined aspects, and rules defining the links of views that have been defined to describe architecture in a specific area. (ISO42010, 2007)

Architectural frameworks can be divided into classification, process and content ones (Zuzák, 2008). The classification frameworks provide guidance on how to properly divide a complex system into individual views, what aspects (domains) to monitor in that view, and what models to use. Typically, they are presented in the form of a matrix, where its rows represent the views and columns of the domain, or aspects we should address in a given view. A matrix element is characterized by a suitable model that captures a particular aspect of the solution from that view. This framework of categories includes, for example, the Zachman frame, E2AF, IAF, etc. Some frames are based on a tree concept, such as the Gartner EA Framework Model. While matrix frames feature the same level of detail of description in all the views, the tree frames are designed in such a way that business is represented by a separate business architecture, and the framework is primarily focused on expressing the relationship between this business architecture and IS/ICT. This relationship is represented by different views and aspects of business support using IS/ICT.

The contents of a system whose architecture we formulate is defined by the business strategy, business requirements, and its environment. The same is also the input in architecture modelling and description. The environment affects both the business itself and its applied ICT in a positive sense since it creates new opportunities (e.g., web services will allow the communication of heterogeneous technologies that would otherwise not be possible) but also in the negative sense of the word, i.e., it creates barriers (e.g., state legislation may limit the supply of services delivered through the Internet).

EA has links to performance measurement and strategic management systems. For example, business process reengineering has a critical impact on EA, but on the other hand, strategic performance impacts potential process reengineering. Figure 5-3 Shows the aforementioned views (architectures) within EA.

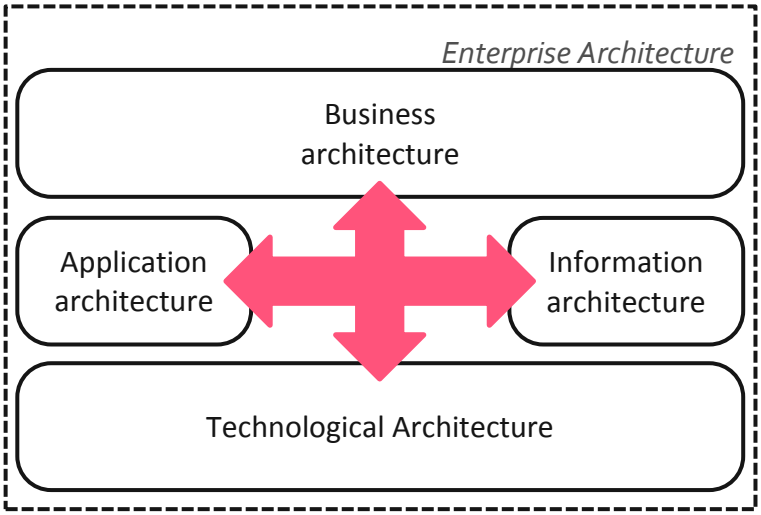
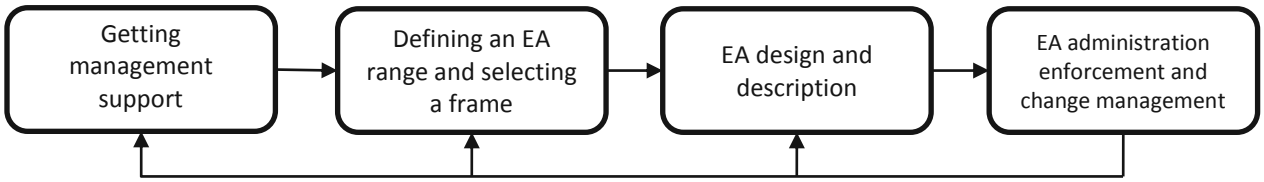


Figure 5-3Typical views in EA - (Voříšek k. , 2015)

Figure 5-4 Shows the process of EA managing, which is the generalization of the processes presented in the individual



frames.

Figure 5-4 Business architecture control process (Voříšek k. , 2015)

5.1.2 Architect's role

Several times, we have mentioned the architect's role. This position has been transferred to informatics from civil engineering, where the architect "is considered to be the master in controlling all the functional, structural, and aesthetic methods of building and construction and also a supervisor during a building process." (Schekkerman, 2006) The architect may be characterized as an expert, strategist, politicians, and leader (Bredemeyer, 2004).

These properties are fulfilled by a number of skills and knowledge. The key ones are:

- Knowledge of the organization's business and its functioning, understanding the products and services offered by the organization, knowledge of weaknesses and strengths of the organization, business strategy, including its justification, knowledge of the organization's environment, i.e. structure of the industry, user needs, competition, supply chain, as well as future business IS/ICT capabilities and IS/ICT trends, and the ability to identify their opportunities and risks,
- ability to always see the components as a whole, and look both at the whole and its parts from different perspectives, ability to model reality, and knowledge of modelling techniques,
- ability to figure out human relationships in a business, identify the key players in decision-making processes, ability to discover "hidden business agendas" that can influence architecture, knowledge of business culture, and key values on which the organization is based,
- ability to be self-aware and promote one's views, ability to persuade workers to identify themselves with the organization's vision, mission, strategy, and tactics, art of communication in various forms or towards various audiences.

The architect's responsibility and role can then be characterized as follows:

- He is responsible for formulating architectural principles, styles and standards, their fulfilment. and observance. He is responsible for architecture formulation, its justification, and enforcement. He monitors the development of ICT means, management methods (informatics and business) and formulates their possibilities in system innovations and maintains consistency between the business and informatics,
- participates in the preparation of business strategy and is responsible for identifying the potential risks and opportunities related in particular to the capabilities of the technologies that should support it. Participates in decision-making processes that relate to investments, as well as decision-making about acquisitions and mergers. He is responsible for identifying those topics that blend through multiple strategic goals and can bring about a new (synergistic) effect. He also ensures that strategic goals are properly transformed into informatics objectives and that the technology-based community understands them well;
- creates an appropriate network of partnerships and cooperation to achieve defined results. He is responsible for reconciling the interests of different groups in the organization and for overcoming the particular and personal interests of individuals. Ensures that "political" changes in the organization are adopted elegantly and smoothly.

The architect's level of responsibility, skills, and knowledge depends on the level of decision-making he is assigned to. Specific ones will be featured by a chief architect (enterprise architect), different ones by an architect responsible for a particular view (business architect, information architect, architect of technology infrastructure, solution architect), and different ones by an application or application system architect.

5.1.3 Service Oriented Architecture

A service-oriented architecture (SOA, Service Oriented Architecture) becomes quite critical. The system described by this architecture is a system of ICT services and their interconnections.

The goal of SOA is to offer the IS functionality in the same way as the business does it to its customers, i.e., in the form of services, including providing appropriate access, which can be used to create new services through the current ones. SOA significantly affects the EA application view contents.

SOA can be understood as policies, practices, and frameworks that allow application functionality to be delivered and consumed as a set of services, at the level of granularity (scope of functionality) required by the service recipient. He is separated from the service implementation and uses only a simple, standard-based interface.

Service-oriented architecture is based on its three key principles. The first principle - "Business processes drives services, and services control technology" - means that services form an abstract layer that allows one to create a relationship among business processes, applications, and technologies. The second principle - "Business agility" - means the IS/ICT ability to quickly respond to changing business requirements. The third principle assumes that a "service-oriented architecture is constantly evolving" and is fully mastered (SOA Governance).

SOA service is characterized by the following:

- Loose relationship - a contract-based service specification encapsulates all of the hidden resources required by the service for its functioning, including the ability to virtualize these resources, and contract is a contractual interface to software logic offered by some application,
- Standardized - in various situations, it always displays consistent behaviour, it is reusable and complies with the industry standards,
- Abstract - service generalization ensures its high internal business flexibility (it is coarse grain) and at the same time, it is an abstract point (endpoint) through which it responds to system events (typically, asynchronous incoming messages),
- Composable and modular - fractal principles allow the use of other specialized and orchestration services to create flexible solutions even while minimizing possible dependencies among services,
- all the service metadata throughout its whole lifecycle is stored at some persistent storage site,
- throughout its lifecycle, it is mastered (SOA governance).

5.1.4 Layered Architecture

Another type of architecture to be mentioned here is the layered architecture. Layered architecture is, in line with the concepts specified in chapter 5.1, an architectural framework that defines the information system building principles.

The layered architecture principles were originally developed for hardware and software design. Later, they were also applied in other areas, even areas that are not directly related to information systems.

The software system architecture determines the software components (software modules) and their links. In other words, when designing a software architecture, we determine which software modules will provide the required functionality for the application, and what the links among these modules will be.

One of the key criteria for judging the architecture suitability is the cost of creating, maintaining, operating, and using a system for which the architecture is used:

- The costs of creation and maintenance are mainly due to the use of work in the creation and maintenance of the software system and are mainly influenced by the following factors:
    - The development environment level (the more powerful and integrated the development environment, the lower the labour consumption),
    - whether the software modules and their functions are reusable in a variety of applications (new development is always more expensive than the application of pre-prepared building blocks),
    - transferability of software components to various environments,
    - system documentation level. Good documentation makes system maintenance easier and less costly;
- the operating cost are due in particular to the use of computing system resources when processing the application (processor time, memory capacity, transmission capacity, etc.) and the amount of labour required by the application during its operation (archiving, restoration and restructuring of database, operation and administration of applications, etc.);
- the usage costs are due in particular to the amount of labour needed to understand and use the application by its user (costs of training and consultations, time spent using the application).

The most suitable software architecture for a software system can be considered as the one that produces the minimum sum of the three specified system costs.

In the current practice, four basic types of software architectures are used: linear, hierarchical, layered, and network - see Figure 5-5.

In the linear architecture, the required system functionality is achieved by sequential arrangement of elementary functions. An example of a linear architecture is the arrangement of the basic components of a classic text system that contains three basic functional components: editor (document creation and maintenance), reeditor (adding variable document parts, such as cross references, contents, index, etc.), and formator (creating the final document version on a screen or in a printer). The advantage of a linear architecture system is that it does not require any complicated organization of work teams, and its testing is very easy. The downside is that it does not support any structured approach to problem solving, and that a change in one function/module may trigger a chain of follow-up function/module adjustments.

If the linear architecture is used to solve an appropriate type of problem, then the three architectural costs are the lowest for all the architectures. In practice; however, systems with purely linear architectures rarely occur because the problem nature usually requires a structured approach to its resolution. Even if a system features its linear architecture at the highest level of abstraction, then, usually at lower levels, its functions/modules are arranged according to one of the following architectures (this also applies to the text system example).

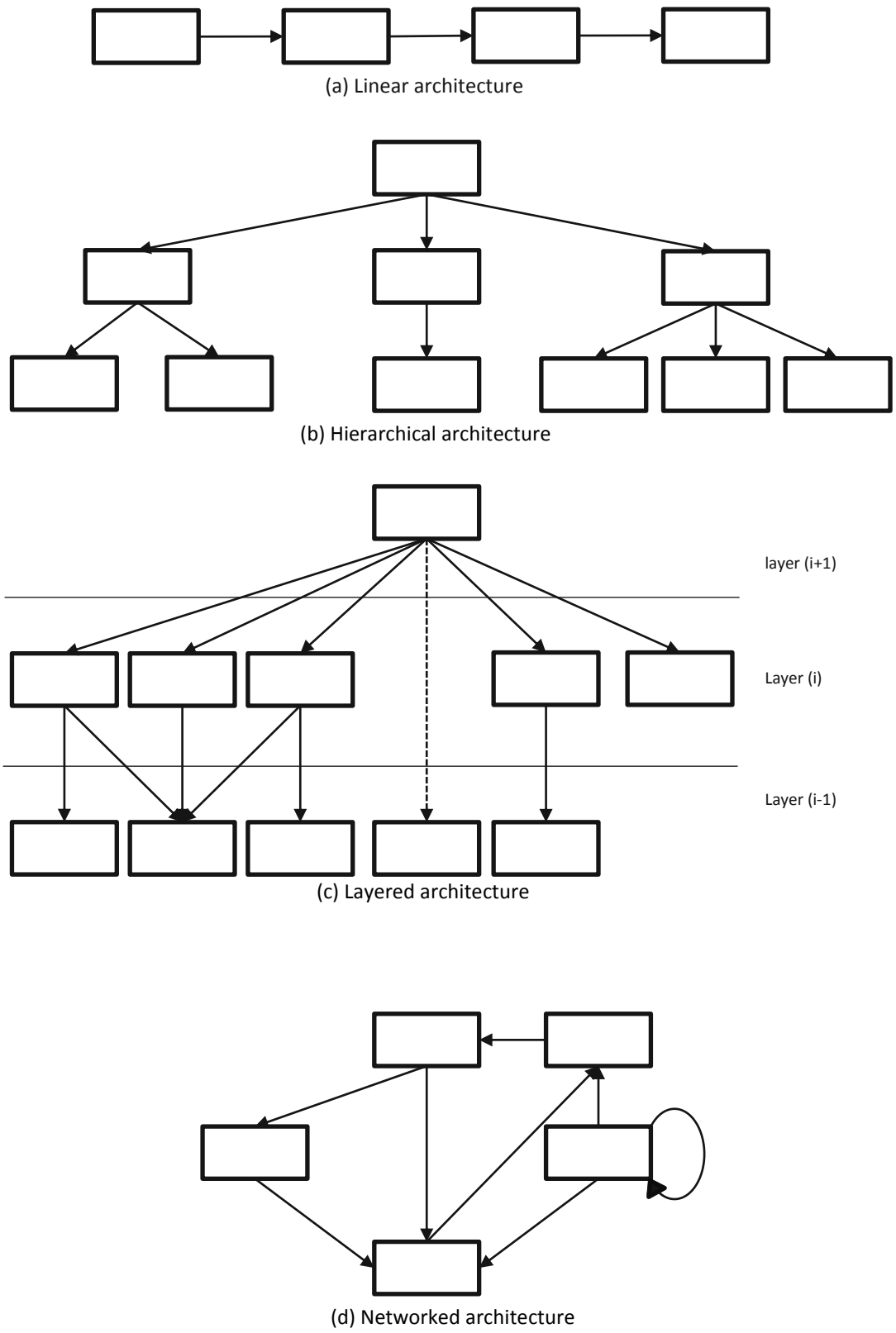


Figure 5-5 Basic types of software architectures - (Voříšek k. , 2015)

The hierarchical architecture features its individual system functions/modules arranged in such a way that their links are represented by a tree graph. This means that every elementary function is always used in just one higher-level function. The hierarchical architecture may only be successfully used if the system is subject to requirements that can be met

through a set of mutually disjoint functions. These functions must be at a lower level of abstraction again divisible into their sets of elementary functions. This assumption is practically rarely met, so strict adherence to hierarchical architecture usually leads to duplicate work and thus increases the creation and maintenance costs. A major challenge also rests in the delivery of new features that do not match the current system structure. On the other hand, the advantage of hierarchical architecture is the clear system structure, which leads to relatively easy system testing and maintenance.

The main disadvantage of hierarchical architecture is its obsolete layered architecture. Its graphical representation is the acyclic graph. The software system functions are arranged in several layers. The higher layer functions may only use their subordinated layer functions. An example of a layered architecture is the current computers structure. The majority of current computers feature their seven basic layers of technical and basic software - see Figure 5-6.

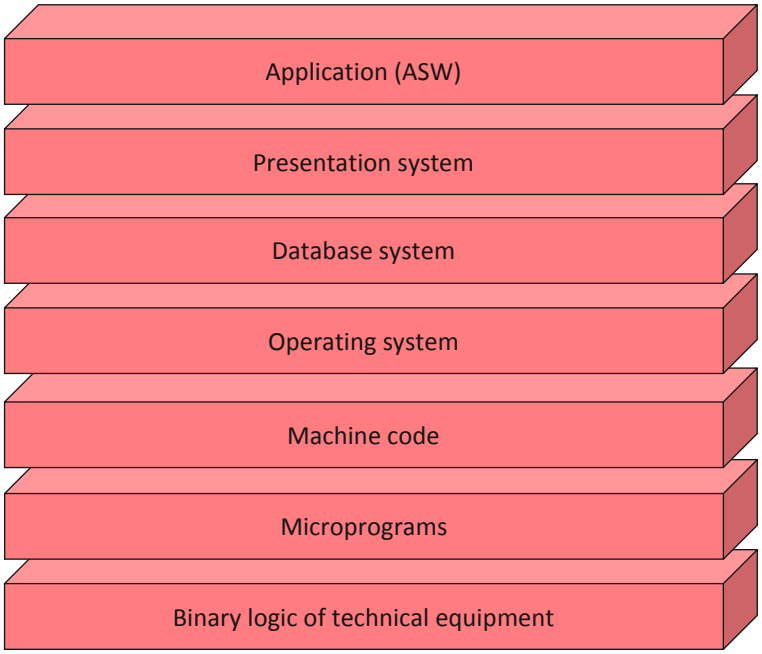


Figure 5-6 Typical basic computer layers - (Voříšek k. , 2015)

The last type of architecture used in practice is a network architecture that is represented by a general graph. It means that there are no binding rules of subordination and superiority of the individual software components. The network architecture is typical of numerous today's extensive software systems. It is de facto the only usable architecture for "real-time developed" systems, because its main benefit is its openness to newly added functions. The previous three architectures are not that flexible because any unexpected requirement to add a particular function may be in sharp contrast to their existing structure of functions. Another benefit of the network architecture is that, compared to the hierarchical and layered architectures, it usually features lower operating costs. On the other hand, out of the specified architectures, it typically features the highest usage costs because its handling by the user is the most demanding. The creation and maintenance costs may be low, but only with the great experience of the creators and their perfect organization, because network architecture leads to the high degree of interdependence of the individual functions (changing one function may enforce a big number of other function modifications). When these dependencies get out of control, it becomes very difficult to detect error propagation across the whole system, and maintenance costs rapidly increase. The probability of such a situation is considerably high in large systems. The experiences with network structure indicate that fixing one error often leads to the occurrence of a poorly predictable number of other errors.

Even a brief overview of software systems architectures indicates that two architectures - layered and networked - are considered for the extensive software system creation. Due to these facts, the use of the network architecture is only justifiable if we have to prefer low operating costs to low creation and maintenance costs and low usage costs (e.g., technological process control systems with response times well below 1 second limit, operating system core). In all the other cases, the layered architecture is more appropriate.

6 BUSINESS INFORMATICS MANAGEMENT PRINCIPLES AND MODELS

Over the last fifty years, the business informatics management has undergone its stormy development. It was characterized by the increasingly deep penetration of ICT into business activities and, at the same time, rapid development of methodologies, methods, and tools of business informatics management.

The aim of this chapter is to describe the current principles and models of business informatics management. The methodological starting point is the MMDIS methodology (Multidimensional Management and Development of Information System), which has been developed at the Department of Information Technologies of the University of Economics since the early 1990s.

The chapter addresses the following questions:

- What are the basic principles of problem-solving related to managing IS/ICT development and operation?
- What is the role of IS/ICT in a process-driven business?
- How to manage the relationship between business and business informatics?
- What are the key ICT processes?

At the Department of Information Technologies of the University of Economics, there the MMDIS (Multidimensional Management and Development of Information System) methodology has been developed since the early 1990s. By the end of the 90s, it was named MDIS and was primarily focused, like most of the methodologies of the time, on the integrated IS development (Voříšek J. , 1999). In this chapter, we will briefly characterize its expansion to comprehensive IS/ICT performance management.

The objective of MMDIS is to develop, maintain, and operate a comprehensive and integrated business information system that optimally exploits the potential of available information technology and information services to maximize its support of business objectives.

The aforementioned MMDIS objective characteristics deserves a more detailed commentary. A comprehensive IS is one that supports all the business activities for which effective informatics support can be found. An integrated IS means that the information system is made up of a whole range of hardware, software, and data components that are interconnected (integrated) into one system. The fact that the IS optimally exploits the potential of available ICT means that it is not necessarily built on the latest technologies and the most sophisticated ICT services, but selects those that have an economic sense for a given business IS. The last part of the sentence then means that the main criterion of business informatics effectiveness is the extent to which it succeeds in supporting business objectives and priorities.

The MMDIS methodology is open, i.e., it evolves along with the development of the economic environment, information technology, and management methods. At present, it consists of eleven basic principles of management and five interconnected conceptual models of business informatics management - see Table 3.

MMDIS Principles
Multidimensionality
integration
Layers
Flexibility
openness,
Standardization
Cooperation
Procedural approach
Learning and growth
Localization of resources and decisions
of measurability

Conceptual MMDIS Models
Business management model
Based on procedural control
SPSPR model
(model of the management of the relationship between a business,
and business informatics)
Model of IS/ICT creation and further development
of the business
Business IS/ICT integration model
ITGPM model
(Reference model of control
of business informatics)
Information strategy creation model

Table 3 MMDIS methodology principles and conceptual models - (Voříšek k. , 2015)

6.1 Business Informatics Management Models

Using the aforementioned management principles, the MMDIS methodology defines the conceptual models of business informatics management. The conceptual models are a methodical tool that supports effective business informatics management. Each of the models:

- Emphasizes other dimensions (views) of management issues,
- Clarifies how to understand and manage a system through the given views,
- It is used to analyse and design a model system and optimize system behaviour through the given views,
- uses specific methods and management tools.

In 2008, when this book was published, MMDIS featured six conceptual models:

- Business management model based on procedural management,
- SPSPR model - model of managing the relationship between a business and business informatics,
- Model of IS/ICT creation and further development
- Business IS/ICT integration model,
- ITGPM model - reference model of business informatics management,
- Information strategy creation model.

A typical feature of all the conceptual MMDIS models is that they do not try to define the individual steps to solve a problem in detail, but provide the user with guidance on how to understand the system, how to access the system management, and where critical solutions are. Concrete solution steps must be designed by the solver himself, while respecting the specifics of a managed system (business size and business informatics, economy field, outsourcing, etc.).

6.1.1 Business Management Model Based on Procedural Management

Model Objectives

The model objective (see Figure 6-1) is to describe the structure of a process-managed business, i.e., the individual management levels and areas, including their relationships. The model demonstrates the place of business process management in management and how certain process parameters affect business performance. The model shows the business performance responsibilities of the individual management levels and how and at what levels the business responds to changing circumstances and changes within the business itself.

Model Diagram

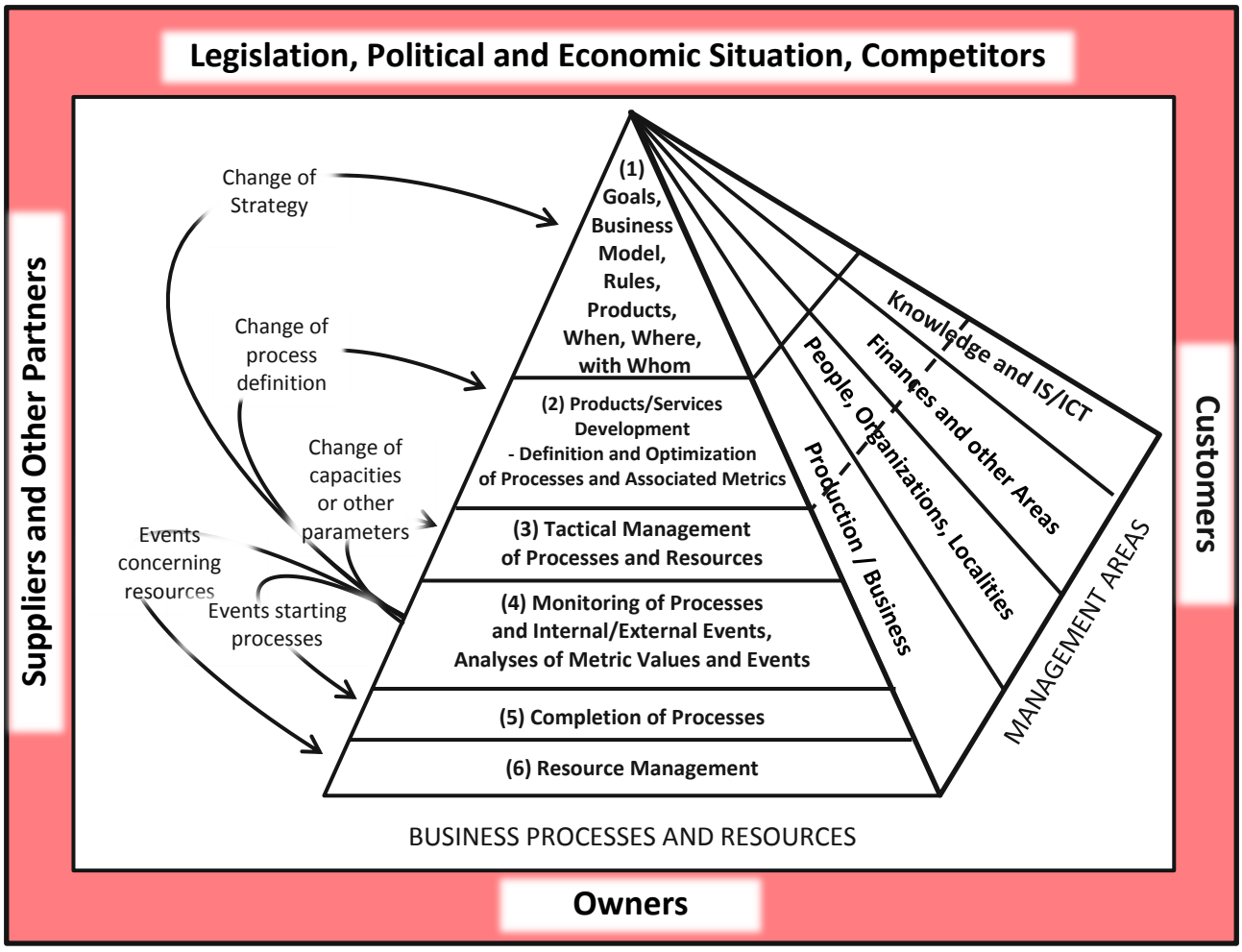


Figure 6-1 Business Management Model Based on Procedural Management - (Voříšek k. , 2015)

The model is important when designing appropriate ICT support for business processes and the individual business management levels.

Principles Applied in the Model

Taking into account that the model covers the entire business and all its areas, it features all the management principles of the MMDIS methodology. For example, the integration principle must be applied when linking processes among businesses cooperating in a supply chain, while solving the linkages of the support processes of every separate business management area with the main processes, etc. The principle of layers is used to divide business activities into six levels (from the strategic level up to the resource management level). The decision localization principle was used to determine the responsibility of every management level for the business performance. An attentive reader of the application of the other model principles will certainly add his own comments.

6.1.2 SPSPR model

Model Objectives

The model solves the relationship between business process management and business informatics management. It defines the basic responsibilities of business and ICT managers in business relationship management - business informatics.

Model Diagram

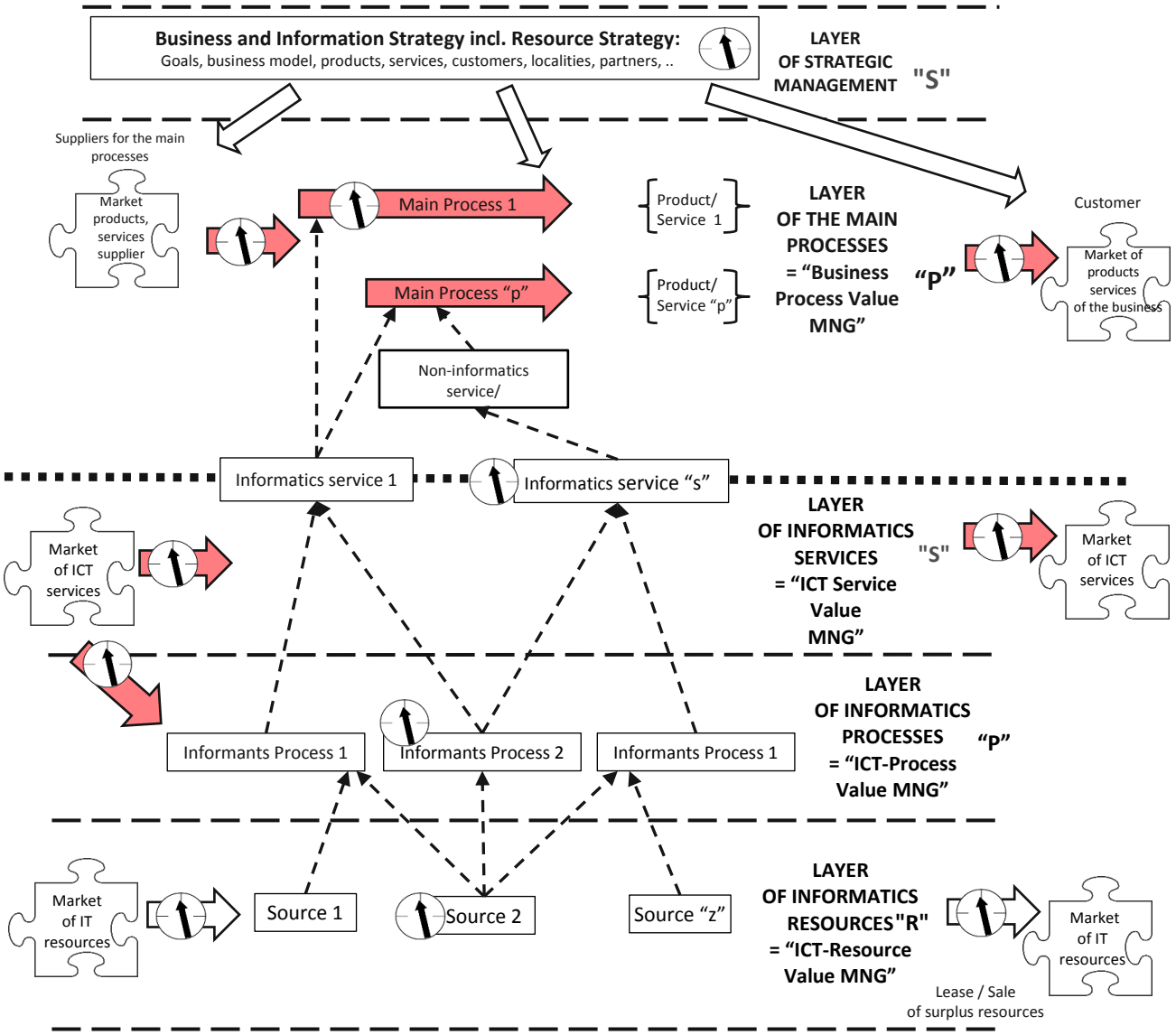


Figure 6-2 SPSPR model - (Voříšek k. , 2015)

Principles Applied in the Model

The principles of multidimensionality, layers, standardization, cooperation, process approach, and measurability are explicitly used in the model.

Comments on the Model

The model solves the relationship between business process management and business informatics management. The basis of the model is business management on five interconnected layers (S - Strategy, P - Business Processes, S - ICT Services, and R - ICT Resources). The goal of the division of management activities into five layers (levels) is:

- A structure of business activities and responsibilities that optimally meets the current requirements for flexible and efficient business management,
- Clear definition of the responsibilities of various types of managers/specialists of the business,
- To make the way of decomposing business objectives into more transparent up to the level of ICT operation management,
- To create a diagram from which you can derive appropriate metrics for the success of individual types of processes and responsible managers for them - see places marked by the alarm.

6.1.3 Model of business IS/ICT creation and further development

Model Objectives

To capture the stages and dimensions of the business IS/ICT development, describe the links among the business strategic management, strategic management of informatics, information projects, and information system operation. To determine which dimension (-s) are priority in every phase of the IS/ICT development.

Principles Applied in the Model

The following principles of the MMDIS methodology are explicitly used in the model: multidimensionality, integration, and layering.

Comments on the Model

The model of business IS/ICT creation and further development is explained in detail in the Strategic management of information system and system integration publication (Voříšek J. , 1999); therefore, here we will only provide a very brief characteristic of the model.

The initial stage of the IS further development is global business strategy (GST). The business strategy is focused on solving those problems, which were characterized in chapter 6.1.1. The business strategy is, of course, focused on the entire business and all of its areas. However, it is the first stage of the IS/ICT development solution because, if we strive for effective IS/ICT, then its main criterion must be how well it supports the achievement of goals defined in corporate strategy.

The second stage is the information strategy (IST). Its main goal is to find effective ways of supporting business goals and priorities through IS/ICT. The main output of the information strategy is the definition of informatics projects that will shift IS/ICT to a state that was planned in the information strategy - for details, see chapter 10.

All the stages of IS/ICT development need to be addressed in terms of multiple different dimensions and their links - see the multidimensionality principle. The set of dimensions and their weights during the solving of the individual stages differ from stage to stage.

By choosing a "top-down" approach to the development of IS/ICT, we ensure that every project is related to the fulfilment of business goals and priorities, while not forgetting to include factors whose omission would lead to project failure and inefficiency of the whole IS. Therefore, the model application thus reduces the risks associated with the effective development of IS/ICT.

6.1.4 Business IS/ICT Integration Model

Model Objectives

To integrate IS/ICT with business and integrate IS/ICT components to each other, thereby increasing the business IS/ICT performance.

Model Diagram

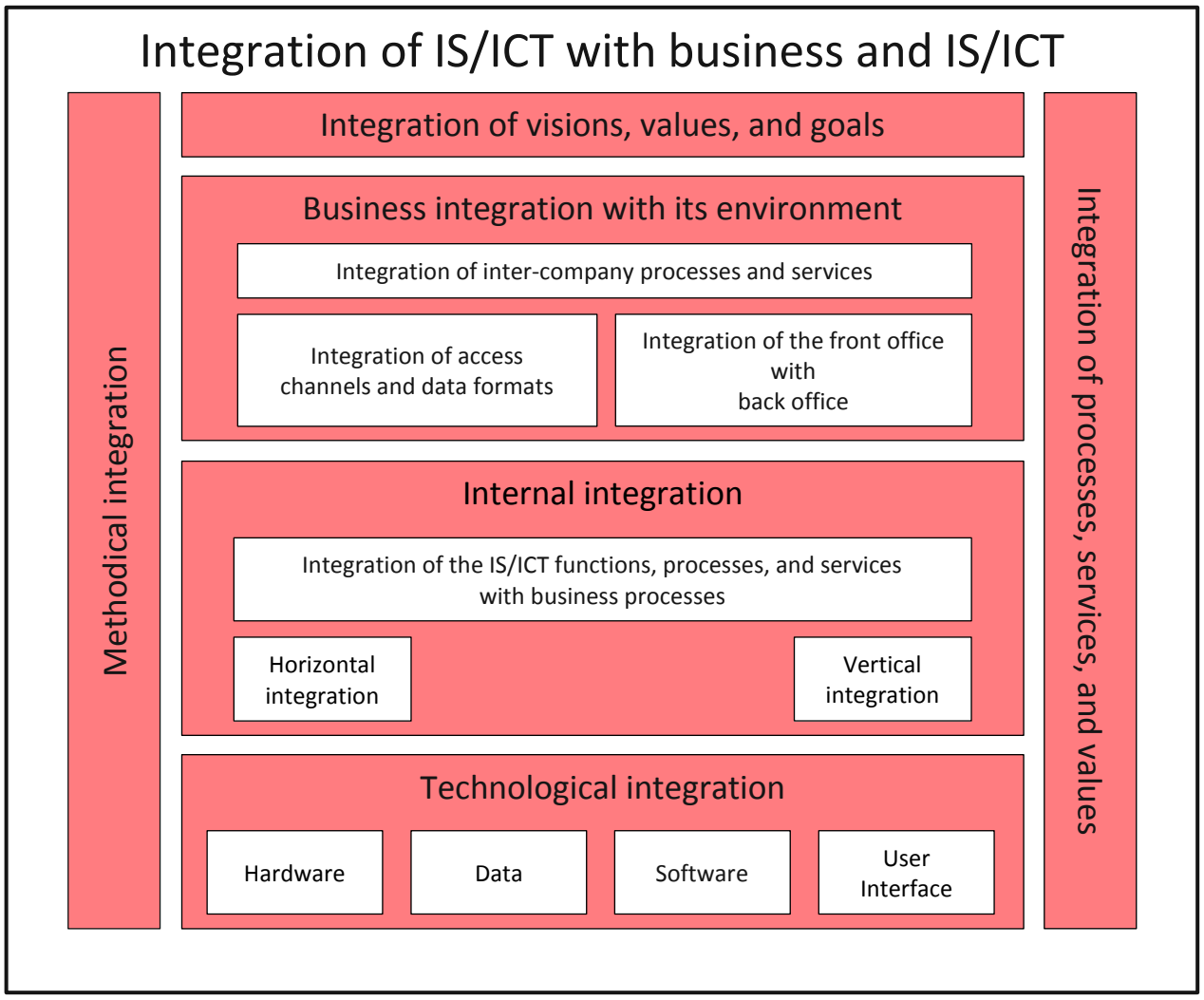


Figure 6-3 Model of IS/ICT business creation and further development - (Voříšek k. , 2015)

Principles Applied in the Model

The following MMDIS methodology principles are explicitly used in the model: multidimensionality, integration, layers, flexibility, standardization, and co-operation.

Comments on the Model

Integration of the business IS/ICT with business activities and integration of IS/ICT components takes place at five levels:

1. Vision integration,
2. Business integration with its environment,
3. Integration of business internal processes,
4. Technological integration,
5. Methodical integration.

6.1.5 ITGPM model

ITGPM Model Objectives (IT Governance and Performance Management)

To describe a reference model of business informatics management based on similar models (in particular from ITIL and CobiTu) and at the same time on the experiences of the members of the Information Technology Department and ITG

consultants.

Principles Applied in the Model

The following principles of the MMDIS methodology are explicitly used in the model: multidimensionality, integration, layers, flexibility, standardization, cooperation, process approach, resource localization, and decision making.

The model diagram and model commentary are available in chapter. 9.2.

6.1.6 Information Strategy Creation Model

Model Objectives

To describe the information strategy creation process.

Principles Applied in the Model

The following principles of the MMDIS methodology are explicitly used in the model: multidimensionality, integration, layers, flexibility, standardization, cooperation, process approach, resource localization, and decision making.

The model diagram and model commentary are available in chapter. 10.

7 CORPORATE PERFORMANCE MANAGEMENT AND ITS ROLE IN BUSINESS MANAGEMENT

The purpose of this chapter is to clarify the core principles of Corporate Performance Management (CPM). In addition, the individual CPM components and their technological support through information technology tools are described in detail here. In conclusion, there we discuss the requirements for an effective CPM system. This chapter is the starting point for the subsequent definition of a business informatics system performance management system.

The chapter addresses the following questions:

- What does the CPM concept contain and how is implemented in the business?
- What are the sub-applications for performance management, and how can IT be used to create them?
- What are the common core principles, models, methodologies, and business management methods on which we will build the following text?

7.1 CPM Characteristics

As already mentioned above, CPM is the main representative of performance management systems. However, the principles described in here are usable (and used) in other more detailed PM systems (described in the previous chapter). The implementation of the CPM principles in business informatics is described in Chapter 10.

If we wish to understand the CPM concept in a broader context, it is worth mentioning the history of its origins. The term Corporate Performance Management only dates back to the late 1990s, especially in academia. At this time, however, there is still no final definition of this term, and, therefore, some readers are lost when the individual authors interpret this concept differently. Since 2001, however, both the academic and commercial environments have leaned towards a unified definition created by the Gartner analytical company, which is in line with the general definition of performance management systems.

Corporate Performance Management is a comprehensive term that describes all the processes, methodologies, metrics, and systems needed to measure and manage the organization's performance (Geishecker & Rayner, 2001).

It is a comprehensive system of organizational, automation, planning, monitoring and analytical methodologies, procedures, metrics, processes, and systems that help management manage their business performance.

CPM is a holistic approach to business strategy implementation and monitoring, combining: (Coveney, 2003):

- Methodologies - including methodologies that support efficient business management (e.g., Balanced Scorecard). At the same time, technological methods for the implementation of CPM systems can also be included in this group;

- Metrics - which are defined in the implementation of these methodologies in a business,
- Processes - used by organizations to implement and monitor performance management,
- Applications and technologies - information systems to support performance management at all the levels of the organization, supporting the given methodologies, metrics, and processes.

CPM combines various modern technologies and business management practices or practices in a way that makes the formulation and implementation of business strategy itself as easy as possible.

The CPM definition can be graphically represented through the following scheme:

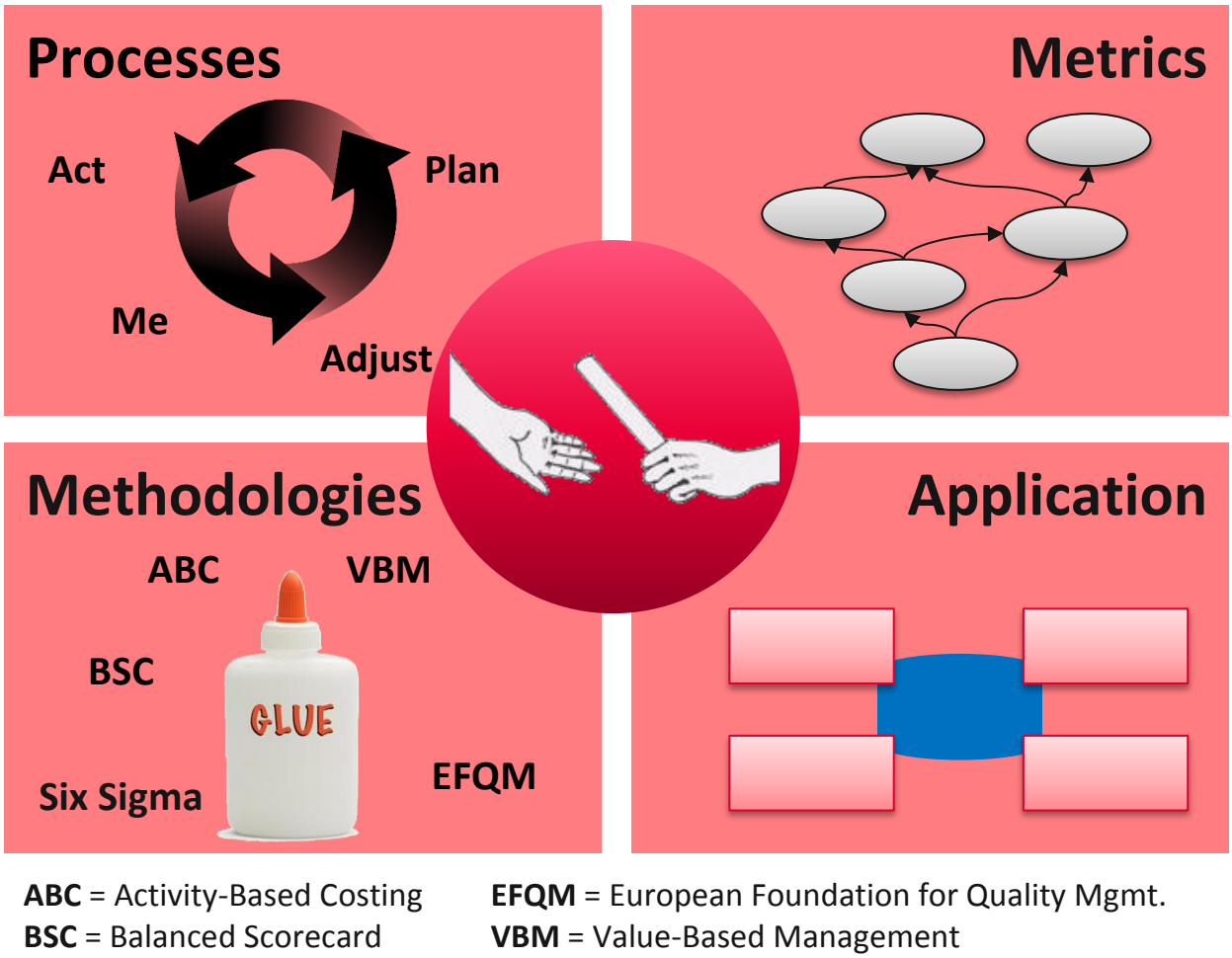


Figure 7-1 CPM as a Relay Run per (Chandler, 2007)

CPM is often referred to as the next generation of Business Intelligence. By way of comparison, we mention the definition of this term per Howard Dresner, Gartner analyst, of 1989: "Business intelligence is a set of concepts and methods designed to improve the firm's decision-making." Also, let us mention a more comprehensive definition of CSSI. "Business intelligence is a set of processes, applications, and technologies designed to effectively and efficiently support decision-making processes in the business. They support the analytical and planning activities of businesses and organizations and are built on the principles of multidimensional data views." (Novotný, Pour, & Slánský, 2005)

Therefore, it is clear that CPM is not synonymous for Business Intelligence, planning, consolidating financial statements, and even not for any Balanced Scorecard. It is more about the integral interconnection of these functions, processes, technologies, and procedures. In the course of time, CPM has matured from vision, into technology up to a comprehensive system, and cannot be isolated to one of its elements. (Cognos, 2005). BI applications used to focus on the measuring of revenues, profit, quality, and similar metrics. CPM extends this approach to the concept of "management," which includes processes, such as planning, forecasting, and business strategy basics. Unlike BI, CPM is characterized by a close link to the performance management methodologies (BSC, ABC, EVA). Although these methodologies can determine what and how to measure, they lack a technological device to process dynamically

changing values that reflect current developments in and outside of the enterprise. It is precisely the implementation of BI applications that support the aforementioned methodologies, which is the core of the current CPM concept.

The practical application of the CPM vision, which is based on the fact that even large multinational companies, thanks to their efficient performance management, gain flexibility and rapid reaction capability, typical of small companies, can only be observed nowadays. The reasons are per (Cognos, 2005) and other authors, as follows:

- Change in the business performance outlook that shifts from past performance measurement to forecasting and future performance management. It turns out that traditional measurements accentuating past performance assessments (typically, for example, most financial metrics) are limiting and insufficient to business management and its success on the market;
- Businesses have already achieved their operational efficiency thanks to their ERP systems, and now, they intend to use the information contained there as their strategic competitive weapon,
- The Sarbanes-Oxley Act (SOX) and other legislation have fundamentally changed the business management methods, with the emphasis on the transparency and clarity of their internal processes, results, and reports. This makes it possible to use forced SOX investments to implement CPM systems, which, besides mandatory legislative outputs, bring additional added value,
- Sufficient maturity of CPM support technologies.

Recently, the Business Intelligence 2.0 term has also emerged in expert discussions about CPM. (Raden, 2007) It is defined as "unlike the first BI generation, as more proactive, working in real time, more operational, integrated with business processes, and going beyond the business borders. It provides its users with a simple environment for analysing and modelling data from various sources without any greater knowledge of data structures, integration processes, and statistical models on which their analytical tools are based." Therefore, this approach attempts to bridge the often-criticized view of BI systems as just a rigid tool delivering static reports with limited usability. The concept of Business Intelligence 2.0 has much more in common with CPM in this respect, and CPM could be considered as a development step towards the second BI generation.

7.2 Basic CPM principles

7.2.1 CPM methodologies

The managerial approaches and information systems that form the essence of the Corporate Performance Management are to substantially accelerate and streamline this process. They are to show managers the strengths and weaknesses of their business and its resources and to help identify market opportunities. It is no wonder that during the 70's - 90's a whole range of managerial and financial theories and approaches come up or improve. They strive to transform the business, so it is able to compete in a modern competitive environment.

At this point, we provide at least their examples in the form of a commented list per (Veber, 2000) and other authors:

- Balanced Scorecard (BSC) - Introduced in the early 1990s by R. Kaplan and D. Norton, which is a comprehensive system of balanced, not only financial standards, aiming to streamline the implementation, monitoring, and correcting of business strategies;
- Total Quality Management (TQM) - representing the 1960s approach based on quality management by all the employees of the organization, pursuing long-term success that is based on customer satisfaction;
- EFQM Excellence Model (EFQM) - a model introduced for the first time in 1992, based on the premise that excellent business results can only be achieved with the utmost customer satisfaction, employee satisfaction, and respect for the environment. However, this is conditional on the precise handling and management of processes, which requires not only properly defined and developed policy and strategy, but also a sophisticated system of managing all the kinds of resources and building partnership relations. This is made possible by adequate culture and leadership at all the management levels;
- Six Sigma (6σ) - a set of principles implemented by Motorola in the 1980s, which aims to systematically improve processes by eliminating their defects. The measurement, analysis, and improvement of business processes, the effort to eliminate variations in outputs and the involvement of resources across organizations are again at the forefront;
- Activity Based Casting (ABC) - represents a modern management accounting method, which emerged in the 1980s, it allows the allocation of costs to the individual process activities. It is a strategic tool for business process

optimization and monitoring;

- Theory of Constraints (TOC) - promoted since 1980s by E. Goldratt. It is a managerial philosophy that seeks to achieve the objective (profit) through the identification and removal of constraints in the system (business) to ensure greater flow and objective achievement. TOC has found its applications in logistics, finances, marketing, information systems, and project management;
- Economic Value Added (EVA) - Developed in the 1990s by Stern Stewart & Co, showing an approximate economic gain, expressed as the difference between accounting profit and capital costs;
- and other approaches highlighting, for example, strategic integrated management, rigorous procedural management, decentralization of competencies, customer-oriented organizational structure of business, etc.

The common denominator of these approaches is also the gradual change in the performance measurement paradigm. There is a clear shift from the "classical", financial, hard metrics (such as profits, turnover, etc.) to the new, soft and combined metrics or entire metric systems. Only then is it possible to capture the whole complexity of the business environment, whether it is its financial condition, the internal processes or the development of relationships with suppliers, customers or the state. This phenomenon has a huge impact on the wider area of management. The aforementioned approaches form the basis for CPM. It is important to keep in mind that CPM is not associated with any specific management approach, but it is a combination of the effective use of various management systems and their elements.

7.3 IT Infrastructure for CPM

The applications or computing infrastructures that support business performance management have a long history in the information systems theory. The beginnings of the systems, which were to support managers during their day-to-day analytical roles, only appeared at the end of the 1960s Businesses began to process their business data in their own computing centres - see chapter 2. Over time, the amount of data that was available for analysis grew steeply. The first development stage of CPM applications was so-called Decision Support Systems (DSS) that were typically built for single-user use in the 1970s and featured their implemented optimization and simulation models. Their most frequent applications have been found in financial planning systems. However, the technology of that time were not yet matured, so their report generation in support of management needs used to take weeks to months. Information was only partially usable - just for the needs of strategic management (Power, 2003). The next stage of development came in the form of Executive Information Systems (EIS) in the early 1980s. These greatly expanded the possibilities, functionality, and concepts of the DSS systems that were previously used. The outputs of the first EIS systems were prepared by business and IT analysts for the senior management. An important novelty was the use of relational databases, which at that time developed in a stormy manner on the basis of E. F. Codd's theoretical foundations. The first deployment of EIS systems is associated with the American aviation company - Lockheed. The market also featured the first EIS commercial products that were based on multidimensional storage and data processing. These were mainly products of Comshare and Pilot.

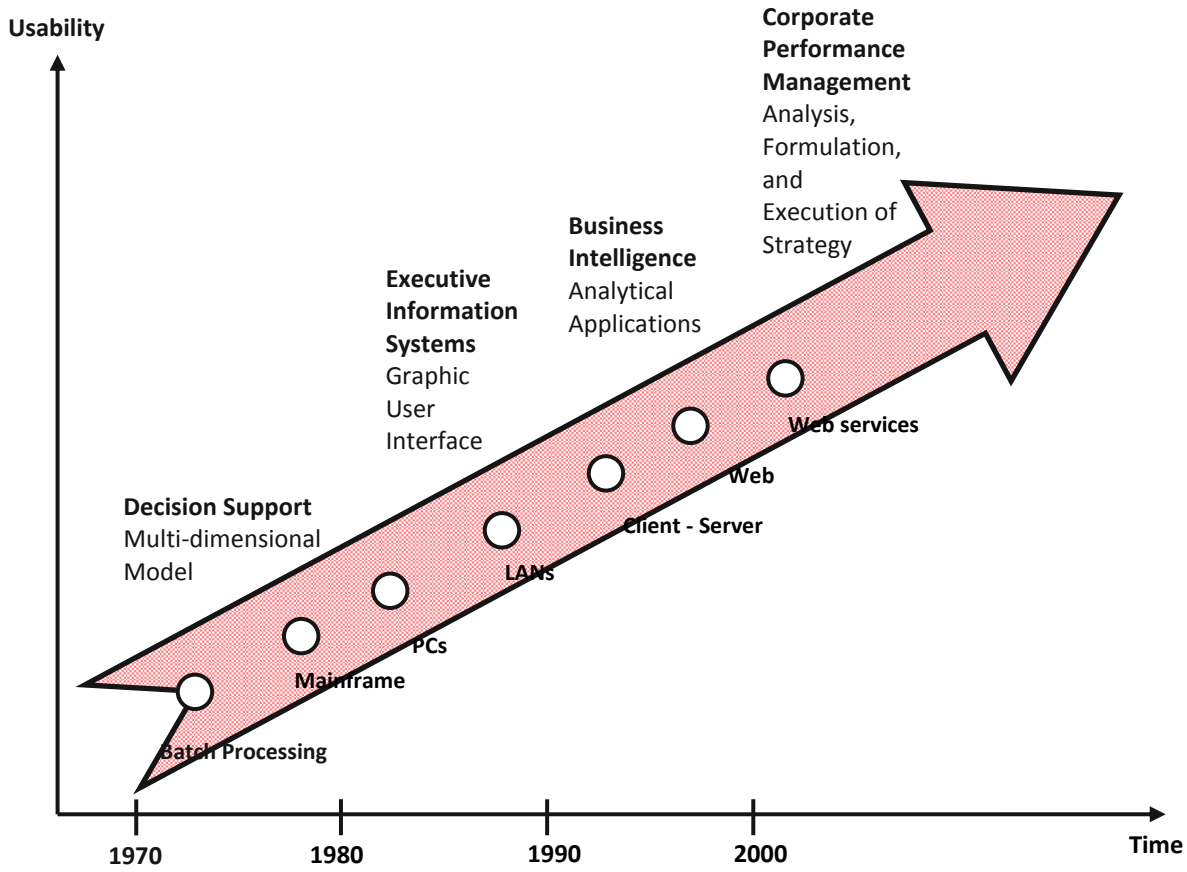


Figure 7-2Development of BI Technologies (Coveney, 2003)

The turn of the 1980s and 1990s is characterized by the stormy development of the theoretical backgrounds and technologies that enable their fulfilment. Their essence is being used even today. There are crystallizing significant differences between the OLTP and OLAP systems, and software developers are reacting to these impulses by offering sophisticated products and technologies (such as HOLAP, MOLAP, and ROLAP data storage). The data warehouse (DWH) and data market (DM) building trend keeps growing. In addition to technologies, the methodologies, procedures, and principles for business intelligence (BI) are developing, mainly thanks to R. Kimball and B. Inmon (Pendse, 2007). At present, we are witnessing the further development of BI, both methodological and technological. There are a number of complex sophisticated platforms for robust BI systems available on the market. The user interface options expand to provide management with intuitive, quick, interactive analysis across a variety of clients and end devices (Internet browser, spreadsheet, PDA, etc.). The new integration tools and development environments are emerging for rapid deployment not only within business systems. Advanced data mining methods are used to process and handle semi-structured or unstructured data.

The CPM technology Infrastructure provides integration tools, scorecard automation, business intelligence components, including reporting and consolidation of financial statements, and planning support. It is generally a set of technologies that can extract useful information from huge amounts of business data for the management of all the layers. Applying the CPM technology to a business earns key information using the tools for planning, budgeting, analysis, and reporting. The CPM applications typically offer advanced support for predictions (forecasts), risk analysis, and work with business scenarios (see the previous chapter). An important feature of these systems is that they provide integrated support for CPM processes and allow them to respond quickly to events occurring in the business or its surroundings. This is not just a set of previously defined activities planned according to a schedule (e.g., a fiscal year). The CPM technology must, of course, also support business management methodologies (e.g. Balanced Scorecard). The basic diagram of the CPM technology infrastructure is shown in the following figure.

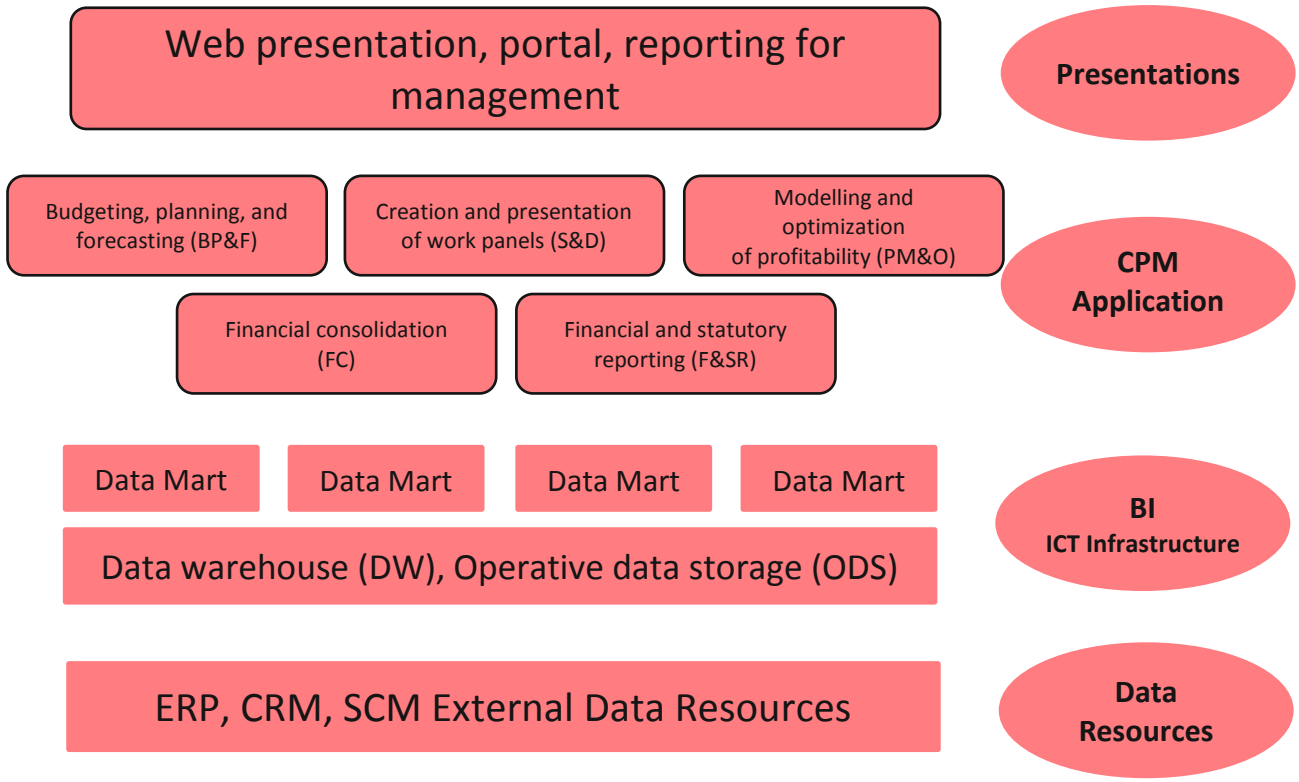


Figure 7-3 CPM technological infrastructure (Chandler, 2007)

As mentioned earlier, CPM builds on years of proven and now mature BI technologies. They include primarily:

- Online Analytical Processing (OLAP) - Tools that allow one to quickly analyse data stored in databases, aggregated into multidimensional views and hierarchies. The user can choose various views on data, trend counting, etc. (for example, instant calculations of the financial profit indicator for one selected product or their group, or so-called drill down analytical decompositions that show detail of the generation of profit by individual items);
- Datawarehouse (DWH) - a data warehouse, is the main storage of enterprise data for later processing in analytical applications. Robust relational database systems (Oracle Database, Microsoft SQL Server, Sybase IQ, IBM DB2) are configured for this use. Depending on the extent and content of the data, a data warehouse can be further subdivided into smaller department-specific data markets (data marts, DM), which are used to analyse one department (e.g., business controlling);
- Extraction, Transformation, Loading (ETL) - tools for extracting data from data sources (such as relational databases, company transactional systems, web services, flat files), transforming them and uploading to a data repository (e.g., DWH). When transforming from primary systems, data quality tools are often used, such as removing duplicate records, adding missing attributes;
- Data-mining (DM) tools are "tools for retrieving non-trivial, hidden and potentially useful information from data." (Berka, 2003) They enable businesses to retrieve information from data stored in data warehouses, for example, about patterns of customer behaviour that can be used for example for marketing purposes campaigns, segmentation), risk management, etc. The data mining tools use complex algorithms based on sophisticated methods (statistics, cluster analysis, neural networks, etc.);
- Analytical Tools - Analytical client tools that inquire the OLAP server based on user requests, and display results in a variety of graphs, decay trees, contingent tables. They allow the user to perform other data operations (definition of custom pointers, prediction of pointer development, etc.). These applications include common spreadsheets (MS Excel), but also advanced analytical applications implementing statistical or econometric models, graphic decay trees, etc. (SAS, ProClarity). Selected analytic functionality is also shifted to business Intranet environments where simple analysis can be performed through a web browser;
- Reporting Tools - client tools used to automate corporate reporting generated from OLAP servers, as well as other data sources. They are primarily used to view predefined reports or define ad-hoc reports. Typically, they

feature their planning and distribution functionalities, allowing them, for example, the automatic spreading of individualized reports by e-mail. Reporting tools have the ability to export reports to a variety of formats (e.g., PDFs) and integration with office applications or business Intranets;

- Business Dashboards - are applications that allow you to organize a presentation of selected predefined key performance metrics (calculated on an analytical server or directly in the application) in a clear and intuitive graphical form. Instead of the exact expression of a numerical value, so-called scales, alarm clocks, graphs, trend indicators, etc. are often used. It is often used to associate a value with an area on a map or product photos to which that value applies;
- Business Process Management (BPM) - these are applications that allow one to monitor the performance of individual business processes, in terms of their connection to the company's information system (e.g., order processing period). They often feature their interface for integration with BI systems;
- Enterprise Content Management (ECM) - ECM systems allow document storage, collaboration, version tracing, workflow, Intranet, Internet, etc. This is necessary to support the individual CPM processes that workflow options use.

When BI/CPM technologies are deployed in a business, multiple routes can be taken. Based on the information strategy, information architecture, user requirements and other relevant aspects, businesses choose:

- A system that offers BI/CPM functionality and is based on the implemented application software. An example of such a solution can be, for example, a modular superstructure over Oracle or SAP ERP systems. The advantage is tight integration with the package, quick deployment. The disadvantage is mostly poor scalability and limited functionality;
- A dedicated BI/CPM software that addresses integration with primary systems and other data sources individually. This can take the form of pre-prepared solutions or a platform to develop these custom applications. The leading suppliers of these systems include (Cognos or IBM, Hyperion or Oracle, Microsoft, Sybase, SAS, and NCR).

Interesting is the genesis of the performance management system functionality requirements. (Hroch, 2007) For example, it is said that most companies are implementing basic reporting with the possibility of analysing in contingency tables. If such a solution is verified and tested within a business, the functionality for advanced analytics, data mining and scorecarding is extended. The most mature level of performance management system is the addition of business modelling (business scenario creation), budgeting, and scheduling; therefore, the remaining components of the CPM concept.

8 SELECTED STANDARDS OF BUSINESS INFORMATICS MANAGEMENT (ITIL, COBIT, ...)

As can be seen from the previous chapters, information systems become more and more profound in business processes and their management. This increases the complexity of enterprise informatics technology. Managing this complexity requires ever more sophisticated approaches to corporate informatics management.

This chapter provides a brief description of the most important standards and frameworks that are used in practice for business informatics management. Standards selected: ITIL, CobiT, ISO/IEC 20000, COSO, Basel II, AS 8015-2005, and IT Balanced Scorecard. We will deal with the first two in more detail.

The chapter is to address the following questions:

- What is the essence of the individual standards, and how are they different?
- How do they affect business informatics management?

8.1 ITIL

This chapter contains selected core ideas and contexts of the ITIL (IT Infrastructure Library) standard. It is a set of publications describing the best practices of ICT services management and a system of certification and training of individuals in the knowledge of these practices.

OGC is a United Kingdom office that was established to gain more value from government spending and, through its activities, assists government agencies in project management, purchasing, and so on. OGC is the owner of ITIL. The

ITIL publisher is The Stationery Office (TSO). The official accreditation for ITIL certification is provided by APMG (OGC, 2008). Development and user discussions on the ITIL topics are covered by the IT Service Management Forum (ITSMF), an independent and non-profit organization that enables its members to share their experiences with business informatics management.

The ITIL publications are broken down into basic publications and derived publications.

The basic publications include:

- ITIL version 3
    - Service Strategy,
    - Service Design,
    - Service Transition,
    - Service Operation,
    - Continual Service Improvement,
    - Glossary,
    - Acronyms,
- ITIL version 2
    - Service Support,
    - Service Delivery,
    - Security Management,
    - Applications Management,
    - Planning to Implement Service Management,
    - ICT Infrastructure Management,
    - ITIL Business Perspective,
    - ITIL Business Perspective 2: The Business View on Successful IT Service Delivery,
- Web publications,
    - Syllabus for the qualification scheme.

The derived publications include, for example, the overview pocket editions of the individual basic publications, study handbooks, translations of basic publications, and others, such as:

- ITIL (version 2) Software Asset Management,
- ITIL process map,
- An introductory Overview of ITIL-v3,
- ...and others.

ITIL also publishes other authors' publications, using the ITIL brand license. The publications are available commercially in their printed or electronic form (OGC, 2008).

8.1.1 ITIL version 3

In 2007, ITIL version 3 was released. The basis of ITIL v3 consists of five books, supplemented by an overview publication that is an introduction to the issue (OGC, 2008).

The third ITIL version, unlike its version 2, was released at once, and the books form; therefore, a consistent whole. In the previous version, the processes were described separately, and the special chapters described the context and process continuities. In version 3, processes are organized into a service lifecycle. The service lifecycle is an essential aspect of book structuring, and a description of some processes appears in multiple books. The process books and chapters feature their unified structure, making it easier to use them in engineering, but on the other hand, it reduces the scope of version 2.

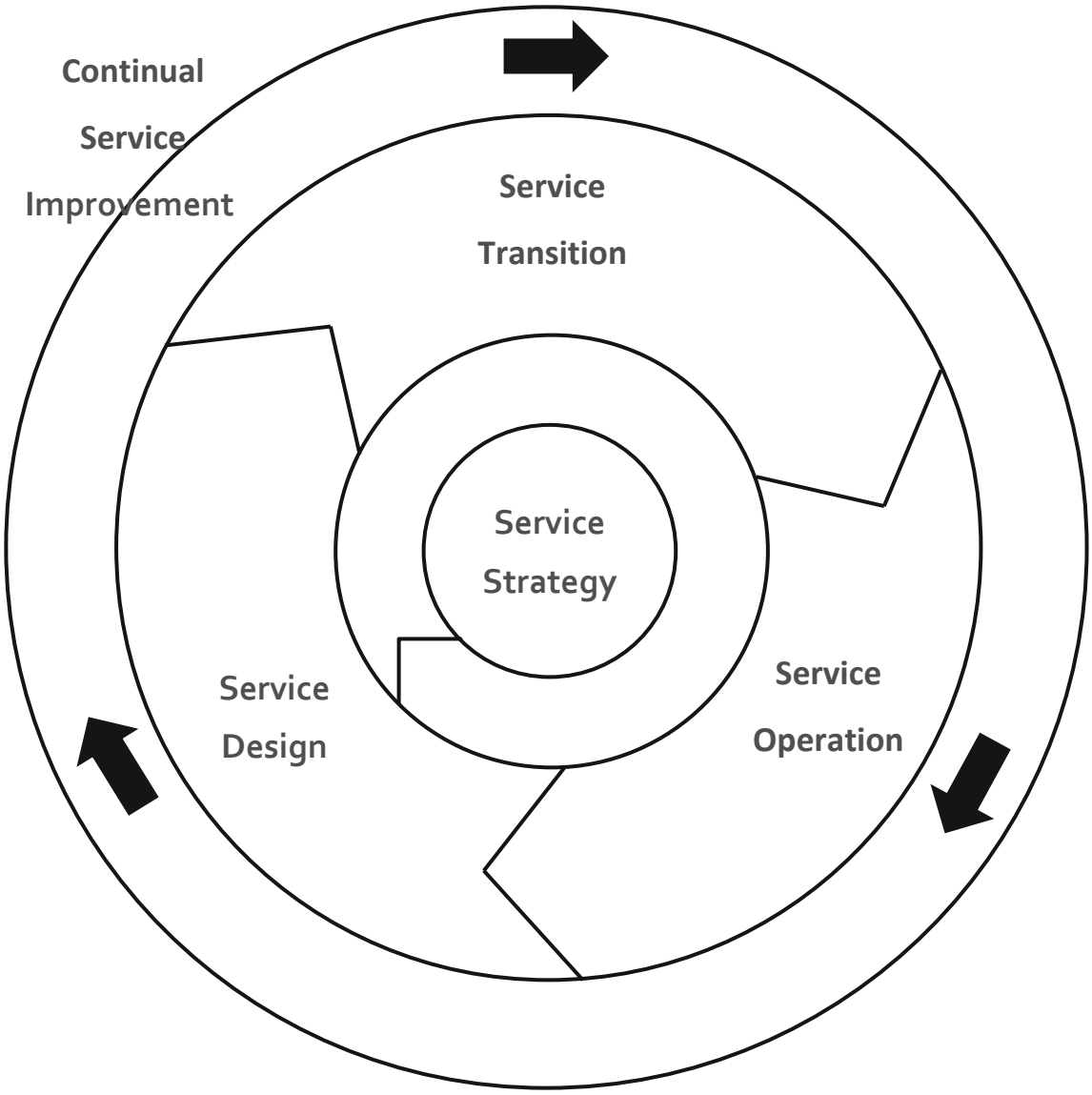


Figure 8-1 ITIL v3 Structure (ITIL3 SS, 2007)

The Service Strategy (ITIL3 SS, 2007) book deals with strategic service management. The book introduces the principles and guidelines for implementing service management as a strategic asset that will provide the business with its ability to transform resources into service delivery, delivering value for business that can be managed through service management processes and continual improvement. The core topics of the book are the development of an internal or external market for services, a catalogue of services, a strategic view of the service life cycle, financial management of services, portfolio management, development of the organization and others. The book explains the reasons for introducing the principles of service management with regard to the customer service business. The relationships between strategies and topics from other books are described.

The Service Design (ITIL3 SD, 2007) publication topic is the design and development of services and service management processes. This includes the principles for converting strategic objectives into service and asset portfolios. This is mainly the design of:

- New or changed services,
- Service management systems and tools (including service portfolios and service catalogues),
- Technological architecture and management system,
- Necessary processes,
- Measurement methods and metrics.

The processes described in the Service Design book are:

- Service Catalogue Management,
- Service Level Management,
- Capacity Management,
- Availability Management,
- IT Service Continuity Management,
- Information Security Management,
- Supplier Management.

The purpose of the Service Catalogue Management process is to provide a single source of consistent information about all the services agreed and ensure that it is available to all the authorized persons.

The Service Level Management process negotiates and documents the subject and parameters of services with business representatives in SLA documents, and then tracks the ability of the provider to deliver negotiated services, as in ITIL version 2. Similarly, there are similar processes like Capacity Management, Availability Management, and IT Service Continuity Management. The new Information Security Management and Supplier Management processes have been added.

The selected requirements for management activities and design of technology architectures (data and information management and application management) are described.

The section on organization describes the roles and responsibilities of process owners. To identify the responsibilities for every activity, ITIL recommends using the RACI matrix as a tool. The RACI matrix is a matrix whose columns feature the individual roles or organizational units and rows feature actions or processes. The matrix cells identify the person's relationship to a given activity:

- Responsible - the person who participates in the activity,
- Accountable - the sole person responsible for the activity,
- Consulted - the person with whom the activity is being consulted,
- Informed - the person who is reporting the implementation progress.

The Implementing Service Design section describes how to introduce processes and how to measure process maturity and organization IT.

The Service Transition (ITIL3 ST, 2007) book provides advice on how to deploy new and changed services, taking into account the risk of errors and interruptions in service delivery. The processes described here are:

- Transition planning and support,
- Change Management,
- Service asset and configuration management,
- Release and deployment management,
- Service validation and testing,
- Evaluation,
- Knowledge Management.

The transition planning and support include activities related to the planning of suitable capacities and resources to create "release", testing, and launch of new or changed services, and related support and coordination activities.

The Process Change Management covers the logistics of any changes in service, asset-related assets, and configuration units. Its goal is to ensure that changes are recorded, assessed, authorized, prioritized, planned, tested, implemented, documented, and controlled in a controlled manner.

The purpose of the Service asset and configuration management process is to identify, record, manage, report, audit, and verify assets and configuration units. Assets and configuration units are stored in the Configuration Management System (CMS). The Definitive Media Library (DML) is intended for software and other media (especially copyrighted or licensed content).

The release and deployment management prepares changes to releases, tests them and puts them into operation, so that the planned value is properly delivered to the customer and does not endanger any service operation.

The Service validation and testing process plans and tests to verify whether a release provides the planned value within the planned parameters, whether the intended purpose is achieved, identifies the issues, errors, and risks during a

service change. For testing, the book recommends the Service V-model (a model that defines the deployment tests for every service description level).

The Evaluation process is concerned with the assessing whether the expected service parameters are in line with the investor's expectation that the current service parameters, once the change is implemented, are in line with the planned and verifies unexpected service change effects. The results are the input for Change management.

Knowledge Management is to ensure the recording, transmission, and communication of knowledge, particularly during service changes. The process is based on the Service Knowledge Management System (SKMS), which is an extension of the Configuration Management System.

In addition, the book describes activities related to communication of changes within an organization, management of changes in organization and investors and IT management with respect to investors.

The Service Operation (ITIL3 SO, 2007) publication is dedicated to operational processes during service provision. The processes are as follows:

- Event Management,
- Incident Management,
- Request Fulfilment,
- Problem Management,
- Access Management,

and operational activities during the other service life cycle processes:

- Change Management,
- Capacity and Availability Management,
- Financial Management,
- Knowledge Management,
- IT Service Continuity Management,
- Service Reporting and Measurement.

Event Management is a process that tracks all the events that occur in the IT infrastructure and detects and escalates exceptional conditions.

Incident Management is committed to restoring an interrupted service to users as quickly as possible to minimize the impact on business.

Request Fulfilment addresses user service request handling.

Problem Management conducts cause analyses to resolve and close incidents and events and to prevent proactive activities from any future incidents and problems. It also creates procedures for quicker solutions of recurrent incidents.

Access Management ensures authorized users may use the service and prevents unauthorized users from using it.

In addition to the processes, a number of activities, especially of a technological nature, that need to be performed during the operation of ICT services are described.

Further, the Service Operation presents the organizational aspects of the operation of the information system, and possible organizational structures are proposed. The basic described functions are:

- Service Desk,
- Technical Management,
- IT Operations Management (IT Operations Control and Facilities Management),
- Application Management.

The latest ITIL version 3 is Continual Service Improvement. (ITIL3 CSI, 2007). This publication addresses the tools for ensuring the compliance of ICT services with business needs through continuous improvement of services throughout their lifecycle.

The publication describes, for example, the Service Gap model, in which it identifies sixteen possible misunderstandings arising from service perspectives from different perspectives. The basis for continuous improvement is Deming/Shewhart's "Plan-DoCheck-Act" cycle. The basic process of the publication is the continuous improvement process in seven steps, followed by Service Reporting and Service Measurement.

The publication also focuses on the return on investment in IT, value of investment, look of business to improve service, and Service Level Management process from the continuous improvement perspective.

Part of ITIL version 3 is also a qualification system. Through accredited organizations, individuals can take exams and qualify at four levels: (OGC, 2008):

- Foundation Level,
- Intermediate Level (5 Lifecycle Stream certificates and 4 Capability Stream certificates),
- ITIL Expert,
- ITIL Master.

8.2 CobiT

The second in practice the most widely used standard of business informatics management is the CobiT procedural framework. CobiT (Control Objectives for Information and Related Technology) was developed and published by ISACA, a non-profit independent organization.

The goal of CobiTu is to use the international standards and best experience for information technology management and auditing. The enterprise is managed as a whole according to defined rules (Enterprise Governance). Business informatics, which is a subset of this whole, is also governed by defined IT-specific rules (so-called IT Governance) derived from Enterprise Governance. IT Governance helps to reconcile IT and business strategy, respectively, transform business strategy and its objectives into specific IT strategic goals and plans. It is an IT management, checking, and monitoring system that helps realize value from IT and manage IT risks, including ensuring unambiguous responsibilities through role and activity definition. (ISACA, 2008).

CobiT is a set of internationally recognized IT Governance Best Practices designed for managers, auditors, and IT users. It provides a set of metrics, indicators, processes, and best practices for designing and achieving business goals.

8.2.1 Structure of the CobiT Procedural Framework

CobiT defines four domains of business informatics management and a total of thirty-four IT processes. For every IT process, it proposes criteria for process performance measuring and for assessing the risks associated with the process. As a control framework, CobiT defines the rules, procedures and processes to ensure that business goals are attained and that the likelihood of any associated risk is minimized.

The CobiT procedural framework describes IT processes and associated control criteria, management guidelines, including activities, responsibilities, competencies and performance criteria, and maturity model models. CobiT also promotes business management in the area of development, deployment, continuous improvement, and measurement through the definition of proven IT methods.

The CobiTu target group includes users, managers, and auditors. Users can engage in IT product and IT service management within CobiTu, allowing managers to find a balance between investment, risk, and management. For auditors, CobiT is a supporting tool for designing internal controls and optimization.

CobiT is primarily focused on strategic and tactical management staff within their organization. It is useful for people with direct responsibility for business processes and technologies (business and IT management). CobiT helps increase the relevance and reliability of IT-information, and will also be appreciated by staff who provide quality control services, control, and IT administration.

8.2.2 CobiT Domains

The four core business process management areas of CobiT include:

- Plan and Organize, PO
- Acquire and Implement, AI
- Deliver and Support, DS
- Monitor and Evaluate, ME

Plan and Organize

The Planning and organization domain covers the level of strategic and tactical IT planning and organization, including business value-added management for business. In this section, you will find answers to questions like:

- Are business and IT strategies mutually consistent?
- Does our organization use its IT resources optimally?
- Are all the risks associated with IT mapped and managed?
- Are the objectives of IT projects clearly defined, and are these objectives generally known?
- Does the quality of information systems correspond to the needs of business?

The Planning and organization domain focuses on the best way of using information and technology to reach its goals. It also focuses on the best possible use of IT in organizational and technological terms to achieve the best possible results.

The domain mainly features these processes:

- PO1 Define a strategic IT plan,
- PO2 Define the information architecture,
- PO3 Determine technological direction,
- PO4 Define the IT processes, organisation and relationships,
- POS Manage the IT investment,
- PO6 Communicate management aims and direction,
- PO7 Manage IT human resources,
- PO8 Manage quality,
- PO9 Assess and manage IT risks,
- PO10 Manage projects.

In Appendix 3, PO1 shows how CobiT defines IT processes.

Acquire and Implement

A suitable IT solution is needed to implement the IT strategy. This solution can be developed by its users, or it may be acquired through external sources, and must be implemented and integrated with the existing systems and processes. This domain also includes the necessary information system change management. In this section, you will find answers to questions like:

- Does the planned IT project meet expectations and business requirements?
- Will the new project be completed at the planned time, will the project budget be adhered to?
- Will the new system work properly after its implementation?
- Will the planned changes jeopardize the functioning of the current business processes?

The Acquisition and implementation domain focuses on collecting IT requirements, acquiring technology, and implementing a comprehensive set of business processes. This domain also includes development and maintenance plans that a business should adopt to extend the life of its IT system and its components.

The domain mainly features these processes:

- AI1 Identify automated solutions,
- AI2 Acquire and maintain application software,
- AI3 Acquire and maintain technology infrastructure,
- AI4 Enable operation and use,
- AI5 Procure IT resources,
- AI6 Manage changes,
- AI7 Install and accredit solutions and changes.

Delivery and Support

This domain is focused on IT services management, including service delivery, security management and service continuity, service support, data management, and necessary infrastructure. In this section, you will find answers to questions like:

- Are the ICT services provided in line with the business priorities and needs?

- Are the ICT services cost-effective?
- Are all the requirements for the credibility, integrity, and availability of ICT services fulfilled?

The Service supply and support domain focuses on the information technology supply specifics. It covers both the area of application operation within IT systems, as well as supporting processes that enable effective and efficient use of these systems. The supporting processes include, for example, security and training.

The domain mainly features these processes:

- DS1 Define and manage service levels,
- DS2 Manage third-party services,
- DS3 Manage performance and capacity,
- DS4 Ensure continuous service,
- DS5 Ensure systems security,
- DS6 Identify and allocate costs,
- DS7 Educate and train users,
- DS8 Manage service desk and incidents,
- DS9 Manage the configuration,
- DS10 Manage problems,
- DS11 Manage data,
- DS12 Manage the physical environment,
- DS13 Manage operations

Monitor and Evaluate

All the IT processes must be regularly monitored and evaluated - i.e., it is necessary to check that their outputs are of the required quality and meet the defined control criteria. This domain covers the areas of performance management, monitoring, internal IT control, and administration. In this section, you will find answers to questions like:

- Is the IT performance measured so that any problems can be solved before they really occur?
- Is the internal control system effective and complete?
- Are all the risks, controls, and performance measured and reported?

The Monitoring and evaluation domain allows you to verify that current IT systems still meet the organization's needs in line with its goals. Monitoring provides an independent view of the system efficiency and compliance with business requirements when meeting the company's internal or external audit control criteria.

The domain mainly features these processes:

- ME1 Monitor and evaluate IT performance,
- ME2 Monitor and evaluate internal control,
- ME3 Ensure compliance with external requirements,
- ME4 Provide IT governance.

8.3 IT Balanced Scorecard

The IT Balanced Scorecard is a tool for business informatics management and management of the relationship between IT and business. This is a modification of Kaplan and Norton's enterprise-wide approach (Kaplan & Norton, 2000) to enterprise informatics management environments. In describing this approach, we come from the concepts of (Van Grembergen, 2000) and (Van Bon & Verheijen, 2006).

The IT Balanced Scorecard modifies four original perspectives (financial, customer, business processes, and learning and growth) into important business information:

- User orientation,
- Business benefits,
- Operational excellence,
- Future orientation.

In every perspective, the approach defines the mission, goals, and their metrics (here, are only provide the perspectives, missions, and goals).

9 REFERENCE MODEL OF BUSINESS INFORMATICS MANAGEMENT (ITGPM)

The IT Performance Management (ITPM) is one of the most important areas of application of the principles of IT management and enterprise performance management (CPM). This part of the text builds on the two previous chapters, which deal with these principles and possibilities. The aim of this chapter is to show the basic characteristics of the reference model of informatics control combining both the basic organizational and procedural principles of its management and its performance management (ITPM). The IT Governance and Performance Management Reference Model (ITGPM) is one of the conceptual models of the MMDIS methodology.

The chapter addresses the following questions:

- What are the main benefits of reference models?
- What is the purpose of the reference model for ITGPM IT control, and what basic control domains does it contain?
- What are the main processes and metrics for the individual ITGPM management model domains?

9.1 Principles of Reference Models

The term reference model in practice refers to such models, which are, besides the methodological aspects of the solution, filled with their predefined contents. That contents, which consists, for example, of business processes and their elements, arises and gradually develops on the basis of the knowledge and experience of the projects implemented so far for various customers in practice.

Reference models, for example, are used as predefined business process models for ERP application deployments or other project types (Basl & Blažíček, 2008). This means that a project supplier has a generalized process model that serves as a basis for his project solution. In the project, there the reference model is adapted to the specific conditions of a given business.

Reference models, however, may not only relate to business processes but can cover indicator systems, organizational and functional structures, and possibly other management components as well. To use a reference model in practice, the following aspects are essential:

- Reference models increase the efficiency of a project or task solution by not starting a project "from scratch" but from its pre-prepared patterns,
- The significant advantage of reference models is that they provide the customer with best practices from real practice,
- The reference model also provides a useful communication base between the supplier or project author and user. From this point of view, it should also meet the generally valid requirements, i.e., clear structure, simple solution orientation, and quality documentation, so that the user can quickly and efficiently orient in his model,
- Reference models should, where appropriate and possible, be specialized according to the type of business. Their examples include MTOs (Maketo Stock) for warehouses, ATO (Assembly to Order) for custom-made businesses, and others. The industry-specific models are particularly relevant in the context of implementations of enterprise-wide applications, such as ERP, in the area of IT management this specialization is not so important, as most processes are sector-independent,
- Depending on the model contents (for processes, metrics, etc.), and according to the methodology and software tools used, the model documentation method differs as well,
- When using a reference model, it is important for the effective co-operation of the supplier with the user to emphasize the fact that it is not a solution, but only a pattern that is modified during the project according to the conditions and requirements of the customer. Practice has shown that in a number of cases, that users reject their reference model already at the first inconsistencies, compared to their ideas and experiences. In this situation, the reference model value is degraded to the minimum. This, of course, does not apply where the reference model contents does not really correspond to the nature of the business and its activities.

9.1.1 Metrics for Informatics Performance Management

The metrics system is another important component of both the company-wide (CPM) and IT-based performance

management (ITPM). The entire concept of performance management is built on business intelligence technologies and applications. This means that even the metrics for computer science performance management are understood in the dimensional concept, i.e., as indicators and their assigned dimensions, see e.g. (Novotný, Pour, & Slánský, 2005).

9.1.2 Applications for Business Informatics Management

Analytical and performance management planning applications are the fourth component of the CPM concept. The same applies to the informatics performance. The selected management methods, management processes needs, and defined metrics are projected into them. These applications are also based on business intelligence and have the character of either standard reports or dynamic OLAP-based applications. The informatics management applications include:

- Applications for the planning and creation of informatics budgets based on multidimensional expression and tracking of all the selected indicators and on strong interrelationships between business or information strategy where the formulation of the information strategy should include the specification of effects and strategic goals of informatics with their projection into forecasts, plans, and budgets,
- Scoreboards to link the informatics performance indicators or analysing the links between the target and really achieved key performance indicators (KPIs)
- Dashboards (also digital dashboards, executive dashboards, or enterprise dashboards) providing information on the selected key metrics and their changes in information technology, with respect to the interrelationships between these metrics, with the ability to track the movement of their desired or actually achieved values,
- Applications supporting the operational planning of services and projects.

9.2 Reference Model of Informatics Management

The rest of chapter 9 is dedicated to the description of the Reference model of ITGPM business informatics management. The model includes dozens of generalized management processes, management documents, predefined roles of information and user staff, and a generalized system of predefined metrics, i.e. indicators and their corresponding dimensions. Obviously, it is not practical or possible to deal with a greater level of detail, so we will confine ourselves to the characteristics of its basic structure, individual domains of management, and their content.

The informatics management structure per the ITGPM reference control model, i.e. the division of its contents into the individual levels of management and domains, is represented by Figure 9-1. In this context, however, it should be emphasized that the model structure used further is not rigid or binding and can be modified according to the specific needs and conditions of the business, as we are going to see in chapter 9.3.

The model is based on the rule that informatics must be managed at three basic levels, as is the case in all the corporate governance, i.e. strategic, tactical, and operational. At every level, the individual control domain (-s) featuring their ICT processes and their elements (activities, inputs, outputs, metrics, roles, etc.) are defined.

In the figure, the names of the corresponding domains are also listed under the names of the individual domains according to the ITIL standard (according to the original ITIL v2 structuring). Thus, the structuring of the reference model is linked to this standard and, above all, to the SPSPR model:

- The model is based on (1) the strategic intentions of the development of informatics, which are projected into lower levels and domains,
- The JSIICT development management and system integration of services and resources domain (2) is the centre of gravity of the entire management, as it compares the strategic objectives of informatics technology with the current needs of business processes and the state of the already solved projects and implemented applications. The contents of this domain is, as its name implies, the planning, interconnection, coordination and integration of the provided information services and necessary resources;
- At the level of tactical management, there are two groups of domains - the first segment focused on the management of ICT services and the other segment focused on the management of ICT resources that are needed for the provision of ICT services. This means, on the one hand, what is required and what is delivered (domains 3 and 4) is determined, and, on the other hand, what is or is to be available to cover the requirements (domains 5 to 8).

The operational level of the management is already implemented with the help of resources. The Ninth domain is

focused on (9) the management of the individual projects that create new and develop the existing ICT services. The last domain (10) controls the existing services operation. The following overview lists the basic characteristics of the model domains, and we will return them in more detail in the next text section.

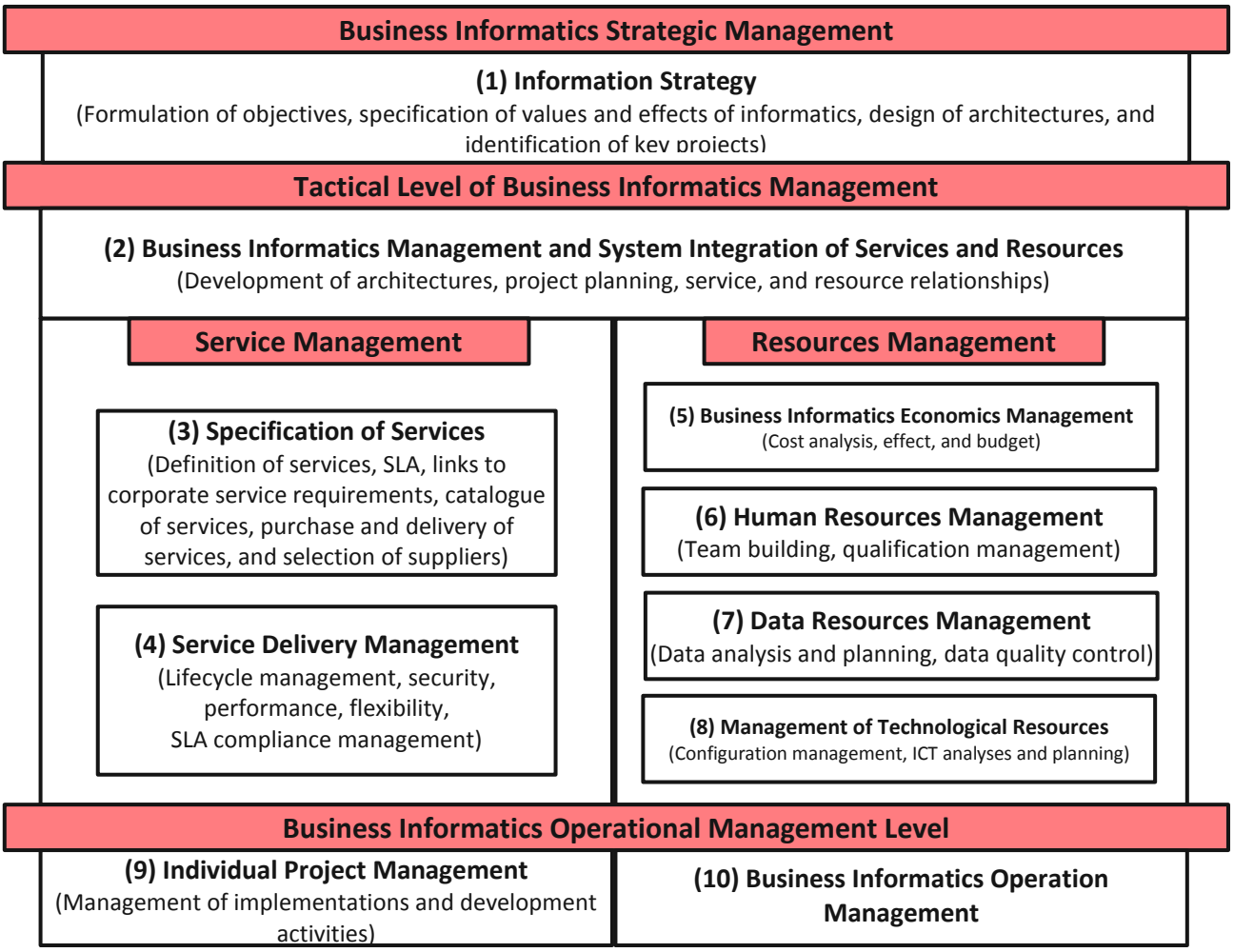


Figure 9-1 Structure of the ITGPM reference model domains - (Novotný O. , 2003)

9.2.1 Business Informatics Strategic Management

The strategic management of informatics purpose (see Figure 9-3) is to direct its development in relation to the strategic and business intentions of the company, increasing its performance and achieving such effects, which will contribute to the higher success of the company in the market and its overall competitiveness. Strategic intentions in informatics are usually formulated in an information strategy that represents the basic concept of further development of informatics, roughly with the time horizon of 2-3 years, with its usual updating at annual intervals. The information strategy is designed to continue to serve as a basic tool for the long-term management of the development and operation of IS/ICT and at the same time as an input for other documents, e.g. for the award of a project, tender documents, etc. Besides formulating the information strategy, enterprise in the area of sourcing, in the application and technological orientation of informatics and others.

Standard Dimensions:

- Time, plan_reality, level (quality, satisfaction, etc.), meaning
- Services, applications, technology, projects, requirements, problems, and incidents,
- Business goals, organizational units, business processes, roles, and professions,
- Service suppliers and providers, customers,

Standard Indicators:

- Basic (e.g., number of services, etc.)
- Volumetric (projects in mandays, etc.),
- Financial (costs, effects),
- Proportional per dimensional structures (in %),
- Indices per time dimension,
- Calculated (e.g., outsourcing rate)

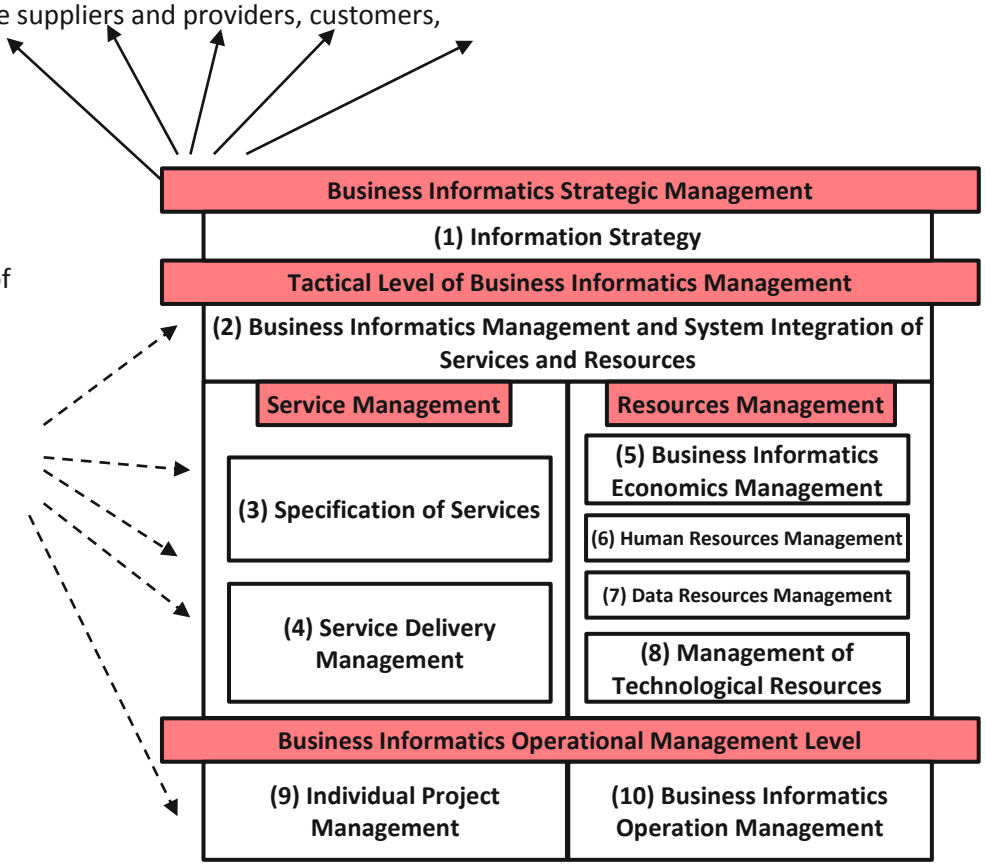


Figure 9-2 Standard indicators and dimensions in relation to domains - (Voříšek k. , 2015)

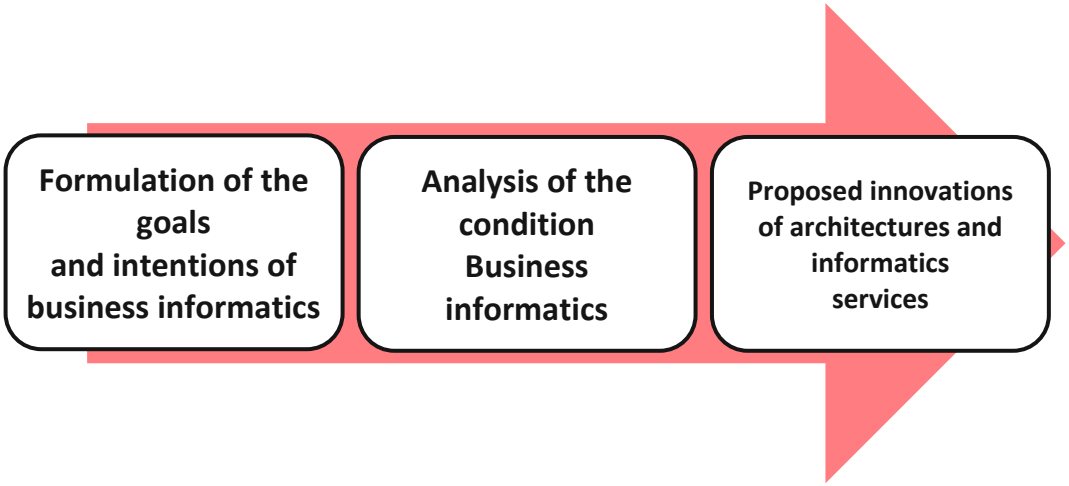


Figure 9-3 Informatics strategic management processes - (Voříšek k. , 2015)

The strategic management of informatics includes the following sub-processes:

- Formulating the basic strategic goals of informatics development based on business goals and strategic business needs of managers and key users;
- Analysis of the current state of the company's informatics, especially its main application and operational issues in relation to its strategic goals and current trends on the IS/ICT market. The specific strategic analysis subject is the state and anticipated development of cooperation and communication possibilities and requirements of external partners, e.g., presumed requirements for solving e-business issues, inputs into corporate clusters and supply chains, etc.;
- Analyses of the achieving of expected effects of business informatics, its values, and specification of areas and issues, where the expected effects are not being achieved,
- The design of an innovative architecture of ICT services and innovative application architectures, i.e. new, especially strategic applications (such as CRM, business intelligence, etc.) are planned, changes in technology infrastructure are proposed, and decisions are made on ownership or leasing of sourcing strategies. In connection with strategic objectives, key projects and potential organizational measures are defined.
- The strategic management of informatics should honour the strategic management principles. This means that it should be primarily a matter of business managers, not IT practitioners themselves. The standard methods of strategic management, such as Balanced Scorecard, RPZ or SWOT analysis, should be applied.

The strategic metrics for informatics performance monitor the quality, performance, and development of business informatics as a whole, in close connection with the goals and needs of a given business. Examples of strategic informatics management metrics are:

- Coverage of strategic business goals by informatics - represents percentage estimates of coverage of business goals provided by informatics services. It follows the level of business objectives importance. The analysis dimensions include the business goals structure, including the importance of goals defined by a score scale or percentage, structure of informatics services (covering strategic objectives);
- Informatics coverage of user (business) requirements - is defined as a percentage coverage of user requirements covered by informatics services. It follows the level of requirement importance or importance of business processes to which the requirements relate. The dimensions represent the structure of user requirements, structure of business units, structure of functions or functional positions, and structure of services to ensure requirements completion;
- The share of the cost of strategic applications in total informatics costs - shows the weight attached by a business to the development of strategic applications, compared to, e.g., infrastructure. The definition of strategic applications is the role of management. These are applications that mostly affect the competitiveness and competitive advantages of a business (e.g., BI, e-business, etc.). The dimensions include the structure of applications, cost structure;
- Share of IS/ICT development and IS/ICT operating costs, compared to the total informatics costs. It shows the extent to which costs are oriented towards the future or only to the existing services operation;
- The business informatics price: performance ration - shows the proportion of total measurable financial effects achieved by informatics, compared to the total costs per unit of time, e.g., 1 year. The dimensions are organizational units (if effects and costs are allocated to these units);
- Benchmarking type: IS/ICT costs / total business turnover, number of ICT workers / total number of workers.

An essential prerequisite for the successful implementation of information strategy is the use of these and other metrics in strategic applications and strategic processes and activities, for example, while setting priorities for the individual projects.

The strategic informatics management and information strategy development are described in more detail in chapter 10.

9.2.2 Management of IS/ICT development and system integration of services and resources

The IS/ICT development management domain, system integration of services and resources, planning, project awarding and coordination (see Figure 9-4) focus on informatics projects completed through both contractors and own capacities, i.e. on the formulation of their specification, assessment, and decision on their acceptance of non-acceptance.

The aim of management in this area is to direct informatics towards the realization of a required set of ICT services,

optimum functionality, i.e. to cover all the necessary functions through application products, and towards the reduction of unnecessary duplicities in provided functionalities. It also aims to optimize the contents of new projects and their time synchronization with respect to business priorities and logical links among projects and already operated applications.

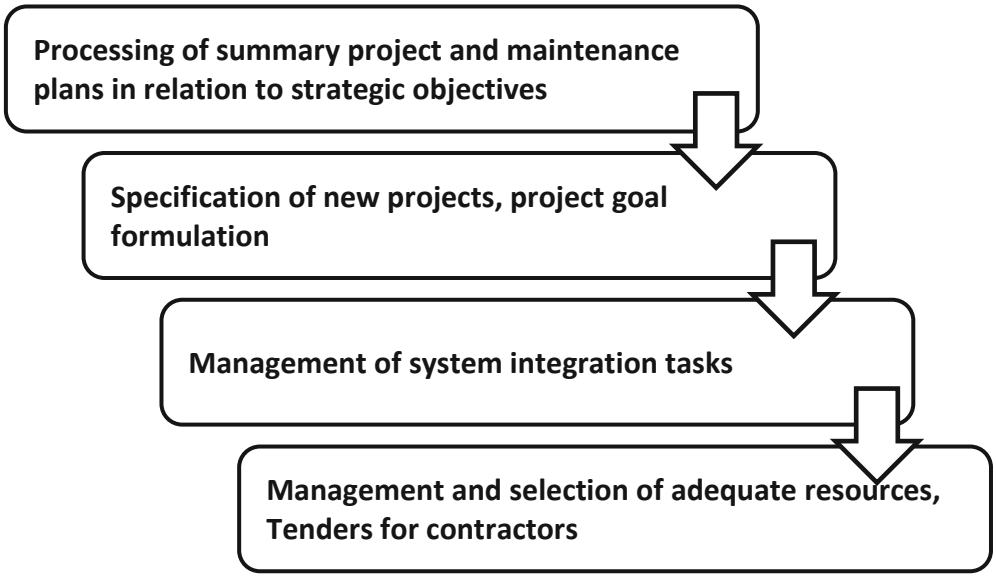


Figure 9-4 Processes of the IS/ICT development control and system integration - (Voříšek k. , 2015)

9.2.3 Informatics Services Specifications

The goal of management in the Informatics services specification domain is to optimize the informatics services structure and quality, ensure the compliance of their functionality and availability with business, economic, and organizational requirements of the business and with valid legislation. A specific part of this domain is the management of relations with external informatics suppliers. This includes the evaluation of the quality of their provided services, addressing long-term cooperation relationships, etc. (see Figure 9-5).

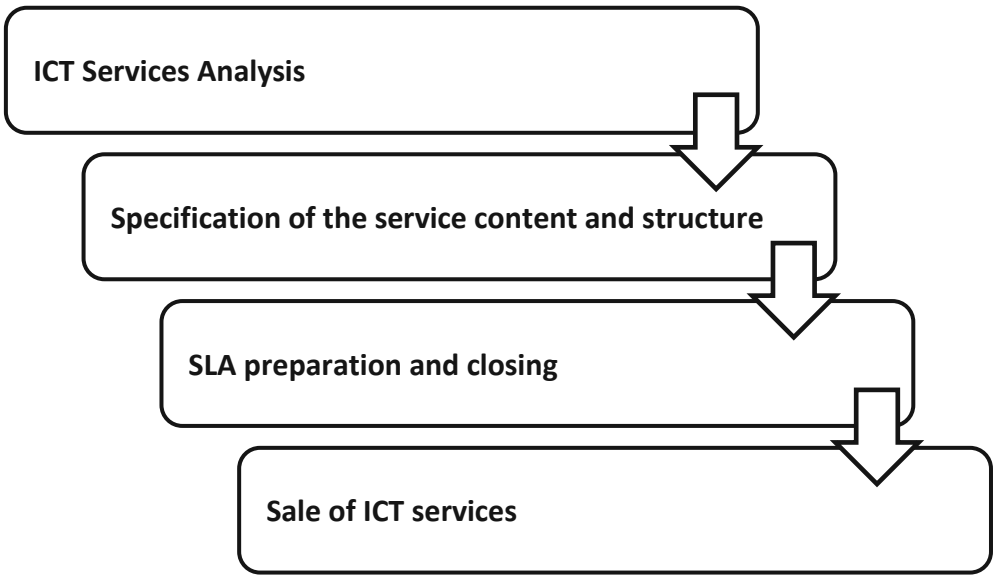


Figure 9-5 Informatics services specification processes - (Voříšek k. , 2015)

Services and Service Level Management (SLM) form the basis for addressing co-operative relationships among various business informatics entities. Particularly, in the context of the increasing share of outsourcing, the specification of relationships among the individual entities and their ongoing monitoring and evaluation based on services vice-based

evaluation, is very critical. This domain frame mainly includes these sub-processes:

- The identification of needs, service demand, and service requirements includes the identification of the requirements of the individual departments, service users, and their completion for service catalogue specification completion,
- Analysis of ICT services available on the market and selection of externally supplied services. It includes surveys of qualitative characteristics of the individual businesses operating on the ICT market, such as a portfolio of services and products, personnel capacities, references, price level, and comparative analyses based on the aforementioned data. The results of analytical operations are the basis for specifying potential suppliers and service providers;
- Specification of service structure and contents, or service catalogue definition (see chapter 11). The purpose is to define such a structure of services that will be comprehensive, i.e. it will cover all the activities and products provided by informatics to the user industry, it will be understandable for all involved parties and, in particular, it will provide an effective basis for management, business, project, and operational documentation. It will; therefore, include the specification of business terms and service prices; therefore, a pricelist for the internal units. The same applies to external customers if a business offers its informatics services as its traded commodity;
- The preparation and conclusion of service level agreements - SLA (see chapter11) include a complete SLA contents preparation. Its input is the aforementioned service catalogue. Then, it represents the specification of the cooperative and business conditions for individual services and units, updating some service data, such as the number of software licenses operated by a unit, etc., agreement contents negotiations, and their approval and closure;
- Sales of ICT services to external partners/customers. This represents an increasingly frequent practical phenomenon. In this case, it is the sale of project services, consulting services, software, etc., either as separate commodities or as value added to basic products and services, such as buying houses, selling cars, furniture, etc. This process must include all the common business activities ranging from customer reviews, order preparation, up to implementation.

Service management is closely related to the other areas of informatics management, in particular to business information strategy, IS/ICT development management, and system integration of services and service delivery management. The following main metrics are used:

- Number of services provided - expresses the current range and portfolio of services provided for the entire user business area. The dimensions include a service structure per content definition (catalogue), user units, service providers;
- Number of service providers - represents the provision of services in terms of supplier diversity. The dimensions include the structure of service providers, unit structure of departments to which services are provided;
- The share of outsourced services in their total volume in mandays of provided services. The dimensions include the content structure of services and unit structures.

From these metrics, it is possible to derive significant conclusions for further orientation of informatics, especially in outsourcing, evaluation of external suppliers quality for their further use in the business,

9.2.4 Informatics service provision management

The service management is focused on the planning and evaluating of primarily qualitative characteristics of provided services, like security, reliability, flexibility, performance (see Figure 9-6).

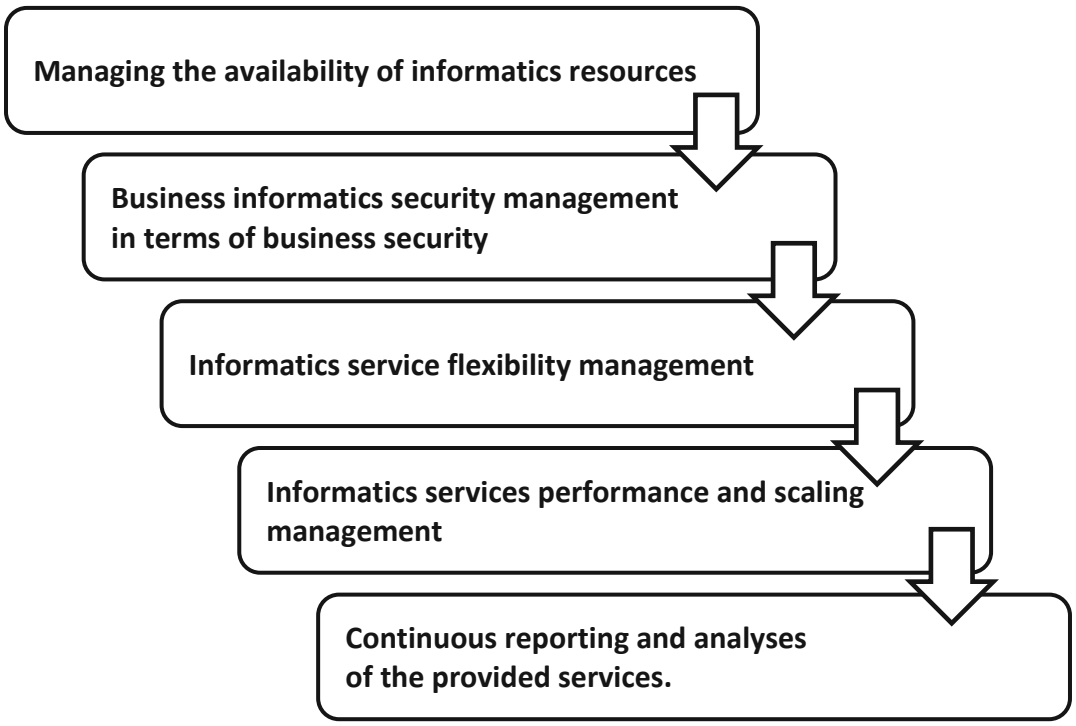


Figure 9-6 Informatics services supply control processes - (Voříšek k. , 2015)

The goal of quality service management is to achieve SLA-specified service features at their acceptable costs. The structure of provided informatics services is based on both the business information strategy and other documents, such as the organizational rules, informatics operating rules, business safety guidelines, or quality control documentation. In the context of the reference model, this domain features sub-processes like:

- The management of the availability of provided informatics services includes analyses of the differences between agreed and actual availability by service, identification of causes of differences and subsequent planning and provision of the necessary technical and personnel capacities for the operation of services at the required availability level. The required level of availability is specified within SLA (chapter 9.2.3) and is then evaluated during operation, based on the assessment, adequate sanctions or bonuses are determined;
- Informatics services operation security management - which includes the creation and updating of the company's security policy and, following this, evaluation of the compliance with the security policy principles at the level of the central administration of IS/ICT and of the individual local workplaces, and localization of attempts to attack its system from outside,
- or from the inside, evaluation of the main server logs, and firewall log. As part of the security of services, a security audit is performed periodically, the results of which are the basis for updating the security principles of corporate information technology;
- Managing the flexibility of informatics services means increasing the flexibility of informatics, i.e. in the area of its organization, links to external partners, and in particular, in fulfilling the requirements of both internal users and external customers for the contents, availability and other parameters of informatics services. Flexibility management must be directly linked to change management and addressing of effective relationships between informatics and business (IT/ business alignment),
- Performance management and scaling of informatics services when the purpose is to ensure continuous monitoring and planning of an information system performance as a whole and its technological infrastructure, in particular with regard to peak loads and possible fluctuations in the demands for their operation,
- Continuous reporting and analyses of provided services per the individual types of services, their providers, user units or customers, including, for example, the volume of services provided, availability of services, user or customer satisfaction assessment, etc. Specific outsourcing in this task is covered outsourcing analyses, i.e. analyses of external service providers, IS/ICT suppliers, their quality, reliability, and portfolio of provided products. All this forms the basis for the planning of further development of services and scope and orientation

of outsourcing.

Management of the informatics services provision may include other specific tasks. The following main metrics are primarily used:

- The number of services with guaranteed availability - and their share in the total number of services, i.e. services whose availability is precisely defined and also adhered to during the last period operation. The dimensions include a service structure per content definition a service providers;
- the number of services with documented and measured quality criteria - and similarly, their share in the total number of services represents the overall level of service provision management. This indicator can also be further specified for the share of services to which SLAs apply. The dimensions include the service structure per their content scope, service providers, and structure of business units to which services are provided;
- the number of security incidents, which is the number of incidents associated with the devices and information system physical security, such as thefts, losses, disclosures, power outages, injuries, number of incidents caused by unauthorized access, and data loss or disruption. The dimensions include the types of incidents, structure: services, units at which incidents occurred;
- the number of services or number of applications whose level of security is inadequate, where such evaluation of applications is mostly a security audit result. The dimensions are application structure, application suppliers, and units using their applications;
- the number of informatics services whose estimated risks were documented, for example in terms of their adequate peak load performance, reliability of changes, security breaches, etc. The dimensions include types of risk, service structure, and service providers;
- the average time required to handle a service change request, such as functionality, device configuration, provided consulting services, etc. The dimensions are the structure of services, structure of requirements, and service providers;
- time of service unavailability - it means service availability level expressed as a percentage of its unavailability. The dimensions are the content structure of services, structure of service providers, and reasons for service unavailability;
- user level or customer satisfaction level - expresses the informatics quality from the user's perspective. It is identified through periodic surveys and assessed per a set range of points. The dimensions include the structure of user units or informatics service customers, content structure of services, and structure of provided services.

These and other metrics used in this domain are mostly based on security audit methods, standards or risk management methods, and are the basis for strong supervisory and analytical tools.

9.2.5 Management of economy and effects in informatics

The "informatics" economy management represents both informatics financial planning and budgeting, including analyses of costs and achieved effects. In the case of effects, micro-economic effects are monitored as well, for example, reducing time-consuming business processes in terms of their strong interdependence with economic effects (see Figure 9-7).

The goal is to achieve the optimal price / performance ratio of the entire information system, i.e. ensuring the required functionality and availability of informatics at adequate costs.

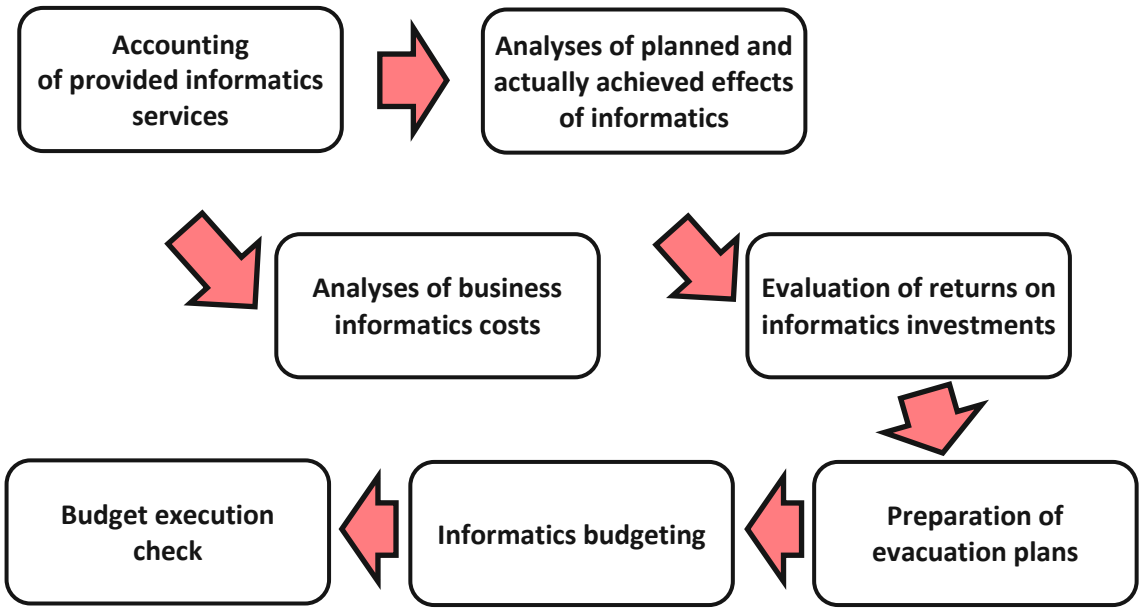


Figure 9-7 Informatics economic control processes - (Voříšek k. , 2015)

The business informatics economy issues are addresses in chapter 13; therefore, we only summarize the key management metrics, sub-processes, and tasks of this domain:

- The accounting for provided services and payments received for external services is a standard accounting operation, mostly provided as part of an entire accounting system of the business. There may be specific requirements for analytical records that meet the requirements for informatics management during analytical operations. However, the general problem lies in the fact that there are very few businesses that are able to incorporate accounting for its informatics services into their functioning and culture;
- the business informatics costs analyses include standard cost analyses, for example, based on the ABC method and resulting problem specification of issues with informatics cost amounts in connection with the assessment of financial requirements in project plans. An essential part of this process is the analysis of financial resources necessary to ensure the operation and development of informatics in order to assess their availability over time;
- analyses of planned and realized informatics effects, where the purpose is to refine the expected economic and non-economic effects according to projects and individual informatics services. The problem of monitoring and evaluating the effects of informatics usually rests in their measurability or financial expression, as these effects are often not only caused by informatics, but they arise in combination with organizational changes, market situations, etc. Despite these certain difficulties, the planned and achieved effects are given very intense attention in practice;
- evaluating the return on investment in informatics - using the standard methods listed in the chapter, 13, such as ROI, NPV, etc.,
- preparation of informatics investment plans - it formulates investment requirements for further IS/ICT development, i.e. The individual projects, new technology, and software acquisition. The process includes, for example, analyses of the current development of investments in IS/ICT, comparative analyses of the investment level of IS/ICT with similar companies at home and abroad, assessment of the actual investment possibilities, and finally, the specification of investment plans for the whole area of informatics;
- budgeting for the informatics development and operation means preparing and discussing the informatics budget with the business management. The budget is usually prepared for a period of one year, and then it is further specified. It is a part of the business overall budget and has to be processed according to a relevant corporate methodology, i.e. it must feature its given structure and form. A part of budgeting includes proposals on securing financial resources for the submitted budget;
- checking the implementation of the entire business informatics budget with detailed monitoring per the individual services, projects, and units.

The main metrics used in this domain feature, of course, their economic character, and this group includes:

- Informatics costs - including investment costs, operating costs, and application maintenance and support costs,

which are costs associated with upgrading application software and maintaining and developing applications. The dimensions include the type costs breakdown, service structure, and service providers;

- share of informatics costs as a percentage of the total business turnover - is a highly monitored indicator for informatics management itself and for comparing the informatics cost-intensiveness of various businesses or economic sectors,
- informatics costs per unit - represent the total informatics costs, or their more detailed breakdown, allocated to the individual business or user units. The dimensions are units, structure of informatics services, and types of costs;
- volume of informatics effects, i.e., effects that are measurable and financially expressed. These include effects directly measured in monetary units (such as increased sales) or effects that are transformed into financial statements, for example, due to increased numbers of customers. The dimensions are types of effects, structure of informatics services, business units;
- indicators of returns on investment per the aforementioned methods, e.g. ROI. The dimensions are informatics projects or investment projects, investment providers;
- volume of successful informatics investments, i.e. the volume of investments in informatics in thousand CZK, which match or exceed the expected effects, based on the return on investment and user satisfaction. This ratio is also related to the share of successful investments in the total amount of investments in informatics in % or the volume of unsuccessful investments. The dimensions are, as in the previous case, projects and contractors.

The attention of business managements directed to the informatics economy has been steadily rising due to its growing costs, along with the expansion of its services, and at the same time, it is rising, as the pressure is on the delivery of such effects that will increase the business competitiveness and bring new competitive advantages.

9.2.6 Human Resources Management in Informatics

The personnel management in informatics includes analyses and planning of personnel capacities and creation of conditions for the qualitative development of both informatics unit staff and the whole user sphere (see Figure 9-8).

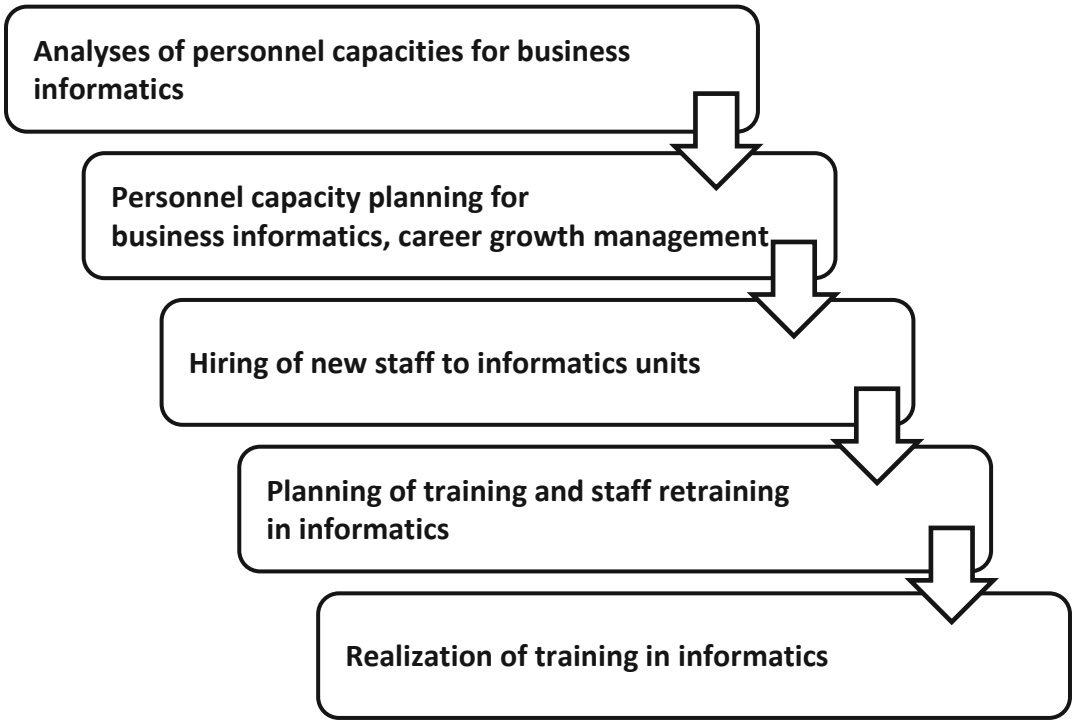


Figure 9-8 Personnel management processes in informatics - (Voříšek k. , 2015)

The objective of personnel management in informatics is to achieve such a personnel structure and such a development of skills and knowledge of business personnel that will create conditions for achieving the desired effects of informatics per business needs.

The personnel domain includes these sub-processes:

- Analysis of personnel capacities for informatics - based on personnel records, the available personnel resources are analysed both in the informatics unit and in user units. The functional, qualification, and age structures of the staff are analysed, and simultaneously, current key potential issues are specified. The available capabilities of user units are analysed per the project and operational requirements. The personnel capacity analyses also include the results of periodic evaluations of informatics unit personnel;
- planning of personnel capacities for informatics - based on completed analyses, in cooperation with the human resources department, personnel capacities development plans are developed. There is also a plan formulated for personnel support according to the individual projects, operation sections, and specialized informatics services. A specific issue is the career growth management, i.e. the perspectives of the individual workers' advancement. Based on personnel analyses and internal capacity plans, demands for external capacities and outsourcing are defined;
- the recruitment of new staff represents standard HR activities, often supplemented by special tests and interviews based on positions available in informatics,
- training planning and retraining represent the processing of qualification programs for informatics issues in the context of retraining programs of the whole business,
- the realization of training means its comprehensive support, including the selection and addressing of lecturers, mostly external ones, procurement, or creation of teaching aids, evaluation of participants etc. Very often, training is linked to a specific project, and then the training is completely ensured by the project supplier, either in its training rooms or directly at the customer's facilities.

The main metrics related to these sub-processes include:

- Numbers of employees - physical numbers of business employees, i.e. not converted per employment types. The dimensions are units, functional positions, and staff qualification structure;
- informatics services users - represent the number of employees using ICT services and their shares in the total number of business employees. This indicator also relates to, for example, the share of strategic application users in the total number of users in % or the share of management personnel - users in the total number of management personnel in %. The dimensions are informatics applications, units, roles, and staff qualification structure;
- working pool - means the recalculated volume of working time of the business staff. Regarding this indicator, it is always necessary to determine how to count part-time jobs, and how to convert external staff. The unit is the capacity of one full-time worker. The dimensions are units, functional positions;
- Volume of contractor capacities - represents the extent of outsourcing in terms of development support or project and operation solutions. The volume of contractor capacities is usually expressed in mandays. The related indicators include, for example, the share of contractor capacities in the total volume of capacities in % or contractor capacity index, which is the volume of contractor capacities / volume of internal capacities. The dimensions are contractors, service structure, projects,
- average length of employment - in the area of informatics and its related and average length of employment in proportion to development costs. The dimensions are units, functional positions;
- % of users of a particular service or application who have successfully completed their training and their final test.

The personnel management also includes a number of other tasks, such as recruiting or getting new employees, developing motivational programs, career maps, etc., which are normally done in a close cooperation with the personnel and training departments of the business.

9.2.7 Data Resources Management

The data resources domain secures analyses and development of both internal and external data resources (Internet resources, public databases, etc.), but not database administration. Its highly current component is data quality management (see Figure 9-9).

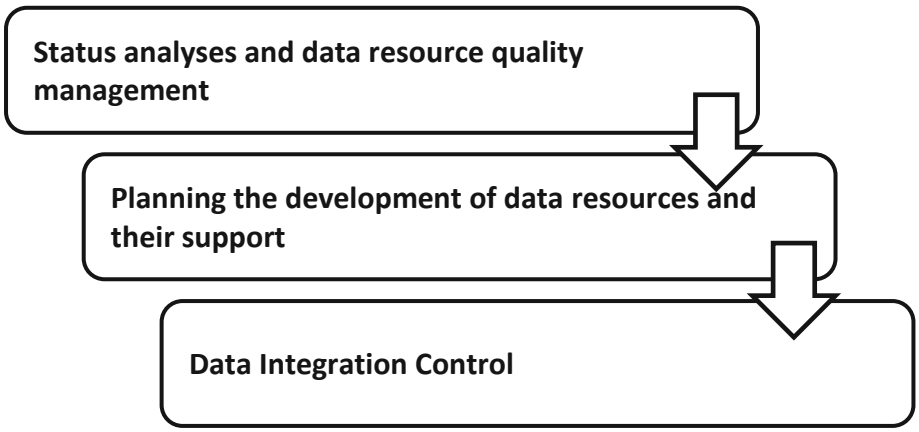


Figure 9-9 Data resources control processes - (Voříšek k. , 2015)

The goal of data resource management is to achieve the optimal range and quality of data for the applications being run, while at the same time finding an effective relationship between internal, business data resources and the use of external data bases and information services.

The domain primarily includes these sub-processes:

- Analyses of data resources state and quality, primarily based on operational records of internal data. The analysis focuses on the state of quality and completeness of data resources, storage identification, overlapping (multiplicity of stored data), determination of responsibility for data resources on the IS/ICT operation side and user units, state of data access rights. The analysis also includes the assessment of potential demands for data resources in running and planned projects;
- data resource development planning - defining content requirements for data, potential data resources, difficulty of acquiring or getting them, concept of data distribution, clear responsibility for data preparation and updating is set. On the basis of the analysis carried out, a set of external data resources for the individual specialized units is also prepared, the assessment of which depends on further steps in the securing of access to selected external resources;
- data integration management - addresses integration, i.e. mutual and effective interdependence of the individual databases, which is amplified by the ever-increasing range and complexity of databases, arrival of external databases into IS/ICT, and development of individual user applications and their associated data.

The metrics that are used to manage data resources include:

- Volume of managed databases - is a basic indicator for tracking the structure and distribution of database responsibilities. It is expressed in standard GB and TB units. The dimensions are the types of databases, services to which the databases relate, units with primary responsibility for their databases;
- volume of corrective activities and activities during corrupted data identification - is an indicator usually expressed in manhours, expressing the workload of maintaining the required data quality. The dimensions are database types, types of issues or errors, data corruption, and units responsible for their databases;
- volume of losses caused by poor data - is an indicator in financial terms, which is increasingly being viewed in connection with increasing attention to data quality. These losses are reflected, for example, in the preparation and execution of orders due to incorrect product data, preparation of offers and marketing campaigns due to erroneous customer addresses and other data. The dimensions are the structure of customers, databases operated, structure of informatics services where losses arise, and responsible units.

9.2.8 Management of ICT Resources and Configurations

This management domain includes all the activities related to the analyses, selection and acquisition of all the components of information and communication technologies - application software, database management systems, operating systems, technical and communication devices and their configurations (see Figure 9-10). The structure of ICT resources and technological infrastructure were clarified in chapter 2.1.

The goal of the management processes in this area is to develop and fulfil the system high-quality technological architecture, thus creating prerequisites for effective ICT operation, minimizing management demands and creating space for gradual expansion of the system without disturbing its internal consistency.

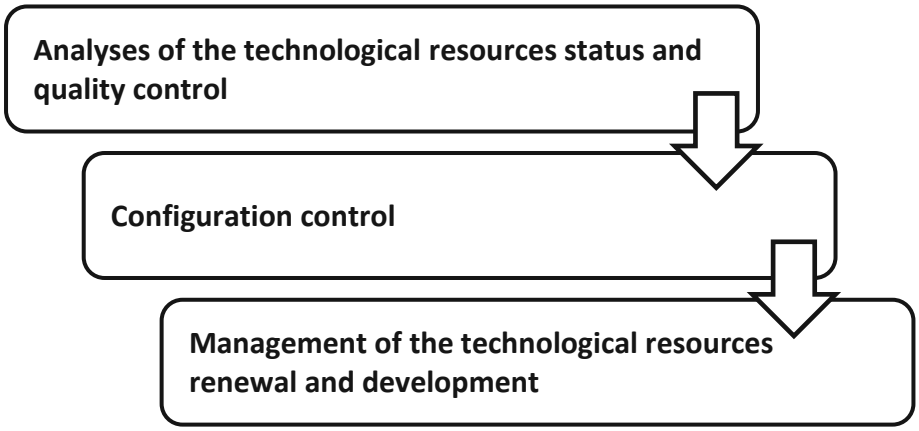


Figure 9-10 Source and configuration ICT control processes - (Voříšek k. , 2015)

The following sub-processes are carried out during the management of technological resources:

- The analysis of the state and quality of technological resources and their requirements includes the registration and categorization of the requirements of the informatics department and user services for development of ICT infrastructure, analyses of the state and possibilities of further utilization of the existing technological resources, formulation of conclusions and background for other ICT development projects, analysis of capacity utilization of resources, outages, ...,
- The configuration management is based on the inventory of operating software and software configurations, analysis of changes in technology architecture, analysis of the current operational problems, and on the new ICT available on the market. It includes the specification of internal ICT resources, their mutual links and required parameters. A special issue is the specification and control of technological standards on which ICT infrastructure is based in a business;
- renewal and development of technology resources involve the selection and acquisition of new technical and software resources and management of existing resources. This process also involves the decommissioning of unnecessary technical means, which is often a relatively complicated issue.

The set of the technological infrastructure management metrics includes:

- Software license numbers - for all the types of software whose missions are similar to the previous case. The dimensions are the software types, contractors, and responsible units;
- The amount of delays in service implementations due to unprepared infrastructure - expressed in days and representing the quality of infrastructure management in relation to the business needs. The dimensions are the structure of services, reasons for delays, and infrastructure contractors;
- numbers of technical and program resources differing from agreed standards. The dimensions are technical and program resources, responsible departments, contractors;
- number of services with performance issues due to technology infrastructure deficiencies. Issues usually concern the response time, volume of processed documents at a desired time, etc. The dimensions are the structure of services, types of issues, contractors, and user units concerned.

To manage a technological infrastructure, a relatively large set of metrics are used, especially in configuration management, stored in their configuration databases.

9.2.9 Individual Project Management

Project management is a very diverse area, and its specific management processes vary according to whether a project is completed through one's own capacities or contractors, what type of project it is (e.g., ERP, CRM, etc.), whether the project is completed individually or a type application software is implemented. From this perspective, we do not deal with any individual peculiarities, but only the basic principles (see Figure 9-11).

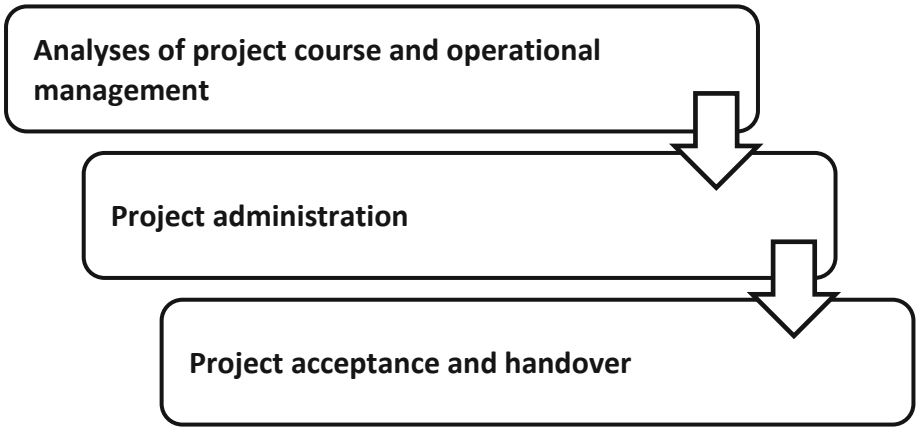


Figure 9-11 Processes of service development and project management - (Voříšek k. , 2015)

The goal of the management of development of services and individual projects is to ensure the required functionality specified in the assignment or inquiry document by a set deadline and with "adequate" expenses. We do not deliberately mention any "minimal" costs here, because these types of creative solutions and projects mostly mean the pressure to minimize the costs through reduced quality. In the vast majority of cases, in practice, cost savings will negatively return through increased costs of replenishment, development, management, etc. This also points to the cost of input analysis vs. implementation costs, where the analysis is as cheap as possible, on the contrary, the implementation as costly as possible, while in the beginning, cost may be much lower during the subsequent stages.

We do not include any project management planning and approval, as they have already been assigned to domain 2. Therefore, we will only consider these sub-processes:

- Analyses of project course and operational management, i.e. securing the necessary project capacities and resources, monitoring specification contradictions, delays against the schedule, etc.
- project administration, preparation and management of documentation, planning of project meetings, securing of opposition proceedings, recording of their protocols,
- project acceptance and handover, including test results, data and technical migration, and protocol processing.

The metrics used in service development and project management, for example, include:

- Project duration - represents the main indicator, possibly broken down by its individual stages, usually expressed in days. The dimensions are projects, contractors, and user departments involved in projects;
- extent of project delays - usually in days, i.e., delays due to delays in investment decisions due to lack of funds to cover projects, lack of work capacity on the part of the business or supplier, etc. The dimensions are issues or reasons for delays, projects (or their stages), contractors, and business units;
- number of successful projects and their share in the total number of projects - means the proportion of projects completed with the full satisfaction of user requirements as a percentage of the total number of completed projects. It expresses the quality of projects completed from the user perspective. The dimensions are projects, contractors, user departments;
- number of changes requested as a result of the acceptance procedure - expresses both the complexity of acceptances and quality of projects delivered. The dimensions are projects, contractors, user units, types of change requirements;
- numbers of application programs with quality documentation. The dimensions are projects, contractors.

We did not include those metrics already included in previous domains, such as project costs, work capacities, etc.

9.2.10 Business Informatics Operation Management

Operation management includes all the management activities associated with the operation of the entire information system and its individual components. The goal of operation management is to ensure the operation of the individual applications and required level of user consultation and technical support. Operation management also monitors the optimal availability of the information system, ensuring the security and reliability of its operation, required response

time of the individual applications, ensuring the required power, including its peak load (see Figure 9-12).

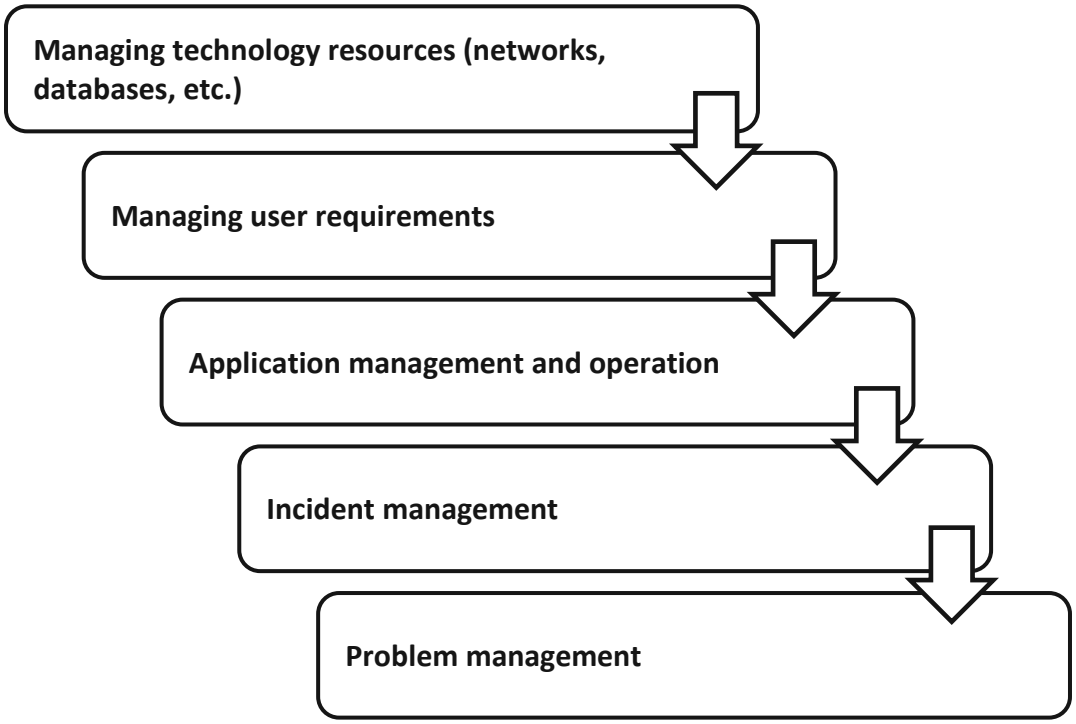


Figure 9-12 Business informatics operation process management - (Voříšek k. , 2015)

The goal is to optimize the costs of running an IS/ICT business. Operation management is a relatively large complex of sub-processes, so with respect to the range, we present the key ones:

- Technology management - includes monitoring and continuous control of the individual IS/ICT components, administration, servers and databases, LAN/VLAN administration, WAN administration, system management and firewall operation, registrations,
- user requirements management - represents, in particular, registrations and checking of the formal accuracy of requirements at the service desk, categorization of requirement/problem level - evaluation and assessment of requirements, operational solutions per the type of request, accumulation of requirements and their valuation, evaluation and statistics of the requirements and their solutions,
- application management and operation - includes commissioning planning, distributing and automatically installing SW, preparing scripts for installing a new SW, SW installation testing, completing operational documentation,
- incident management - includes recording, incident evaluation and incident resolutions,
- problem management - includes recording, evaluation, and problem solving. Here are the relationships among incidents and problems, such as, how problems in a particular area derive from incidents.

IS/ICT operation management also uses a very extensive set of metrics, such as:

- Numbers of managed servers, number of peripherals and other technical devices, which are the physical numbers of managed servers, peripherals, and other devices. The dimensions are technical means, contractors, and responsible departments;
- numbers of requests for edits and changes of applications, i.e., physical numbers of requests of users and other business employees for changes, and application editing. The dimensions are the types of requirements, units, roles, and applications;
- number of incidents reported by users - is the total number of incidents that are caused by the individual issues and reported by users. It shows how strongly specific problems directly affect users. The dimensions are the types of incidents, units, roles, and applications,
- Average time to resolve an incident/problem, which is the ratio of the total time to incident/problem resolution and the number of incidents/problems over a defined period. The dimensions are the types of incidents/problems,

units, roles, and applications.

This group does not include, for example, any large amount of metrics resulting from database or server administration. In these cases, we refer one to every item's relevant documentation.

9.3 Model Customization Possibilities

Throughout this chapter, we have dealt with the reference model of information management and its performance. The reference model can be implemented either comprehensively or only some of its selected domains. However, since it is a reference model, it is necessary to customize it to the conditions of a specific business or organization before it is used.

The conditions that are then the subject of customization considerations and operations include:

- Business size, i.e. whether it is a small, large, or multinational business:
    - Management content defined by ten domains should be implemented in large and small businesses. It goes without saying that in a small business, there is accumulation of numerous informatics activities among a few people, and most processes will be significantly simplified and implemented with minimum formalization, due to the simplicity of the organizational structure (see chapter 4),
    - in the case of multinational corporations, corporate-wide standards must generally be respected, which also applies to informatics management processes and methodologies,
- what is the level and scope of outsourcing, whether only development is outsourced or whether or not the SaaS model is used:
    - In the case of businesses with intense outsourcing, especially operation outsourcing, a number of processes are also outsourced, such as technology infrastructure management, project management, traffic, and possibly others,
    - Even in large outsourcing businesses; however, some processes or entire domains should remain on the customer side. This is especially true about strategic informatics management, economy management, and HR management;
    - some management processes become more complicated during outsourcing operations, e.g. user requirements management, where more complex cooperative relationships and approval procedures have to be clearly defined,
- whether it is a contractor business on the ICT market or a user organization:
    - If a business is an ICT service provider supporting external customers, then it is usually useful to define processes and metrics in all or most domains. A very important position is held by the domain of informatics services management, as these services are at the same time the main trading commodity;
- in which sector of the economy the business operates:
    - the economic sector does not basically the structure of processes or metrics. However, it is necessary to consider their partial modifications from the point of view of the character of applications typical of the sector, such as customer systems for utilities, banking systems, etc.
- what is the informatics management style, whether it is based on full centralization, whether it is decentralized or possibly hybrid:
    - for a more efficient application of the individual processes and metrics, a more obvious centralized management system is more suitable,
    - in a decentralized or hybrid system, it is useful to set binding standards, and in particular common metrics and rules for reporting and analyses,
- what the business culture is, built primarily on personnel discipline or whether more space is provided to their initiative and invention:
    - it is clear from the previous text that a business that is based, in particular, on employee initiative, does not usually create any effective room for implementing detailed and documented processes. In this case, it is; therefore, advisable to focus on creating a system of key metrics only.

10 BUSINESS INFORMATICS STRATEGIC MANAGEMENT

The importance of ICT for the business competitiveness has seen lately a number of contradictory views. The chapter sums up these views and presents the book authors' opinion on how a business can gain its ICT strategic advantage on the market. In the next part the chapter describes in detail the process of strategic management of business informatics and creation of information strategy according to the MMDIS methodology. It is; therefore, a detailed breakdown of the strategic management level in the ITGPM reference model - see chapter 9.2.1.

The chapter addresses the following questions:

- Does business informatics affect business competitiveness?
- How did the approaches to strategic IS/ICT business management develop over the last decade?
- What is the content and process of information strategy creation?

In other words, if business information technology is to be of strategic importance to a business, its activities must be primarily focused on business, not on improving technology without impacting on business effectiveness - see Figure 10-1.

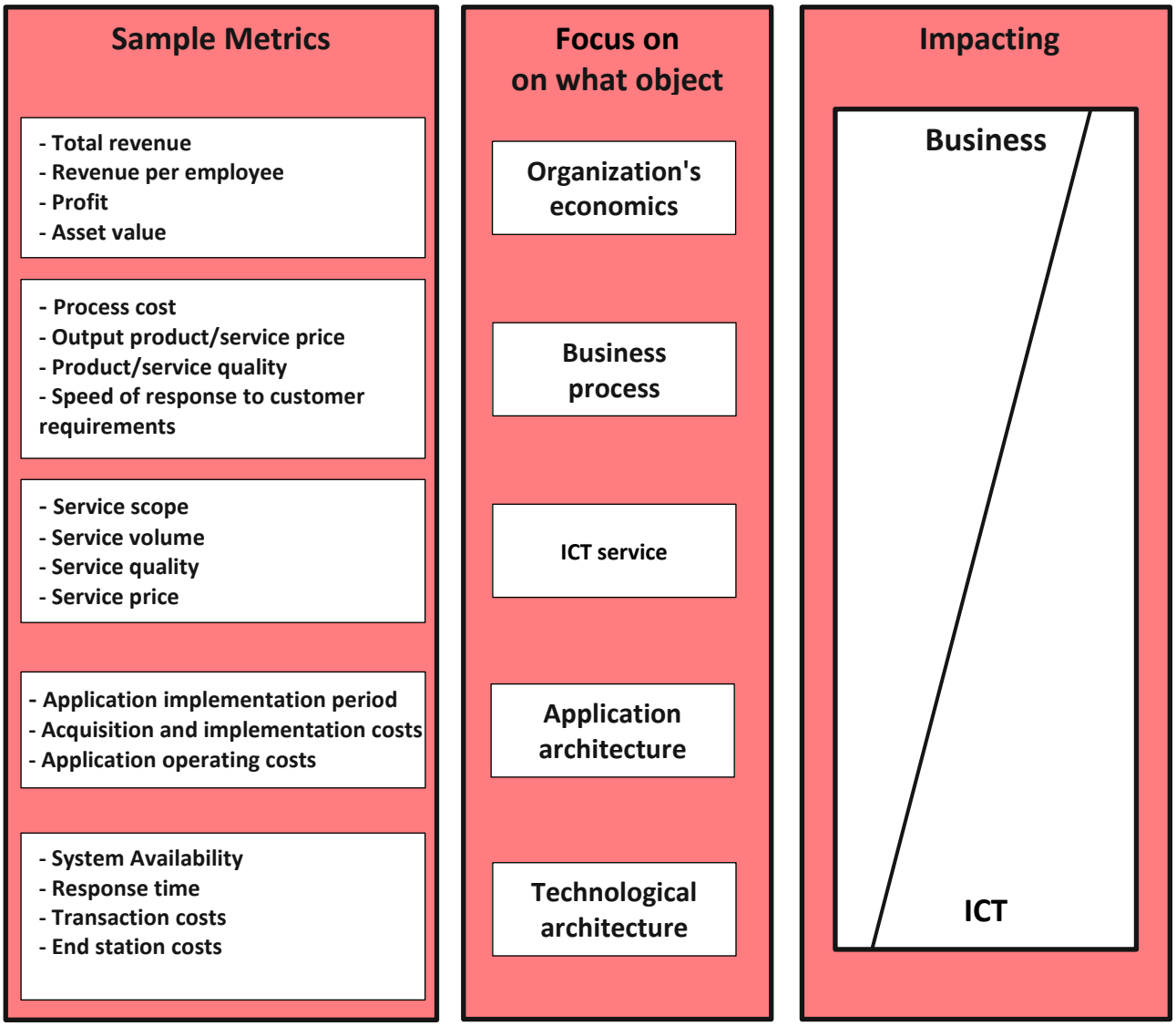


Figure 10-1 Potential business informatics orientations - (Voříšek k. , 2015)

However, the aforementioned facts do not mean that projects focusing on technology innovation and business

informatics management cannot bring economic effects. For example:

- Innovation of ICT processes, using ITIL, CobiT, or ITGPM can improve the quality and performance of ICT processes, reducing ICT service delivery time and increasing their quality,
- ICT consolidation focused on reducing the number of heterogeneous used platforms, database systems, and operating systems may reduce software license costs and costs of managing these resources,
- simplifying the application architecture may reduce the costs of licensing, maintenance, and component integration.

The key to gaining the economic effect of investing in technology is the identification of the line-cause result from the level of business towards technology and vice versa. Then, we are able to determine what economic effect or value will be generated by technology investments. If an investment has no benefit (i.e. generates no new value, eliminates no problem, reduces no risk, etc.) then it is unreasonable to make such an investment.

The following conclusion derives from the aforementioned arguments: The strategic importance of ICT has not diminished, but it cannot be achieved in the same way as in the past. Strategic benefits cannot be achieved simply by deploying new technology. The premise is a unique and effective linking of ICT with business model, business culture, and business processes that enable the business to increase its speed of response to significant events, reduce costs, improve quality, or provide new products/services to its customers, and obtain key information before its competition does. Therefore, future information projects must follow this direction.

10.1.1 . Three Conceptions of IS Strategy

(Chen & Teubner, 2010) has summarised IS strategy is the focus of the current study, in literature review. In the 48 articles that study IS strategy, he discussed the implications for the contextual elements (i.e., process, impact, and business/IS strategic alignment) of the IS strategy construct displayed in Table 4 In particular, he analyzed these 48 articles along the three contextual elements and identified three different conceptions of IS strategy employed implicitly in these articles: (1) IS strategy as the use of IS to support business strategy; (2) IS strategy as the master plan. IS role within the organization. In fact, deriving the conceptions of IS strategy from these articles was challenging, because many authors used the term (e.g., IS or IT strategy) without defining it. He therefore developed these conceptions inductively by examining the theoretical basis, research questions, and content of these articles. It is important to note that a conception of IS strategy is not necessarily synonymous to a definition. While a definition specifies the content and scope of the construct, a conception reflects the set of underlying assumptions that an author has inherited (mostly implicitly) about a construct. The three conceptions of IS strategy that he identified from the 48 studies reflect the three general assumptions of the authors related to the contextual elements of IS strategy outlined above (i.e., process, impact and alignment).

Table 1. Three Conceptions of IS Strategy Identified from IS Literature				
Conception: IS strategy as…		the use of IS to support business strategy	the master plan of the IS function	the shared view of IS role within the organization
Differences in the definition of IS strategy (or the questions answered by the IS strategy) applying Mintzberg (1987)'s Ps.		**Position**: For a chosen business strategy, how can IS be used to support business strategy/gain and sustain the targeted competitive advantage?	**Plan**: What IS assets (IS staff, IS process, infra-structure, applications, IS budget) are required and how to allocate the existing ones efficiently?	**Perspective**: What is our view towards IS within the organization?
Assumptions related to the IS strategy development process	Starting point when developing IS strategy	A chosen business strategy	The IS function	The managerial attitude toward IS
	Standpoint taken when developing IS strategy	Business-centric	IS-centric	Organization-centric
	Relationship between IS and business strategy	IS strategy is developed as an inherent part of the business strategy. IS strategy is not a strategy in its own.	IS strategy is developed in isolation from business strategy. IS strategy is viewed as functional level strategy.	IS strategy can be devel-oped separately from the business strategy. IS strategy is an organiza-tional level strategy.
Assumptions related to the IS strategic impact	Desired impact of IS strategy	Ensure business strategy is implemented and the desired strategic position of a business is achieved.	Identify IS assets require-ments; ensure required assets are retrieved and effectively allocated.	Provide a shared under-standing across the organization to guide subsequent IT investment and deployment decisions.
Assumptions related to IS/business strategic alignment		Intrinsic *a priori* alignment	*Ex post* alignment	Dynamic alignment

Table 4 - Three Conceptions of IS Strategy, (Chen & Teubner, 2010)

10.1.2 Conceptual Model and Information Strategy Structure

The information strategy conceptual model (IST) per the MMDIS methodology defines the IST creation process - see Figure 10-2. It becomes clear from the Figure 10-2 diagram that the IST creation features its three main groups of activities:

- Description and evaluation of the current IS/ICT state,
- Definition of the IS/ICT target status,
- Suggested path of transformation of the current state into the target one.

The description and evaluation of the current state characterizes the strengths and weaknesses of today's business informatics. This determines the starting point for the journey to new goal, and also allows you to estimate the cost of travelling to that goal.

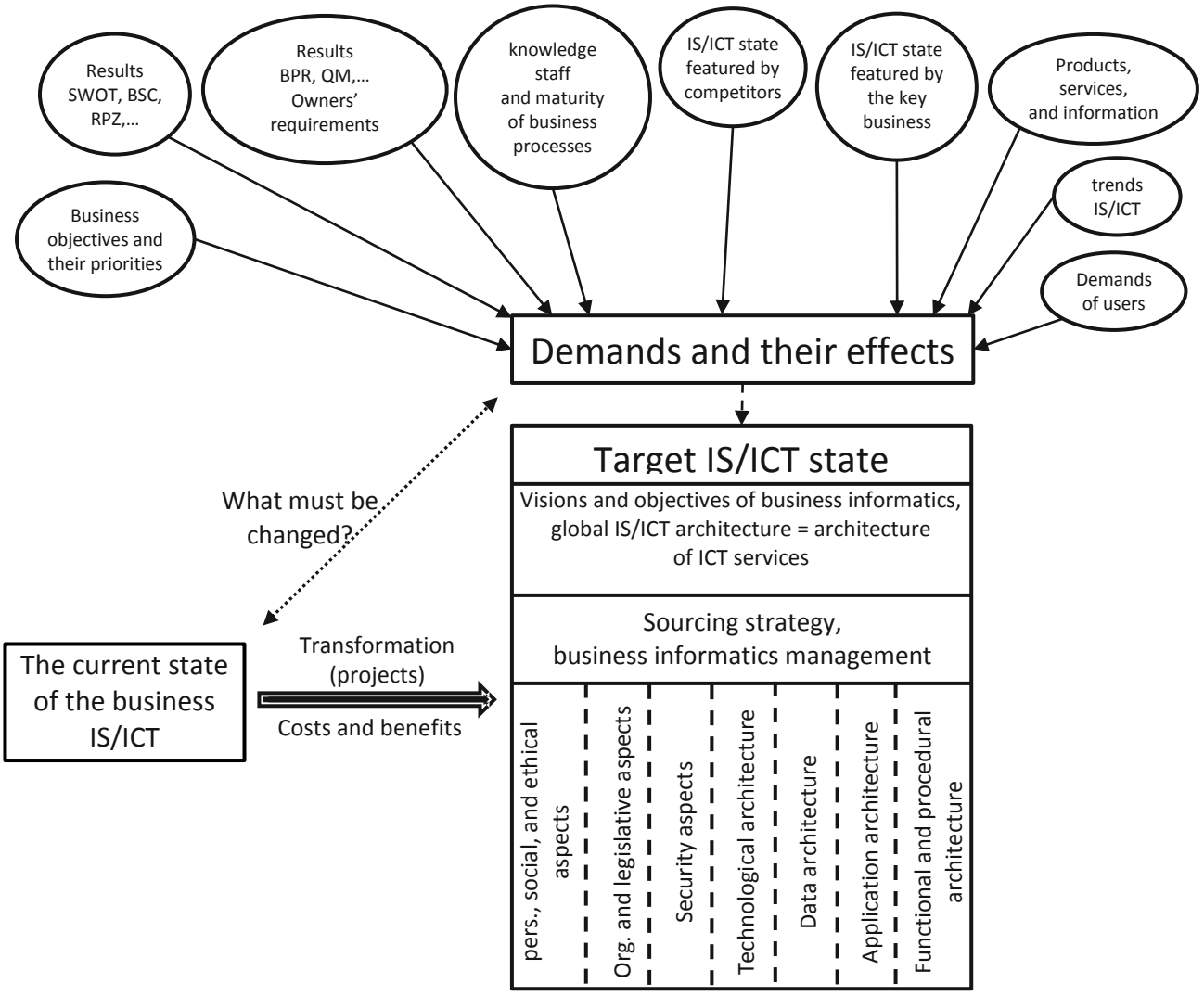


Figure 10-2 Information strategy development conceptual model - (Voříšek k. , 2015)

To define requirements for the target IS/ICT state, nine key inputs and analyses are used:

- Business objectives and their priorities (predetermining IS/ICT objectives and priorities);
- results of business SWOT analysis and similarly oriented strategic management methods, such as BSC or RPZ (they indicate, which strengths of the business should be further promoted, which weaknesses need to be eliminated, and which business activities need to be prioritized);
- results of project BPR and TQM (from the description of innovated business processes and results of quality management projects can be derived the optimal IT support)
- employee knowledge and current maturity of business processes limit objectives that are achievable in a short term and predetermine the areas of training required,
- analysis of the IS/ICT competition status (benchmarking with competition can set us a useful mirror for our IS/ICT management)
- assessing the state of the key IS/ICT business partners can help us establish closer co-operation with our suppliers and customers,
- evaluation of application software, services and information available on the market (gives information on what building blocks we can use when building our IS/ICT, and when we use it, what we need to adapt to)
- evaluation of the IS/ICT trends (it is appropriate to know where those who are building the components, methods and tools of the future information systems proceed and whether the current trends can be used to streamline business informatics);
- user requirements (where experiences and user experiences are concentrated).

10.1.3 Business Informatics Strategic Management Process

In this sub-chapter, we will describe in detail the process of strategic management of business informatics and information strategy creation process. The main stages of the process are shown in Figure 10-3.

1) IST Planning

The first stage is the information strategy plan development. The plan includes as follows:

- Specification of the solution content and depth,
- specification of the IST timeframe, i.e., period covered by the information strategy,
- proposed solution organization - team composition, definition of responsibilities and authorities of the solvers, determination of working conditions,
- setting a strategy development timetable.

A point that deserves more detailed clarification is the specification of the solution content and depth. Like any other methodology, it is not appropriate to use the IST creation methodology described here, regardless of specific conditions. The procedure and resulting IST structure must be modified in particular per the following conditions:

- Business size and scope of its IS/ICT,
- what is the main reason for the IST creation (e.g., the decision to innovate a part of the information system focused on production logistics, decision that the business will strive to outsource its IS/ICT operations, global strategy has changed, etc.)
- whether it is the first IST version or whether an existing IST versions will be verified and updated,
- how it is composed, and what experience the research team has.

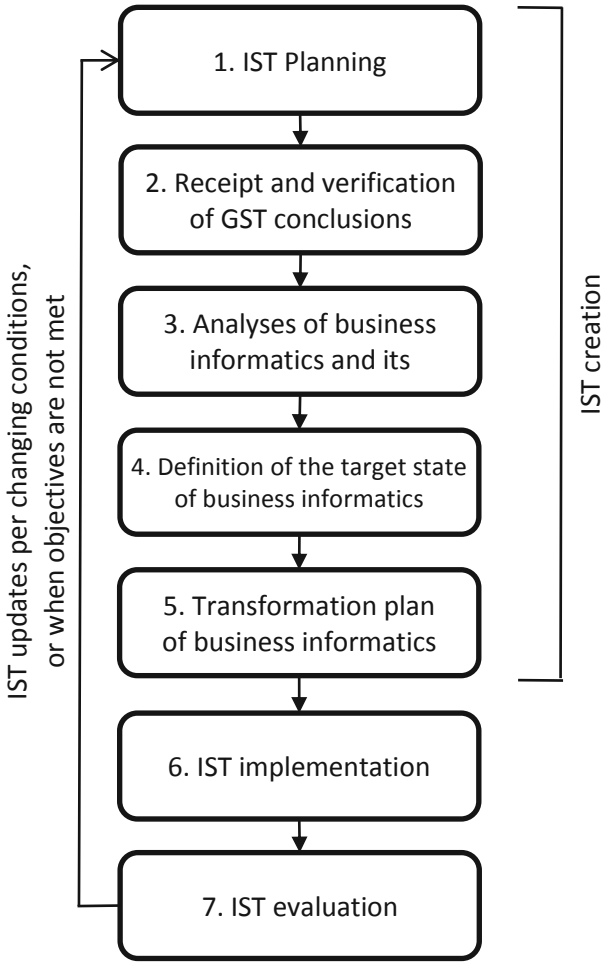


Figure 10-3 Business informatics strategic control process - (Voříšek k. , 2015)

2) Receipt of the GST Conclusions and their Verification

The second stage is to take over the global strategy results and verify them from the IS/ICT perspective. During this stage, global business strategy documents get analysed (global strategy objectives, business development programs, SWOT analysis, BSC, RPF, etc.) and identified by factors that will require specialized or extensive information support or will affect IS/ICT operations.

For example, when one of the enterprise development plans to set up another branch office in another city and counts on its close linking to the headquarters of the company, a number of important IS / ICT requirements will emerge from this development program (creating a technology infrastructure at a branch and connecting it to a central system, training new users, etc.).

3) Analysis of Business Informatics, its Surroundings, and Summary of IS/ICT Requirements

The third stage of the strategic management process focuses on the analysis of business informatics, its significant surroundings, and summary of all the IS/ICT requirements. This stage consists of seven sub-steps:

1. Analysis and evaluation of the IS/IC trend.
2. IS/ICT competition analysis.
3. Analysis of IS/ICT business partners.
4. Analysis of products, services, and information available on the ICT market.
5. Analysis of corporate culture, maturity of business processes, and employee knowledge.
6. Analysis and evaluation of the current IS/ICT status.
7. Summary of IS/ICT requirements.

Note: These analyses may be quite laborious and; therefore, time-consuming. Therefore, when developing an information strategy, the analyses that are at the most important ones for the business informatics direction setting get completed. The remaining analyses can be completed in the next strategy version when their urgency becomes clear.

4) Definition of the Business Informatics Target State

The fourth stage of the strategic management process is the definition of its target state over two to three years. The stage features six steps:

1. Formulation of vision and business informatics objectives.
2. Proposed global IS/ICT architecture, i.e. ICT services architecture design.
3. Proposed IS/ICT sourcing.
4. Design principles for IS/ICT development and operation.
5. Proposal approval.
6. Projection of global architecture into sub-architectures.

5) Plan of Transformation to the IS/ICT Target State

The fifth stage of the strategic management process and the final stage of the information strategy is the plan of transformation from the existing to the target IS/ICT state. The stage features three steps:

1. Project specifications and time-schedule.
2. IST economic analysis and budget.
3. IST approval.

10.1.4 IS/ICT strategic management principles

Upon reading the previous chapter, numerous readers may have become concerned and tell themselves: "If the information strategy includes all that is described here, then it is a document whose preparation must take years of work." This is not correct. We must bear in mind that the IS/ICT strategic management goal is not to write a report, but a positive change in the IS/ICT area.

Nevertheless, even after this introduction, the reader seems to miss answers to multiple questions: Who addresses the information strategy? How long? To what depth? How much forward does IST look? When does IST change? When and how is IST used?

Who Handles the Information Strategy?

The IST author is usually a team of top business executives, business IT experts, and external consultants. It is not appropriate for IST to be only created by an external organization. The main reason is that IST must change the genetic information of the business. This change cannot be accomplished by delivering a multi-page document. Any desirable changes to an organization's genetic code are only achieved by "delivering" new knowledge and a new value system through discussions among external consultants and business staff, training, and management interventions of the business management.

In the ideal case, the core team has about 4-6 members, and when it is led by a chief informatics officer, or if a business does not have this position, one of the business technical directors in charge of informatics. It is appropriate to involve other business employees in the sub-materials and analyses, especially during the second and third stages of IST creation.

What is the IST Processing Time?

Both the world and economic environment are evolving increasingly quickly. Whoever plans slowly, and his changes are slow as well, he usually "misses the boat". Therefore, when developing a new or remarkably innovated IST, the reasonable IST preparation period is about three months.

Once a strategy is developed, strategic management does not end, it begins. More specifically, IS/ICT strategic management is a continuous process in which developing a new strategy version is one of its milestones. In the meantime, between the end of the creation of one version of the strategy and the beginning of the creation of another strategy version, they serve as a basis for strategic decisions. During this period, strategy content gets modified, both in order to capture the changes that have occurred and, secondly, the strategy is complemented in those parts, which, during the main formation period, were subject to limited time; however, they became critical later on.

During strategy implementation, at least during quarters, the extent to which plans are successfully implemented in the strategy (schedule and budget projects planned benefits, etc.) must be evaluated. If the identified state is in conflict with the plan, the causes must be identified and plans revised.

How Detailed is the IST Processing?

As has been mentioned more than once, the aforementioned information strategy content is to be understood as maximum one. When planning a strategy development, it is necessary to decide which parts of the strategy can be omitted, postponed at a later stage, or forwarded to tactical management. However, it must always be true that IST covers the entire business, all its locations, branches, and business activities. Otherwise, IST could not ensure the integrity of the entire IS/ICT business.

The information strategy, on the other hand, must not go into too much detail, particularly in the section on partial architectures. Information technology is evolving so rapidly that IST describing future ICTs could become obsolete too early. Therefore, it is advisable to only leave a detailed specification of partial architectures to the individual planned projects.

What Time Period does the Strategy Cover?

The planning horizon for which the information strategy proposes the IS/ICT target state is about two to three years. The information strategy planning period should be the same as the business corporate strategy planning period. The plan for the first year is more detailed than year two and year three plans. After a year, the strategic plan will move one year ahead.

When does the Strategy Change?

Information strategy changes can be divided into two groups - changes further specifying the strategy and conceptual changes. A further specifying change occurs when:

- Any project begins, changes or ends,
- it became clear that previously omitted parts needed to be added, or only roughly processed parts needed to be further improved.

A conceptual change creates a new information strategy version. This new version responds both to changes in the business environment and to changes in business objectives and changes in the potential of available information technologies and services. A new version should always be developed when:

- over a few subsequent quarters, it became clear that meeting the objectives of the latest IST version is unrealistic, and that some of the strategy-related metrics shows longer-term warning values,
- global business strategy has changed. Significant changes primarily include: acquisitions, expansions into new territories, change of the main line of business, decentralization/centralization of resources and decision making;
- changed requirements of business partners for the way of managing mutual relationships,
- there is a new trend in information technology that the business could use to gain its competitive advantage.

When and how is the Strategy Used?

We have talked about the use of the strategy in the previous text many times. Therefore, we only summarize the main application areas of the information strategy:

- it is the basis for the awarding individual projects, their mutual coordination, and control of solutions,
- it defines the interdependencies among IS/ICT projects and other business development projects (ISO 9000 projects, business reengineering, professional development projects, etc.)
- is the basis for controlling the information system development (its content, time-schedule, technological levels, costs, and effects),
- is the basis for creating/adjusting the relationships with external partners,
- is the basis for processing a demand document for system integration, or demand documents for outsourced services and products,
- solvers (external and internal) of the individual projects, preliminary studies and other important documents related to IS/ICT must be (organizationally, economically and, time-wise) guided to the consistent use of already processed materials within the information strategy.

11 BUSINESS INFORMATICS SERVICES CONTROL

In chapter 2, we defined the information service, described the basic characteristics of ICT services, ICT services life cycle. From chapters 6, 8, and 10 we know, that the service catalogue and service architecture are some of the basic documents of business informatics management. The importance of ICT services is mainly due to the fact that they are a tool for communication between a business and business informatics (see the SPSPR model in chapter 6.1.2), tool for managing relations with external partners in business informatics and a product that - unlike the technologies themselves - enables a business to gain its competitive advantage (see also chapter 10).

In this chapter, we will explain in detail the life cycle of ICT services and will focus on how to design ICT services architecture and how to define ICT services in order to fulfil their role as one of the key tools for managing the relationship between a business and business informatics.

The chapter addresses the following questions:

- What is the ICT service life cycle?
- How to design and structure application services?
- How to describe an ICT service in a service level agreement (SLA)?
- How to manage SLA-based services?

11.1 Structure of ICT services and design of ICT services architecture

The objectives of the ICT services architecture of a user organization and ICT service-specialized provider vary. The objective of the user organization is to provide (internally or externally) at an affordable price, all the services required by business processes and to integrate these services. On the other hand, the service architecture of an ICT service provider is to offer and deliver such a portfolio of integrated services to such a segment of customers, in those territories, and in such a volume, that will provide the highest value for invested money. The text of this chapter primarily focuses on managing ICT services in user organizations.

An activity that has the greatest impact on the relationship between business informatics and a business is the creation of an ICT services architecture. The creation of an ICT services architecture is part of the IS/ICT strategic management and determines:

- which ICT services will be provided in at a business during a given period,
- to which users,
- what the links among the individual services are.

The basic categorization used to define ICT services in a service architecture is the categorization per the ICT service subject. This categorization divides ICT business services into information, application, infrastructure, support, and mixed services.

Records of ICT business services are contained in the service catalogue. In the catalogue, at least the following attributes are tracked for every service:

- service identification,
- service name,
- service category (information, application, infrastructure, support, mixed),
- external/internal,
- service state (planned from, in progress from),
- service owner,
- service version.

In a separate document (SLA - for details, see chapter 11.2), the following parameters are defined for every ICT service:

- customer (business process, business unit, business partner),
- user category,
- supplier,
- service effects and metrics,
- content - functionality/data, training, service centre services, etc.,
- volume - number of users, data volume, number of transactions, etc.,

- quality - availability, response time, reliability, safety, etc.
- price - basic price and influence of volume and quality characteristics on price,
- other terms and conditions - the rights and obligations of the contracting parties, service changes, methods of measuring SLA performance/service delivery, revision and audit cycles, rules for non-conformance management and escalations, etc.

Part of the ICT service design is to which users, customers will be offered a service. The basic breakdown of ICT service users (see Figure 11-1) is as follows: internal users, customers, partners, and public. The same service may be provided to multiple user categories at the same time, while the SLA parameters of this service may vary from category to category. For different users of the same service, the following service parameters may be set differently: availability, service centre services, business conditions (comparison with various mobile operator services to prepaid customers and contract customers) or vice versa, a service with unchanged parameters can be provided to all (for example, telephone services are provided by the internal ICT department as a rule to everyone, email is also usually provided by all the same channel, the same client, same infrastructure and protocols, etc.).

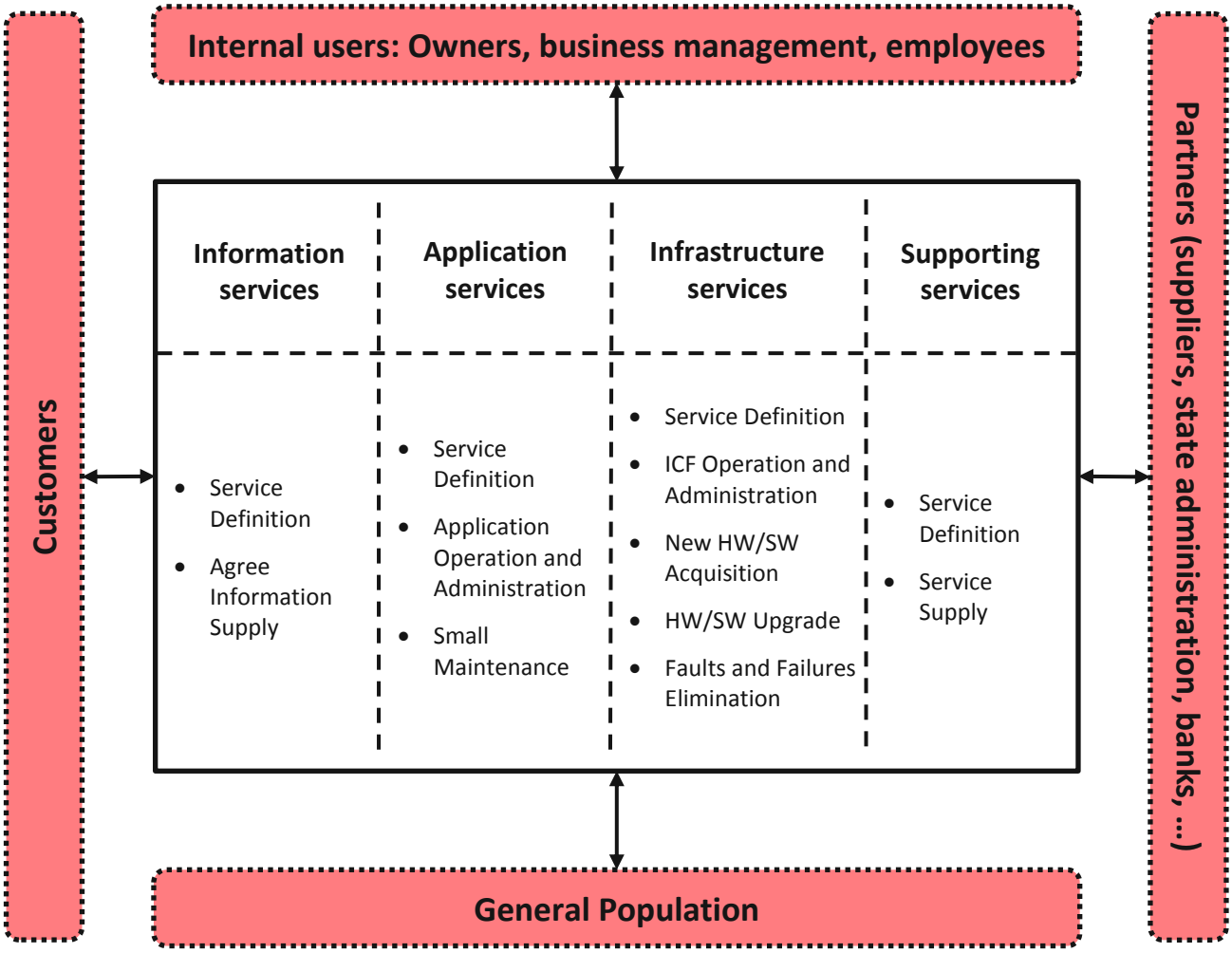


Figure 11-1 ICT Services and their users and the main operations above the service - (Voříšek k. , 2015)

The relationships among services determine the conditionality of ICT services, i.e. The existence of a service is a prerequisite for the provision of another service (for example, an infrastructure service as a prerequisite for providing an application service, an ancillary service as an accompanying service to a particular application service).

From the business point of view, the most important ICT services are information and application services. While the definition of information services is usually not problematic because it is based on the information provided by the service (e.g., product catalogues supplied by our suppliers, current exchange rates, etc.), the definition or structuring of application services is a greater problem. There are three ways of application services structuring:

- application services correspond to the structure of business processes and their sub-functions (or activities). In a not too extreme case, this means that for every business process one application service is defined,
- application services correspond to the structure of software used to provide the services, i.e., every software package or software module comes with its application service,
- application services correspond to the basic user categories (partners, customers, etc.) and to the structure of business units (for internal users), i.e., every business unit comes with its application service.

Each of these variants features both its strengths and weaknesses that we will analyse in the following paragraphs.

11.2 ICT Service Definition

The service architecture and service catalogue creation is followed by the definitions of the individual ICT services. The ICT service definition describes all the essential parameters of a delivered service. It arises from a dialogue between the customer and ICT service provider - see the dimensioning of ICT resources per business requirements in the SPSPR model, as described in chapter 6.1.2. The ICT service definition is an integral part of a Service Level Agreement (SLA). The agreement specifies what the provider is obliged to deliver to the customer, to what extent, in what quality, and how much the customer will pay for it.

The basic SLA structure per the MMDIS methodology is as follows:

- identification answers the question, "Who provides his service to whom?",
- goals, effects - specify, "Why is the service provided?",
- content - says, "What?" and "How is the service provided?",
- volume - answers the questions, "Where?", i.e., in which locations and to which users is the service provided, and "How much?", i.e., what is the total volume of service during a given period,
- quality - specifies "With what availability, response time, reliability, and security is the service provided?",
- price and terms of business - indicate "For how much is the service provided?" and "What circumstances affect the resulting service price"
- other service characteristics - this section lists the remaining business and technical characteristics of a service, such as service reporting, service change procedure, service termination procedure, etc.

12 SOURCING IN BUSINESS INFORMATICS

In interpreting the principles on which business informatics management is based, we have formulated the principle of cooperation: "The key to success in the global economy is to identify our own" unique "knowledge, competencies, and resources that will underpin our business plan. It is usually more beneficial to gain other necessary knowledge, competencies, and resources from business partners. The goal is quick response, low cost, scalability, and quality. "

This chapter addresses the issue of how to identify those services, processes, and resources that business informatics should secure itself in the business, and how to find a suitable external contractor for other services, processes, and resources.

The chapter addresses the following questions:

- What are the usual reasons for transferring a certain functional area to an external provider?
- Which functional areas can be transferred without increasing the risks of doing business?
- What are the outsourcing options that are relevant, and what are their critical success factors?
- What steps should be taken to transfer a functional area to an external provider?
- How to choose an external provider?

The cooperative society is a significant feature of the existing economic environment. It features the creation of alliances and close cooperation of businesses involved in supply chains. One of the typical characteristics of a cooperative society is the use of outsourcing as one of the strategic business management tools.

Despite its importance, academic research remains surprisingly sparse in the area of IT service management for multi-sourcing environments and service integration. Existing research does not provide enough guidance on how to further develop IT service management for enabling integrated end-to-end management of services. The question at hand is how IT service management needs to evolve to achieve integrated services and which processes are most important. A better understanding of the critical processes including the changes required would enable more focused research and

more successful multi-sourcing solutions in practice (Goldberg, Satzger, & Fromm, 2016).

To contribute to this ongoing discussion, we investigate IT service management in the light of service integration by addressing the following research questions (Goldberg, Satzger, & Fromm, 2016):

1. Which IT service management processes are most important for successful service integration in a multi-sourcing sourcing context?

2. How can selected IT service management processes be designed and implemented for effective service integration in a multi-sourcing context?

In the IS/ICT area, two opposing tendencies advance: on the one hand, the importance of IS/ICT for the competitiveness of economic operator is steadily increasing; on the other hand, the IS/ICT needs to provide more and more human, financial, and technical resources. For multiple economic organizations, it turns out to be financially and personally intolerable, or even totally impossible, to carry out all the activities related to the development, operation, and maintenance of IS/ICT on their own. Therefore, they try to transfer some of their activities or most of them out of business - to external suppliers of IS/ICT products and services. In other words, they strive to use outsourcing.

12.1 Sourcing Concept

Business source ownership is associated with resource investments and responsibilities for managing the resource (records, operation, maintenance, development, protection, etc.). These responsibilities can make the business stop to concentrate on its core business. Therefore, businesses proceed from their ownership of things to the use of things and services and strive to only own those resources that are absolutely necessary for the realization of their main subject of business.

Sourcing is a business process whose objective is:

- decision on which services, processes, and resources are to be secured by the business itself, and which are to be secured through external providers,
- selection of the most suitable external service providers,
- drafting contracts with providers on the content and level of services provided,
- checking of provided services and management of relations with external providers.

Outsourcing is a process that assures the transfer of responsibility for a given service/process/resource to an external provider.

By contrast, insourcing is a process that assures the transfer of responsibility for a given service/process/resource from an external provider to a business.

12.2 Potential Outsourcing Reasons

In this sub-chapter, we will analyse the reasons that may lead to a decision on why to allocate a certain functional area to the responsibility of an external provider. The reasons are analysed first in general in the individual paragraphs, i.e. for any area, and then, the IS/ICT specification is performed.

12.2.1 Cost Reduction and Control

Reducing and easier control of the cost of a particular functional area are the main reasons for outsourcing. The reduction of the costs of an individual business is made possible by transferring costs of several businesses to one joint entity - provider. It is able to economize, i.e. apply economy of scale, i.e. costs savings. The costs per service unit decreases with the range of services rendered. Above all, these are fixed costs that are required to operate a functional area but cover a wider use than one particular business is capable of. In this way, the provider may be a cost-sharing agent, for example, for buildings, machinery, and equipment, but also for acquiring and maintaining the skills of the required workforce. Outsourcing of a functional area is; therefore, particularly beneficial if a functional area can be addressed in a standardized way for a certain range of businesses (accounting, catering, software development, maintenance, etc.). A standardized solution enables shared cost sharing to a wider range of customers.

12.2.2 Concentration on the core business

This reason for outsourcing is linked to the transfer of supporting business activities outside of a business in order to activate its own resources for the core business. This is not a narrower specialization within a business focus but a shift away from complementary functional areas. The focus of a business may be expanded. While operational details are taken over by an external partner, the business may focus on its broader business themes or tasks in its core focus. Outsourcing is a tool for optimizing business resource consumption, while at the same time achieving strategic goals.

12.2.3 Access to world-class capabilities and abilities

The substantial advantage of outsourcing is the easier move towards the world level in the functional area and the tendency to remain at the world level. With a good choice of supplier, outsourcing allows businesses to become expert partners. If a business is not a "leader" in its area, maintaining the world level is very costly and difficult, and the business tends to stagnate in such a functional area. This aspect is particularly noticeable in the information technology area.

The goal of (outsourcing) providers should be to provide their customers with services at a global level. Just as businesses transfer a functional area to focus on their core business, providers invest all of their resources and options into providing their services deriving from their focus. The abilities and capabilities of these providers usually result from extensive and long-term investments in technology, methodologies, and people.

12.2.4 Resources are not Available Internally

Businesses also transfer their functional area because they do not have access to the required resources within the business. This is often the case, for example, during a geographical expansion of a business, a larger reorganization that separates a business its resource, or during a business split when an important activity (such as transport) remains with the parent business. In the case of IS/ICT, this deficient resource is usually people - specialists in the information system development and operation.

In situations where a functional area needs to be built from the ground up, outsourcing is an attractive alternative. The possibility of rapid growth or expansion is an outsourcing suitability indicator.

12.2.5 Quick Solution of New Functional Area Requirements

The external variant of a newly-created functional area solution is feasible more quickly than an internal one. Outsourcing is; therefore. a by-product of another management tool - business process reengineering (BPR). A business that re-engineers its processes can transfer some of its functional areas to an external organization that is already running the required activity at such a level that would be expected from the re-engineering of this activity at the business itself. Thus, the required level is immediately accessible to the business, and it is possible to concentrate BPR activities on other functional areas.

12.2.6 Increase of Resource Flexibility

Major problems are faced by those businesses whose all functional areas or some of them are unevenly exploited due to seasonal fluctuations. If such a functional area is dimensioned to maximum performance, then the business features high fixed cost at a time of downturn that complicates its financial situation. On the other hand, reduced dimensioning of a functional area leads to the non-coverage of a peak season demand.

Outsourcing of such a functional area can be an effective solution to the problem. Obviously, this implies that payments for the provider's services are directly proportional to the volume of services provided.

This reason is usually not a reason to outsource the entire IS/ICT operation. However, it may be used for impact-driven applications - see, for example, the delivery of ICT services through SaaS.

12.2.7 Standardization of the solution to the subject area by securing one provider globally

If an business transfers a functional area to one, usually a multinational provider, it can easily and efficiently achieve standardization of the solution of the area in question in all of its locations.

This reason is very beneficial for the IS/ICT area. In this case, the IS/ICT service provider is usually a multinational company that, with its standard services, standard methodologies, and standard technology tools, guarantees the uniformity of application processing for all the sites. A classic example of this type of outsourcing is the worldwide contract between Continental and IBM.

12.2.8 Organisational Reasons

Outsourcing of a particular functional area results at some businesses from their organizational reasons, such as:

- business slimming,
- reorganization and flattening of the organizational structure,
- eliminating excessive dependence on one or a few people,
- reducing the number of workers.

12.2.9 Sharing risk management costs

There are various risks associated with investments and multiple business operating activities. Through outsourcing contracts, risks are divided into a network of a few businesses. In particular, providers, if they provide their services to multiple businesses, reduce their risks arising from a single business. They can invest (including research and development) "on behalf of" not one business, but on behalf of all of their clients. A business that buys their services shares the risk management costs with all the other customers of their provider. However, the outsourcing relationship itself, on the other hand, brings new risks.

12.2.10 Release of capital funds and spreading of costs in time

Outsourcing is a way of reducing investment into marginal functional areas. Instead of getting resources through investments, a business has these resources contractually available for their regular use with the use of routine, operating expenses. Capital funds are, therefore, applicable to the core business.

In the case of investments into any internally-run IS/ICT, there is a typical uneven spread of requirements for financial resources and a relatively significant time shift between the investment and its benefits. Outsourcing makes it possible to evenly spread ICT services financial costs. In addition, the costs are synchronized with the provided service volume.

12.3 Outsourcing Risks

Outsourcing of a business functional area is also associated with numerous risks. When comparing the benefits and disadvantages of the external and internal solution variants, the impact of the risks associated with the external variant must be taken into account as well. The assessed outsourcing risks should include:

- We will not find a partner on the market that manages the given area better,
- increasing dependence on external partners, their effectiveness, seriousness, and stability,
- increase in the business process time (thanks to the complicated interface between the provider and customer, for example, the extension of the IS/ICT operation incident time)
- leak of sensitive information,
- conflict of various business cultures,
- difficulty/inability to return to the original state,
- not handling another way of managing the transferred area - low maturity of business for this type of business relationship,
- low relationship (contract) responsiveness to changing customer requirements and changes in technology and market,
- loss of specialized knowledge related to a transferred area. In the case of IS/ICT outsourcing, larger businesses try internally to keep at least these very important experts - business architect, IT architect, and project manager.

The outsourcing risks need to be carefully assessed and certainly not underestimated. According to a 2006 survey (McLauglin & Peppard, 2006) 43% outsourcing contracts were terminated prematurely. Per the survey authors, the main reasons for terminating outsourcing contracts were:

- issues in formulating a mutually acceptable contract,
- not achieving the expected outsourcing benefits,
- IS/ICT was assessed as a strategic area in the next period, the outsourcing of which through an external provider is not desirable,
- changes on the ICT market,
- business management change.

12.3.1 Outsourcing of comprehensive IS/ICT

The other variant is the outsourcing of a comprehensive IS/ICT business. In this variant, the outsourcing provider transfers its responsibility for the delivery of all the ICT services and responsibility for ICT processes and ICT resources that relate to ICT services - see Figure 12-1. Unlike the previous variant, the responsibility for supporting business processes remains in the business, for example, its accounting process remains the responsibility of the business, but ICT-enabled accounting services, as well as other business processes, are outsourced.

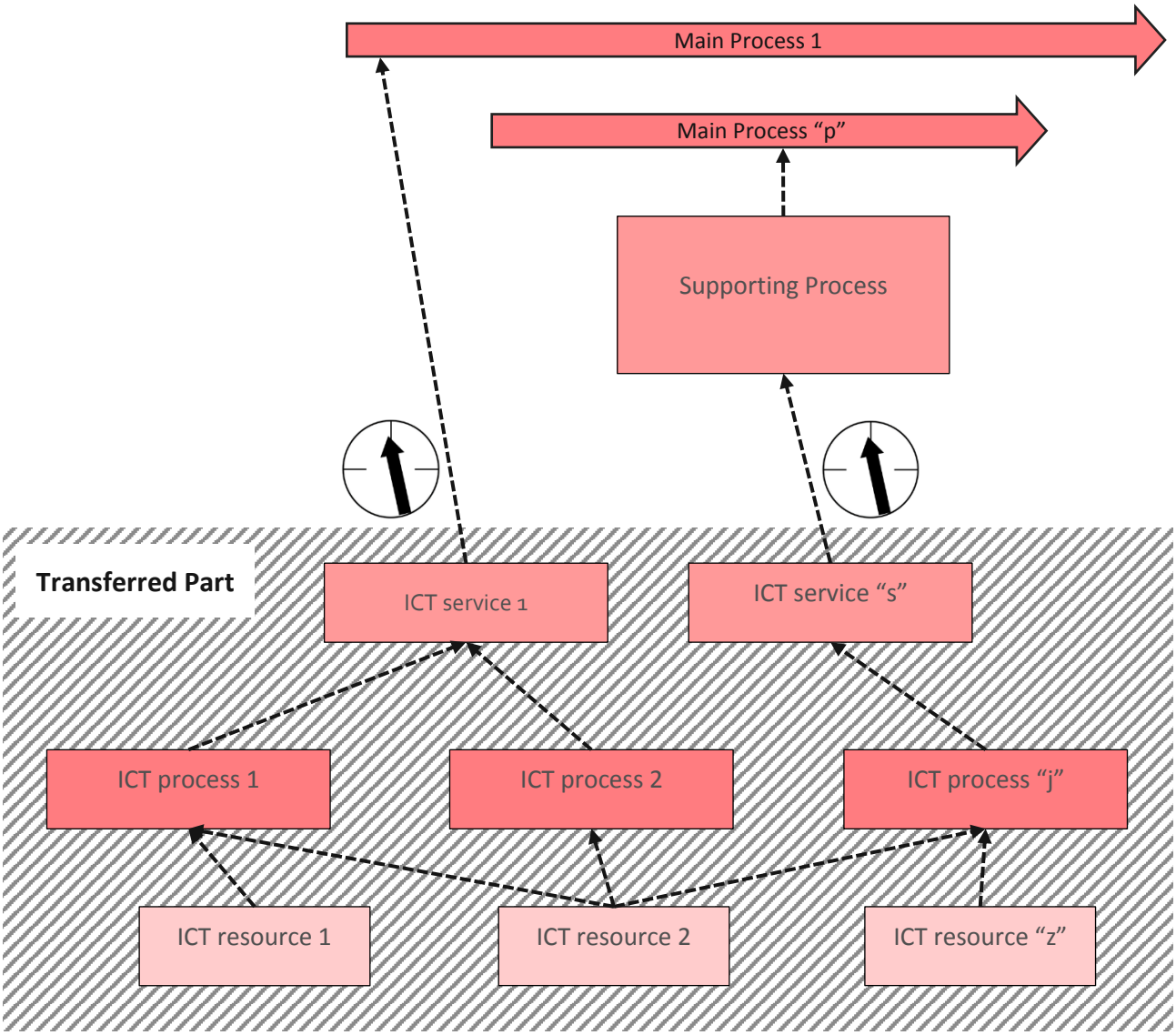


Figure 12-1 Comprehensive IS/ICT outsourcing - (Voříšek k. , 2015)

13 BUSINESS INFORMATICS EFFECTS AND COSTS CONTROL

The chapter deals with the fundamentals of business informatics financial management. Since the amount of financial resources consumed by a business IT keeps growing, it needs to be transparently managed also in terms of cost and achieved benefits. This chapter provides the basic information on linking financial management of a business IT department to business accounting. In the chapter, we will further familiarize ourselves with the accounting of services, cost analysis, budgeting and investment plans, as well as evaluating the return on investment in business informatics.

The chapter addresses the following questions:

- How do I charge for business informatics services and payments and how do I link them to the business accounting system of the entire business?
- How can I analyse costs and what does this activity require?
- How to identify and quantify business informatics effects?
- What procedures can be used to evaluate return on investments into business informatics?
- How to prepare investment plans and create budgets for the operation and development of business informatics and how to control them?

13.1.1 Breakdown of costs in business informatics

Cost may be defined for the purposes of this publication as: "Value-for-money, purposefully spent business resources for the purpose of economic activity." (Král, 2006) This definition emphasizes cost-effectiveness and is further refined by the following two characteristics:

- Purposefulness: Only an expense that is reasonable and proportionate to the result of an operation is considered to be an expense,
- Purposeful character: Any spending of an economic resource should lead to its appreciation.

In business informatics, there we can come up with a breakdown of costs in various ways. Costs breakdown is important for their subsequent internal allocation to individual corporate departments and therefore for determining the amount of payments that they should cover for the performance / services provided. It is also used to track the costs of delivering services, implementing individual activities, financial planning, and managing IT investments.

Let us mention the basic approaches to the breakdown of business informatics costs.

Breakdown of costs per the possibility of ownership assignment or clear identification:

- Direct (easily attributable, have a definite connection to a certain activity - can be entirely attributed to a particular customer),
- indirect,
    - absorbed overhead (indirect costs that can be fairly attributed to the customer);
    - non-subsidized overhead (indirect costs that cannot be uniquely attributed to the customer, and their assignment is often based on the forms of percentage surcharge to a certain defined price).

Cost Type Breakdown:

- Investment (term CAPEX is used)
    - HW according to the individual types of HW resources (servers, terminals, peripherals, routers, switches, cable distribution, spare parts ...)
    - SW (licences, upgrade),
    - services related to HW and SW installations,
    - buildings and work spaces,
- non-investment/operational (term OPEX is used)
    - purchased services (application and infrastructure services, communication services, consultancy/advisory, implementation, integration, prophylaxis, post-warranty service, training, help desk, marketing,
    - people (wages, skills upgrading, insurance, indemnities, ...),
    - buildings and workplaces in the case of rentals,

- consumables,
- other costs and overheads - travel, interpreting.

Breakdown of Costs by Asset Type:

- Technological infrastructure (acquisition, maintenance, repairs, upgrade, space, energy, maintenance, insurance, operating costs, administration, and administration);
- application functionality and performance (acquisition, implementation, customization, integration, operation, maintenance, upgrade, administration, support, and administration),
- data (acquisition and updating, saving, backups, archiving),
- human resources (acquisition, education, education, employee care, wage costs, insurance, workplace and personal equipment, and administration (HRM, PAM)),
- ownership risks (security and reliability costs (prevention), damage elimination costs).

Breakdown of Costs by IT Lifecycle Stages:

- Acquisition and development:
  - development
  - purchase - contract costs, delivery cost
  - rental - contract costs
  - Implementation and testing
  - related business process changes
- to ensure operation and use:
  - ICT infrastructure operation,
  - applications operation,
  - buildings, energy, consumables, insurance, property administration, etc.,
  - user training.
  - User support (help desk),
  - administration (CIO team, data management, application administration, ...),
- maintenance (extending lifecycle, modifying functionality, increasing performance),
- disposal.

Costs Breakdown according to Services Provided by the Business Informatics

The breakdown corresponds to the business informatics catalogue. At this point, let us just recall that we can divide the costs by services according to the subject of the service, the way of consumption of the ICT service, recipient type, service provider, and also the necessary resources and knowledge of the provider.

Unfortunately, it is not possible to recommend which of these cost breakdown methods is the best. It always depends on the particular business, the ways in which it manages its financial and in-house accounting, and also on the goals it wants to achieve through its costs breakdown.

13.1.2 Activity Based Costing

Activity Based Costing (ABC) is a method to analyse cost information for the individual services, products in a more detailed breakdown (compared to the requirements of "standard" accounting, etc.) ABC's foundation is a process that measures costs and performance of cost objects, activities, and resources. ABC is based on the principle that resources are consumed by activities that are further consumed by cost activities. The ABC method is further based on the use of cause-result relationships among cost entities and activities, and among activities and resources

ABC's foundation is to abandon the cost centre concept. The original cost centre term is used in ABC as an activity or group of activities. Examples of these activities may include OS upgrade, new HW configurations, service provisions (e.g., laptop service for personnel departments) etc. ABC may cover tens or hundreds of these "centres", thus creating space for achieving much more detail.

13.1.3 Total Cost of Ownership

The TCO method was first published in 1987 by Bill Kirwin of Gartner.

The Cost of Ownership or Total Cost of Ownership (TCO) is used as one of the most important approaches to business informatics assessment. TCO may be considered as a financial estimate calculated to help customers and business managers assess their direct and indirect costs associated with IS/ICT (HW and SW purchase and operation). TCO allows for clear and clear allocation of costs incurred to own and manage ICT infrastructure in a business (Gartner, 1). However, it should be noted that although we use the general term TCO, there are numerous detailed methods and methodologies to calculate TCO. Therefore, a TCO presentation should always state the methodology through which the TCO was calculated. It is important to mention that the TCO is not a total cost management system in general but is always calculated for a particular IS/ICT component.

The first company that started working with TCO was already mentioned Gartner, but due to the confidentiality of the calculation process, other approaches to identifying the TCO have begun over time. It follows from this that it is not possible to compare TCOs from different consulting companies, as the results are often different due to these different calculation methods. Another negative aspect is that the calculation methods change, according to the purpose for which the costs are allocated (data centre, help desk, etc.).

The TCO was designed to expose all the costs (both direct and indirect) that arise during the IS/ICT component lifecycle. Throughout the lifecycle, different costs arise, which can be broken down in various ways (see chapter 13.1.1).

TCO allows you to split costs from one total number into certain subcategories (and compare them with other businesses) to identify inefficiently managed IT segments or cost savings potential in the future.

The benefits and disadvantages of the TCO indicator are described in the following table:

Benefits	Disadvantages
Clear results for staff involved in financial management.	Non-public calculation algorithm. Various consulting companies use various evaluation procedures.
Used as another element of a portfolio of indicators when evaluating return on investment.	The use of IT for private purposes during working hours (ICQ, Skype, emails, etc.) is not included.
Possibility to take into account the time value of the money affecting the evaluation.	Focus only on costs (does not work with benefits or revenue).

Table 5 TCO Benefits and Disadvantages - (Voříšek k. , 2015)

13.1.4 Benchmarking

Benchmarking is a specific process developed by Xerox Corporation in the early eighties. Its basis is the process of re-comparing and measuring a selected company/company with reference organizations, both in a given country and anywhere in the world. The objective of benchmarking can be considered to be the acquisition of information that will help the rated companies to adjust/change their assets, so as to improve their performance. Per (Gartner, 2005), several types of benchmarking can be distinguished, based on business needs: Internal, competitive, strategic, functional, and financial.

The benchmarking definition per the Czech Benchmarking Company is as follows: "Benchmarking is the process of identifying best practices and learning from them in other organizations. It is an efficient tool in looking for continuous improvement and significantly better results."

13.2 Evaluation of returns on investments into business informatics

The evaluation of methods of economic efficiency of investments can be distinguished by methods:

- Static
    - average rate of return (ROx),
    - average percentage of revenue,
    - average annual cash-flow (CF),
    - average return on accounting unit,
- dynamic

- profitability index - PI/IZ,
- payback period (PP/DS) method,
- net present value (NPV) method,
- internal rate of return (IRR).

Each of the aforementioned methods has its benefits and disadvantages (proponents and opponents). Regarding the need for practical management of investments in business informatics, it should be the rule that comparisons or calculations will be performed through a predefined portfolio of methods, and the results will be compared to each other.

Graphically, previous methods and their relationships can be viewed through schematics.

In the following text, some of these methods will be explained, and a model example will be presented as to how such calculations are taking place.

13.2.1 Return on Investment

The ROI financial indicator describes the return on investment. From the ROI, it is also possible to determine how long the investment will be repaid before it generates a positive result in accounting.

However, long-term investments are one way of ensuring a competitive advantage for maintaining the business viability. The ROI indicator allows you to analyse the profitability/return on investment over a long period of time.

There are a number of profitability/return indicators. The basic ones include (Grünwald & Holečková, 2007):

- Return on Assets (ROA),
- Return on Equity (ROE),
- Return on Capital employed (ROCE);
- Return on Investment (ROI),
- Return on Costs (ROC),
- Return on Sales (ROS)

Profitability can be calculated as follows:

$$r_x = \frac{Z_r}{X}$$

Where:

r_x = return (profitability),

Z_r = average profit resulting from the investment (assuming the same profit every year for the life of the investment);

X = the value with which we want to compare the profit (total capital, sales, costs, etc.).

13.2.2 Investment Repayment Term

The repayment term defines the period (number of years) for which it will last, before the cash flow yields a volume of funds equal to the value of the original investment (investment costs). In the case of PP, it is necessary to consider whether the return on investment over the life of the investment will be the same.

If the returns are identical throughout the life of the investment, it is possible to calculate PP using the following simple formula:

$$PP = \frac{I}{CF}$$

Where:

I = investment costs,

CF = Cash-Flow from one year's investment (assuming the same CF for the life of the investment).

13.2.3 Investment Net Present Value Method

NPV (Net Present Value) is the difference between discounted revenue from business informatics (or its specific action), compared to the cost of the given activity.

The discounted value is the recalculated value of a certain amount of money whose outflow/income is planned in the future, but its expression is considered today's price level, that is today's value. Discounted value derives from the discount rate that takes into account, among other things, the risks associated with the acquisition of the given value (yield).

It, for example, (Synek, 2003) states that, in the current financial theory, it is preferable to use the assessment of enterprises through NPVs prior to other valuation methods such as profit-based, cost-based or return-to-pay assessments.

Some of the reasons why NPV is preferred:

- It respects the time factor,
- It considers the effect of revenue and expenditure over the life of the investment,
- It shows the benefits of investing in growth in the market value of a business.

There are two basic methods of determining NPVs, depending on what is expected:

- One-time investment event,
- Investment event, during which spending will take place gradually.

One-Time Investment Event

$$NPV = CHCF - I = \sum_{n=1}^{N} \frac{CF}{(1 + i_{VK})^n} - I$$

Where:

CHCF = Net Cash-Flow Value (investment income),

I = Capital Expenditure (investment),

CF = Cash-Flow (monetary income in the individual life years),

i_{VK} = Interest (required return - business discount rate),

n = individual years of life,

N = lifetime.

13.2.4 Internal Rate of Return

The internal rate of return method is the same as the previous one based on the present value. In the case of the internal rate of return (IRR), the discount rate is the identified variable. In the case of IRR, a discount rate is determined at which the current expected returns from the implemented/planned investment action are equal to the present value of all the expenditures associated with the investment event.

There is an indirect disadvantage of this method indirectly from the previous text, namely the need for an iterative process. To determine the IRR, we need to gradually determine those interest rate values that we will gradually approximate the result of the following equation to zero (we assume that Cash-Flow is given in individual years of life).

$$IRR \rightarrow \sum_{t=1}^{N} \frac{CF_t}{(1 + i)^t} = I \rightarrow i = VVP \; nebo \; IRR = i_n + \frac{\check{C}SH_n}{\check{C}SH_n - \check{C}SH_v} * (i_v - i_{n)}$$

Where:

n = time for flowing CF,

t = lifetime years,

i_n = lower rate of return,

i_v = higher rate of return

NPVn = net present value at a higher rate of return

NPVn = net present value at a lower rate of return

This method is popular in practice, but its implementation is not easy without proper IT support.

The advantage of the IRR is that it takes into account the time value of the money and, compared to the repayment period, it works with Cash-Flow over the entire life of the investment. One of its disadvantages is that if there is a significant difference between long-term and short-term rates of return, the IRR values may be disproportionately low or, on the contrary, high.

This method should be used especially in cases where the objective is to determine the profitability of the investment to cover investment costs. Another application of the method is, for example, its comparison with a discount rate including risk (e.g. the already mentioned WACC). In case of their comparison, if the IRR> WACC must be IRR, a project is acceptable Both ways of using IRR may be combined.

The latest method of using the result obtained is its comparison with the interest that would have to be paid if an investment loan was realized. In this case, the IRR should be greater than the interest rate that is paid on the loan.

If multi-investment decisions are made, the highest IRR is always selected.

13.3 Budgeting for Business Informatics Operation and Development

It is one of the most important and most complex activities realized in the management of the business informatics economy.

It should be remembered that a budget must not be a permanent document which we will draw up and continue to work with, but that it is a document that will serve us as:

- communication instrument,
- motivational instrument,
- control instrument.

13.3.1 general budget characteristics

Just as the three levels of enterprise management are distinguished, three basic levels of corporate budgets with a similar time focus are distinguished, namely:

- strategic (long-term) business informatics budgets. Long-term budgets are compiled globally and, in most cases, considered as a financial statement (that is, a financial budget) that is based on a forecast of future developments by obtaining information from past profit and loss, balance sheets and, of course, the Cash Flow statement;
- tactical business informatics budgets. Tactical budgets and plans can be viewed from time to time as plans created with the calendar year period or as plans created with the "natural length and business cycle" period. A typical example of plans with a "natural length and business cycle" period are the business units of a foreign company that differentiate the accounting period according to the laws of the Czech Republic (from 1 Jan to 31 Dec of a given year) and also perform the reporting in the business year interval according to the determination of the head office. Today, another approach is preferred in the world, i.e. their implementation in terms of natural length and business cycles;
- business informatics operational budgets, which can be elaborated to a very detailed level (e.g. weeks), through which relatively accurate tasks are determined by departments and their responsible leaders.

Refining and splitting higher levels of budgets into the individual parts of a business is a demanding activity whose successful implementation is a prerequisite for achieving business goals. For this splitting (Král, 2006), we recommend as follows:

- splitting must be motivational,
- consistency of activities of lower departments that lead to the fulfilment of the "individual" goals, so that their results support the achievement of the goals of the business as a whole,

- criteria by which a success rate is measured should be influenced by the department responsible for their fulfilment.

The basic process of creating an annual IT budget is similar to creating a company's budget. This budget should be based on the strategic IT budget in the information strategy, which usually covers a period of three years (see chapter 10).

When a budget is compiled, it is necessary to have a clear idea of the company's value objectives, from which the objectives of the individual parts of the business can then be derived. The business value objectives are primarily defined in:

- budget balance,
- budget statement,
- budget Cash-Flow

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