Perspectives of building project orientation of an organization and its technological support

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OBSAH

PREFACE

The dynamics of technology development in economy, social environment, legislation and global trends in general lead to need more extensive and complex processing of business tasks in order to be for any business organization successful on the marketplace. Since 50tieth of last century the project management has become a tool, which enables processing of complex data faster and more goal oriented compared with utilization just current operation techniques within given organization.

Modern approaches to management lay stress on project management, which is necessarily equipped with qualitative information. The most important information used for managing projects inheres in memories and experiences of employees – tacit knowledge, that is the basis for the creation of enterprise knowledge. A good project-oriented organization strives to use modern technologies as much as possible for the formalization of tacit knowledge and to store it into enterprise information systems. Thus, by application of advanced techniques – Data mining, Knowledge extraction, Knowledge discovery – the new knowledge can be extracted, serving to increase the competitiveness of a company or to predict its further development.

Software tools, i.e. information systems, which these activities enable are called Business Intelligence systems. The level of project management implementation, as well as the level of Business Intelligence systems´ implementation, can be determined by means of maturity models, which reflect actual state, whether in project orientation area or in the area of Business Intelligence adoption.

This monograph titled „Perspectives of building project orientation of an organization and its technological support" is one of the major results of the project VEGA, No. 1/0933/14, titled: „Perspectives of Business Intelligence tools' application for the development of knowledge within the building of project-oriented organization".

Authors

PART I
PERSPECTIVES OF BUILDING PROJECT ORIENTATION OF AN ORGANIZATION

Author: Ing. Štefan Marsina, Ph.D.

INTRODUCTION

Project management has been considered for a long time as a discipline for application techniques focused on planning and a combination engineering science and optimization theory (Söderlund, 2004). However, the field of project management has broadened its focus from the study of an individual project to the certain way used by companies in order to achieve their goals by using projects (Project Management Institute, 2005). Nowadays, projects are not used only as a solution for technical problems, but in an extensive way for developing and mastering businesses (Cleland and Ireland, 1999). Increased recent interest in project management is caused by the need for organizations to successfully cope with assignments coming from the rapidly changing business environment (Woodman, Sawyer, Griffin, 1993). Since the early 90s, authors have started using terms such as "modern project management" or "managing by projects" (Edum-Fotwe and McCaffer, 2000; Gareis, 2005). We can encounter with the common opinion that project management is in a process of transforming into a new paradigm, which involves proper control or certain project process to reach and ensure high-quality output (Stiglitz, 2002; Gareis, 2005). There are several reasons for such transformation. Increased pressure from the stakeholders´ side who want to ensure that their invested resources will be appreciated and the value of the organization will be increased in term of organizational growth. Creating a project management system undoubtedly requires a certain rethinking of "business-as-usual" and asking not only managers but also employees at all levels to approach their daily tasks differently (Kini, 2000).

Using the benefits of ´managing by projects´ for small and medium enterprises has a substantial impact on their development. These enterprises create an appropriate environment for project-oriented companies and subsequent creation of mature project oriented organization (Marsina, 2009). There are a lot of advantages that can be taken when the company reaches the level of maturity. Whether it is the ability of top managers to predict future opportunities or threats, use their financial knowledge to draft the budget needed for projects, manage and motivate human capital, etc. (Birkhead, Sutherland, Maxwell, 2000). Undoubtedly, there are many opportunities for these companies, how to use projects on a daily basis and thus replace daily routine tasks, but not all of them take this change because the level of their project-oriented

organization has not reached a particular level of maturity. This is a long lasting process, but if managed well, it is a way for immense development (Bryde, 2003).

1. STRATEGIC ORIGIN OF A PROJECT IN THE ORGANIZATION

The low level of strategic thinking of the manager‘s results in focusing on short term goals and lacking the ability to predict future opportunities and threats, as well as to formulate a grand strategy (Higgins, 1991) of an organization. When an organization as a whole overlooks the current trends in the environment, it becomes vulnerable. Despite this fact, the majority of the organizations have the traditional approach towards the strategic process and also use an autocratic approach when managing human resources. This approach was undoubtedly useful during the industrial phase of the economic development. However, this traditional approach is far from being as effective as new approaches towards the effective management. One of them is undoubtedly the project management.

Influenced by overall and mass usage of information and communication technologies, convergence of industries, the global conditions of entrepreneurship have significantly changed. The dynamics of current competition has reached the level, where above all innovations and shortening of strategies´ life cycle ensure success in business. Innovation strategies integrate the effort to accomplish goals through strategic projects. The most companies henceforward maintain a traditionally planned approach to strategic process and in doing so, they use rather autocratic means of decision-making towards their employees. This approach worked in the industrial phase of economy development, but it becomes a weak point in the management of a company at present. There are many companies in the world which develop new approaches to long-term strategy in cooperation with public experts that ensure a successful business. The strategies, and specifically innovation ones, are implemented more and more by programs and projects. There is a trend to become a project-oriented organization. Becoming the project-oriented organization cannot be the result of a sudden decision of executives but the mature project-oriented organization is coming to existence at the end of the long-term process.

Influenced by overall and mass usage of information and communication technologies, deregulation and convergence of industries, the global conditions of entrepreneurship have significantly changed. The dynamics of current competition has reached the level, where above all innovations and shortening of

strategies' life cycle ensure success in business. Innovation strategies integrate the effort to accomplish goals through strategic projects. The most companies henceforward maintain a traditionally planned approach to strategic process and in doing so, they use rather autocratic means of decision-making towards their employees. This approach worked in the industrial phase of economy development, but it becomes a weak point in the management of a company at present.

One of the substantial ways to be successful in today's rapidly changing environment is for organizations to be able to cope effectively with changes. Therefore, after realizing that the traditional managerial approach is no longer sufficient, managers have to look for the optional approaches. Gradual implementation of project management techniques and projects as means of change has proven to enhance the effectiveness of organizations and helps them to become more competitive. It is important to realize that the more an organization moves towards the mature project-oriented status, the more competitive it becomes, because of its ability to react to unexpected changes in the environment, both positive and negative ones. Except for project management, mature project-oriented organizations have also well developed other cross-sectional activity areas such as communication systems, knowledge management, training and development of human resources and organizational standards and norms.

1.1. Importance of Strategic Management

Changes of the global conditions of entrepreneurship logically resulted from the mass development and utilization of information and communication technologies, mutual pervasion of market and enterprise. Competition dynamics thus generates pressure on innovation and shortening of the company strategy life-cycle. Innovation strategy then integrates this effort by means of innovation core business projects and conjoint projects. Thereby projects have become tools of the implementation of this strategy. Preference for innovative initiatives through projects and the optimization of routine activities leads to flattening of company's hierarchy and new approaches inside the company. The borders with the market are wiped off and an enterprise develops various forms of cooperation with the external environment. Successful companies using these new approaches are becoming models for many companies in the world and also for Slovak companies. In order to gather relevant data, a survey in this field was carried out in Slovak companies.

Influenced by overall and mass usage of information and communication technologies, deregulation, and convergence of industries, the global conditions of entrepreneurship have significantly changed. The dynamics of current competition has reached the level, where above all innovations and shortening of strategies´ life cycle ensure success in business. Innovation strategies integrate the effort to accomplish goals through strategic projects. The most companies henceforward maintain a traditionally planned approach to strategic process and in doing so, they use rather autocratic means of decision-making towards their employees. This approach worked in the industrial phase of economy development, but it becomes a weak point in the management of a company at present. There are many companies in the world which develop new approaches to long-term strategy in cooperation with public experts that ensure a successful business.

1.1.1. Globalization in Strategic Management

Globalization which significantly influences the quality of competition is a dominant sign of the long-term development of world economy. Dynamic changes and uncertainties, present since the 80ties of the 20th century up till now, have tested a number of managerial methods and tools of strategic management. Unprecedented development and mass usage of information and communication technologies, but also deregulation of sectors and convergence of industries and technologies preceded changes in global conditions of entrepreneurship.

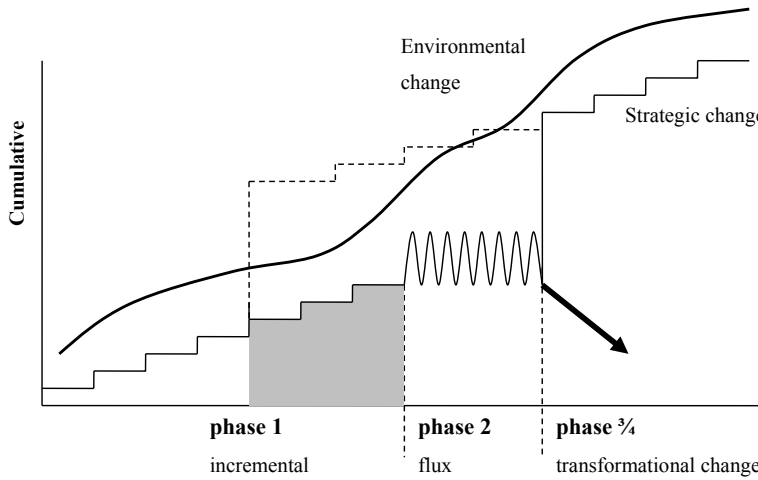
The accelerating pace of changes has brought significant opportunities for active companies but has become a threat to the unprepared ones. This arouses pressure on changes in the strategic management itself. Especially large companies strive for advancing towards a flexible model of small companies. The management system and qualified employees are a key presumption of the flexibility of a company. In developed economies, there is an intensive competition among companies in the recruitment of talents and maximal motivation them for teamwork and creativity.

The present time is a less and less reliable guide because of surprising and discontinuous future. As the rate and frequency of cycle changes accelerate, large companies more often find out that they haven't caught the signals of changes. Hereby, They realize that hereby they jeopardize not only their competitive position but also their own industry. Especially massive taking up and unusual development of information and communication technologies cause the reduction of profit margin. The configuration of boundaries between actors within the company and outwards is changing.

Life cycles of strategies accelerate and shorten under pressure of the above-mentioned trends to achieve a competitive advantage. Alternation of a period of relatively calm growth, when mistakes in planned development can be corrected and a period of a fundamental change, when lessons learned from the past fail, is radically shortened. The company is forced to look for qualitatively new approaches to strategy and to experiment permanently. The present company practice tries to adapt to these trends by shortening the usable lifetime of new strategies to three years.

A successful company traditionally approaches incremental strategy changes, because at present the high-profit strategy enables the company to maintain a headstart in comparison with its competitors. Generally, there are risks in using this adaptive approach at the time of discontinuous changes. Figure 1.1 refers to the origination of a certain type of strategic drift during which the company need not to take notice, that presently executed strategy falls behind the changes in the competitive environment. It is a difficult strategic situation for the company because underestimation of weak signals of an incoming drift increases the risk that it will not be caught in phase 1.

Figure 1.1 The risk of strategic drift



Source: Adapted from Johnson et al, 2005

The majority of companies learn too late that the environment has changed too much and this requires a transformational change in their own

strategies. This state causes fluctuation of the strategy insofar, that it interrupts the company performance without a clear continuation. This establishes a critical threat for the company. By explaining the strategic drift, there is emphasized the delicacy of the borderline, at which the company finds itself in developing its own strategy (Johnson, Scholes, Wittington, 2005). This issue is addressed in the literature under the term strategic drift, as shown in Figure 1.1.

A large company has a natural tendency to organize laboriously its processes within the hierarchy and is unwilling to change them. Many traditionally thinking companies have placed their innovative activities within specialized units not to disturb the effectiveness of operation activities and the units fulfill their tasks for the whole organization. In this regime, they undergo a permanent, but only incremental change. As mentioned above, turning-points in a competitive environment may surprise and endanger the company that is managed this way. Companies with a stereotype of the traditional way of thinking manage with the permanent incremental innovation of products, without a fundamental change of their entrepreneurship model. They consider such fundamental change of their character to be risky for their competitive position. Managers are often confronted with the dilemma how to handle an unmanageable creativity of their employees and external cooperators.

1.1.2. Strategy formulation in business management

Contemporary theory introduces all the range of approaches to formulation and implementation of strategies. According to the alertness of implementation them in real life we can recognize emergent approaches on one side and ongoing approaches on another side. It is obvious that emergent approaches react more to signals coming from sudden changes of business environment while ongoing approaches reflect more continuing changes and characteristics of the internal environment of an organization (e.g. development of strengths and elimination of persisting shortcomings). Emergent approaches enable to interlink the strategy formulation with implementation so that to speed up the frequency of cyclic changes and thereby radically shorten the life span of strategies.

Structure of the strategic management process in innovation

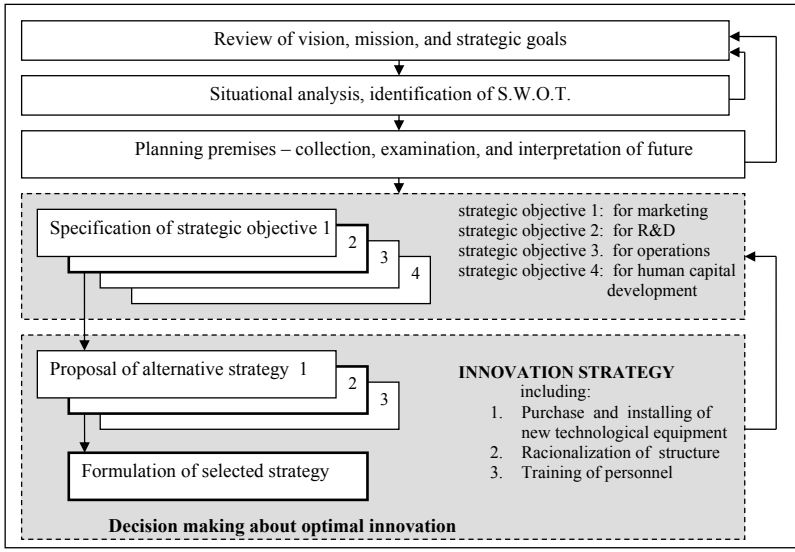
Not every innovation of product, process or organization arrangement generates revolutionary competitive advantage. Some of them are just of incremental

nature. The traditional hierarchical (scalar) picture of organizational structure has been known for about one hundred years. It is characterized by cascade pyramid with a typical chain of command. This is a basis for ongoing, planned, i.e. systematic approach to formulation and implementation of strategies. However, they are ineffective, drowning in stereotypes of long-term planning and narrowing of sea room for taking use of future opportunities. As mentioned above, especially large enterprises have a natural tendency to align internal processes into relatively unchangeable hierarchical structures. This expresses a mental model of top management thinking, which prefers operational effectiveness but, on the other side depresses so important initiative, creativeness, and devotion of employees.

The traditional interpretation of the strategic management process structure as formulation, implementation, and control have been already overcome. For example, the demonstration of strategy formulation process appears proscriptively, schematic, as if step by step without respecting functional organizational division (Dobson, Starkey, 1993). The sequence of steps does not consider feedback, alternative strategies, stratification by functional units, by divisions, or by other distinction. Figure 1.2 shows a model, which tries to remove these shortcomings.

Results of situational analysis and planning premises precise or change the reviewed strategic goals coming from vision and mission of an organization. Knowledge of the current state and expected future changes enables to specify realistic strategic objectives for different areas of activities within the organization. The accomplishment of each is conditioned by the optimal strategy, which is chosen according to set up criteria from the pool of alternative strategies. The optimal strategy will be realized.

Figure 1.2 Innovation strategy formulation process in nonfinancial organization



Source: Adapted by Marsina, 2010

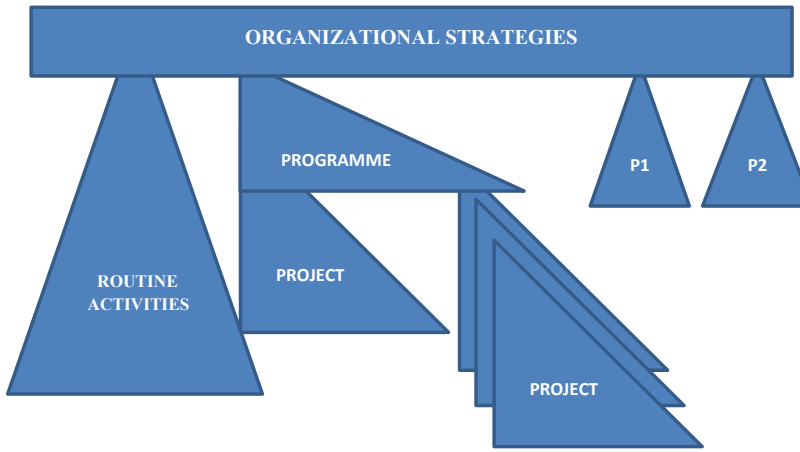
1.1.3. Strategy Implementation

Implementation of the formulated strategy makes sense to the all strategic management process. Implementation has two basic phases – preparatory and executive ones.

The following figure (Figure 1.3) shows three main streams of the strategy implementation. Basically, the first stream represents the fulfillment of the day-to-day routine tasks, which are a substantial part of the activities in most of the organizations. Those are, for instance, administration works, persistent manufacturing, negotiations with customers, etc. The second stream encompasses program development. Each program consists of the project portfolio. All projects within the certain program have the same purpose, even though they might be in the process of preparation, prepared to be implemented or simply implemented. The purpose of programs may be education and training of human resources, innovation of product, cooperation with new partners, etc.

The third stream represents implementing individual project when necessary or when new opportunity or threat occur. Therefore these projects are a reaction to the particular situation. For instance, such reasons might be inevitable need of the technical innovation, prevention of diverse threats, getting a new strategic partner, etc.

Figure 1.3 Main streams of the implementation of tactics for the organizational strategies

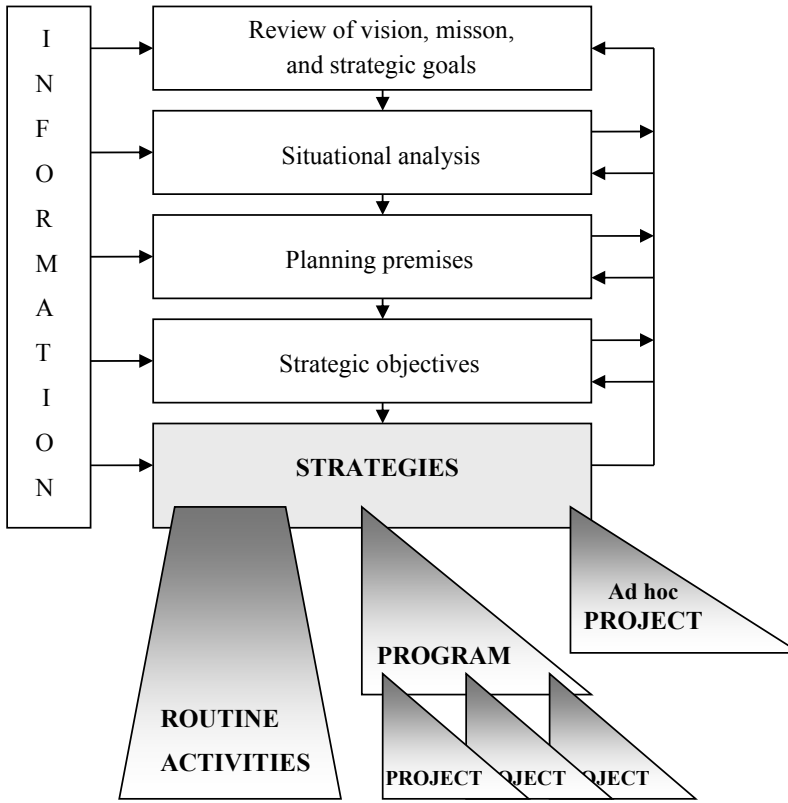


Source: Marsina, 2003

1.2. Project as a Tool of Holistic Understanding of the Innovation Strategy Implementation

Just formulated strategy expresses what principal has to be done, what effort to undertake to meet the strategic objective. Next step is an implementation of just formulated strategy. Next, the implementation of the formulated strategy requires a process readiness of enterprise to transform ideas into the concrete results. Implementation has two phases – the preparatory one and another of realization.(Stevenson, 2005)

Figure 1.4 Model of strategy formulation and its implementation by three streams of realization tactics



Source: Okruhlica, Marsina, 2012

Preparatory phase consists of the transformation of formulated strategy to concrete measures such as developing various forms, pro forma contracts, procedures and rules for smooth progress of works, monitoring them, training of specialists, etc. The second phase – realization of the strategy includes the transformation of measures to tangible results. In other words, the concrete work leading to measurable outcomes.

Innovation strategy in Figure 1.2 can be perceived as an assignment for innovation activity implementation. Since Figure 1.2 underlines dynamics and structured steps of the strategy management process, Figure 1.3 shows possible ways for performing implementation activities. These activities can be carried out by three ways in Figure 1.3. In Figure 1.4 they are presented as three streams of realization tactics.

It is obvious from the Figure. 1.4 that boxes starting with review of vision, mission, and goals, and ending with strategies, express process of strategy formulation, while implementation is represented by three streams of ways or realization tactics, which are either routine activities, ad-hoc project(s) for resolving emergent situations, or programs, which systematically, each of them encompasses projects of one purpose, being ready for starting at right time.

The model in Figure 1.4 tries to integrate innovation strategy shown in Figure 1.2 so that the innovation program includes innovation projects, such as the installation of CNC machines, organizational restructuring, and training personnel for operation and maintenance.

Above mentioned comparison and distinguishing projects from routine, repetitive activities often oversights fact, that it is necessary systematically prepare a good environment and climate for preparation and realization of projects. Those are programs, where is a mix of routine work like administration of all projects and the unique work on individual projects.

There are many definitions of the project. A project can be considered as any works and tasks, which have a specific objective, date of start and end, limited financial sources and consume human and other resources. (Kerzner, 2006) The projects are a kind of work that is temporary, unique, and progressively elaborated. (Rosenau, Githens, 2005)

In this context, Verzuh sees the definition of the term „project" as a „work that is temporary and produces a unique product or service. Temporary work has a beginning and an end. When the work is finished, the team disbands or moves on to new projects. Producing unique products or services is why projects are often referred to as „one-time shots" (Verzuh, 2003).

Verzuh also gives further explanations. „If projects are temporary and unique, ongoing operations are neither; for example Installing robots to paint automobile bodies at an assembly plant is a project; painting cars is an operation". (Verzuh, 2003)

From the repeatability perspective thus there are three kinds of activities: routine, program and project ones.

Figure 1.5 Project vs routine

Source: Adapted by Verzuh, 2003

Figure 1.5 depicts a model of two extremes – purely single, unique action due for the project on one side and purely repetitive routine activity on the other side. Between these extremes, there are actions and activities from the real life of organizations, which are either prevailingly of unique or of repetitive nature. In general when simplifying we can consider the path from repetitive to unique state continual, but in reality we can distinguish on one side the position of project-oriented organizations (in the Figure 1.5 dashed line), which their business improve by projects and, on the other side position of project weakly oriented organizations (in Figure 1.5 dashed and dotted line), which have not built up their own project management capacity.

1.3. Summary

Strategic management is one of managerial discipline. Priority of the strategic management in the life of any organization underlines the fact, that this discipline ensures surviving of the organization. Development of organizational systems is inevitable for being competitive in the marketplace. In permanently changing environment organizations cope with operational problems by gradual improvement of processes but with systems changes almost exclusively by projects. The projects are coming from strategic thinking of executives, i.e. projects are tools for implementation of organizational strategy.

2. PROJECT DEFINITION

Although the word ´project´ may seem as a clear notion, it is linked with many documents and joined forces of many people in order to be properly planned and performed. According to the standard of International Organization for Standardization, referred to as ISO 10006:2003 Guidelines for quality management in projects, project is defined as a "unique process consisting of a set of coordinated and controlled activities with start and finish dates, dates undertaken to achieve an objective conforming to specific requirements, including constraints of time, cost, and resources". The project can be also described as a sequence of actions within a certain period of time. The aim of the project is to reach a unique outcome, usually qualitative change, new service or product (Lifelong Learning Programme). Projects of the enterprise of different sizes usually vary in their complexity, resource requirements, duration, the size of project teams as well as the level of information needed for a detailed schedule. The final outcome of a particular project may be either tangible or intangible (Project Management Institute, 2013).

Therefore, in the contrast to the ongoing work, which is usually repetitive process following the procedures of the company, because of the unique nature of the projects, they may differ in the provided results, even when they are tangible or intangible. There might be involved single or multiple individuals, as well as organizational units as a whole.

According to Project Management Body of Knowledge (PMBoK), a project can create:

- A product, which can represent either component of another product or improvement of another product, or in the third case, product itself
- A service or support and capability to perform service
- An enhancement or improvement of already existing product or service lines
- A result, for instance, outcome or document. (Project Management Institute, 2013) Further examples of projects might be conducting a research whose findings will be properly recorded, constructing of buildings and machinery, implementing or enhancing business procedures and processes, etc.

The project is a temporary unique role, with specific and clearly defined results, resources and timelines. Consequently, it is defined by three main parameters: time, cost and performance/technology (Kerzner, 2006).

One of the natures of perceiving projects is that they are temporary organizations (Turner and Muller, 2003). Once the new project is started, there is necessity of changes in configuration of human resources, which have impacts on the work organization and thus create inevitable need for particular processes, such as assignments for stuff onto projects, creating link with those assignments and people's carriers, and so on (Huemann, Keegan and Turner, 2007). They also conclude that project-oriented organizations are very dynamic since the quantity and size of projects are changing on a constant basis, both, temporary and permanent staff are hired, also cooperation with thirds parties, such as partners, suppliers and clients are organized in created teams. Furthermore, when projects are defined as temporary organizations, either the formal establishment of such projects, either their integration into overall aim of the company organization, as well as developing of project specific culture need to be emphasized (Gareis, 2004).

To conclude, projects may be defined as contracts for external clients, as well as for product developments, marketing campaigns, investments in the company infrastructure, or for reengineering activities for internal clients." (Gareis, 2004, p. 126). In case the company wants to differentiate itself from the competitors, on way to reach this aim is to differentiate itself with the change of organization. For instance, line functions, such as production or procurement of material will stay in charge or routine types of business processes. However, applying projects or programs allow the company the further differentiation. Permanent organizations, such as profit centers, divisions, and departments can be enriched by temporary organizations.

The higher diversity and variety of projects company holds in its project portfolio, the stronger competitive advantage it has and it also becomes more differentiated organizationally and the complexity of its management will become greater. In order to encourage the successful performance of individual projects and ensure the acceptance and compliance of the objectives of those projects with the overall aim of the company and its strategies, particular integrative structures, such as PM office, expert pools, strategic center and project portfolio group are indispensable.

2.1. New Management Paradigm

When discussing of the project-oriented company, we need to mention that the existence of an explicit project management culture is inevitable. Basically, a set of values and norm related to the project management needs to be shared

among all the people in the organization (Gareis, 2004). In means that specific procedures for project management, developing of common understanding of these processes to enhance performance and results, individual roles for ordinary employees, as well as management methods, need to be applied. The application of "new management paradigm" thus boosts the efficiency of the company as a whole.

To compare the traditional management approaches, which emphasizes detailed organizational functions, such as planning, organizing, or controlling and focus on the given assignment and rely on traditional hierarchy as a central integration tool, "new" management concepts, such as TQM (Total Quality Management, LM (Lean Management), learning organization or business process reengineering provide new approaches that can help company get into new level.

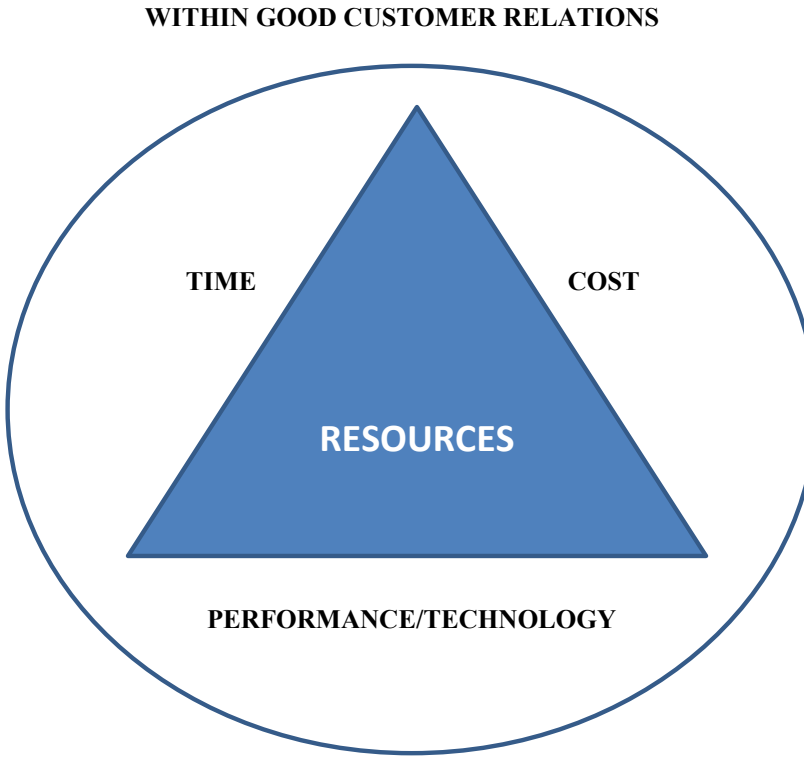
The examples of common features of abovementioned approaches may be following:

- Using new organization to create a competitive advantage
- Empowering employees
- Organizing of teambuilding and be process oriented within flat organization
- Organizational changes on a continuous and discontinuous basis
- Being customers oriented and create strategic networks with clients and suppliers (Gareis, 2004).

There is no doubt that projects may be performed even within the culture with traditional management. However, many authors claim that it will cost more, not only in terms of finance, but it will be far more time consuming. True benefits and advantages of project management can be uniquely achieved in the companies managed by projects (Gareis, 2004).

It is a classic triangle of project management. In case that any one of three parameters was changed, this change would also cause the change in other two parameters. As can be seen in Figure 2.1, "project management is designed to manage or control company resources on a given activity, within time, within cost and within performance" (Kerzner, 2006, p. 8). In case the project should be accomplished for an outside customer, then there is the fourth parameter of the constraint of a project, which is the good customer relations. This fourth parameter or constraint is a key for the classifying project as successful one.

Figure 2.1 Overview of project management



Source: Kerzner, 2006, p. 8

- **RELEVANCE**

The project must be focused on the real needs of beneficiaries. In other words, the ultimate outcome of the project must be the common ground of positive changes. In order to achieve this goal, future recipients or clients should be involved in the planning process from the very beginning. Planning is performed through the process of analysis of problems and the formulation of clear objectives with regards to benefits for the target groups.

- **FEASIBILITY**

Initiative intents must be achievable. It is necessary, that all the project parts and aspects need to be carefully analyzed, taking into account technical, economic, environmental, financial, ethical and cultural factors. Assumptions and risks related to the project must be defined as well. There must be a concrete subject of the continuous monitoring throughout the whole project life-cycle. The project itself must be performed only in a suitable work environment. If the environment of the project is changing the particular activities must be re-planned and re-oriented. In the case of an investment project, its feasibility should be analyzed by the Feasibility study. It is a standardized document with the specific content and structure.

- **SUSTAINABILITY**

The impact of the project may not lapse after its completion. For example, if the aim of the project is to build an education center, at the end of the whole project process, this center should be capable of operation.

2.2. Implementation Measures for Successful Projects

According to the CEO of Business Improvements Architects, Michael Stanleigh, who is also the author the 2010 PMO Global Study: How a project management office can improve organizational effectiveness, it is crucial for the manager of all the projects to have knowledge in so-called PMBoK as well as ISO 10006:2003 Guideline for quality management in projects. Even though there are many similarities, discrepancies and misunderstandings coming from the improper comprehension and comparison may cause a lot of problems for project managers. However, when combined properly, they represent an important body of knowledge. Stanleigh also recommends the reviewing and understanding of both. Then project managers should develop a clear and understandable methodology or process from the very beginning to the end. However, both, ISO 10006:2003 and PMBoK provide framework only. As already mentioned, projects vary in their size, scope and other features. The concepts provided in these documents must be adapted and adjusted to the different requirements of various projects.

2.3. Summary

In order to properly implement the knowledge gained from PMBoK and ISO 10006:2003, other strategies are required:

- Development of a process for key elements within a certain project
  Key elements encompass processes such as risk management process, communication process, change management process, even stakeholder management process, and so on.
- Development of quality standards
  Quality standards are an inevitable part of a whole project managing because they help to identify what is necessary to be done from the beginning of a project till its end, in order to ensure that all the initial objectives and requirements are achieved and met and the result is according to client's expectations.
- Incorporation of all the processes into one superior plan
  Managers need to ensure that it will be always evident whether or not everything that needs to be done is done according to the established quality standards.
- Implementing audits
  Stanleigh also emphasizes the importance of the projects audits to ensure the required quality and suggests using the guidelines included in ISO 10006.
- Evaluating and capturing
  At all the stages of the project process, managers must ensure a proper evaluation of the level reached by the entire process.

3. PROJECT MANAGEMENT DEFINITION

Before developing a theoretical framework for project management, we searched the roots of whole project management concept. Many academics say that the "father" of project management is Henry Gantt, who developed Gantt chart back in the 1910s and which nowadays serves as a standard model for project management practices (Söderlund, 2002). The Gantt chart is a type of bar chart which basically illustrates a project schedule and contains the beginning and finishing day of the terminal elements as well as summary elements of the particular project. Nowadays, project management is globally used tool for managers in order to lead their companies to the success (Birkhead, Sutherland, Maxwell, 2000). Project management is an undoubtedly complex process which is targeting multiple outcomes. Thus, in order to deal with projects efficiently, responsible managers have to focus on them complexly and take into consideration time, budget and performance levels as well as the satisfaction of a person who asked the company to lead and get the project done. From the professional perspective, project management is not only diverse and multifaceted, but also contradictory in many respects. Growing interest of professionals in the field of project management can be explained by a common increase in the way of organizing business activities in projects (Söderlund, 2002).

3.1. Definitions of Project Management

Project management is a discipline with huge potential of bringing various disciplines to focus and concentrate on a pivotal feature of study, meaning projects. Several diverse opinions may be found in the research of authors. Some argue that the field of project management has developed rapidly in recent years and the others argue that despite the growing academic interest, for example in courses or programs, the research has not been developed enough. For instance, Morris (2001) claims that the awakening of academic is not fast enough. To conclude, Packendorff (1995) argues that a consideration of project management is it to be a general theory, not sufficiently empirical. He also said that in a majority of research, projects are perceived as tools and project management itself is usually seen as a set of techniques and models for the planning and control of commitments. Shenhar and Dvir (1996) said that in the most of

the researchers devoted to project management need to deal which the insufficient theoretical basis as well as the lack of concepts. More recent papers, such as Project management written by Pinto (2002) points to the current trends and deal with certain issues inevitable for the basis of the research of project management. Simultaneously with the growth of the interest from both, practitioners and researchers, the need for clarifying several of the fundamental ideas and identification of project management research.

3.2. Summary

Project Management Institute defines project management as an "application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (Project Management Institute, 2013). Project management is performed through the proper application of project management processes that can be grouped into five main processes groups, which are initiating, planning, executing, monitoring and controlling, and closing.

Therefore, managing a project usually includes:

- Identification of requirements
- Dealing with the expectations and needs of the stakeholders within planning and executing processes of the project
- Active and effective communicating and collaborating with stakeholders
- Managing stakeholders regarding requirements meeting and outputs of project
- Creating balance among project constraints, such as scope, schedule, quality, budget, resources and risks (Project Management Institute, 2013)

4. PROJECT ORIENTATION CONCEPT – MANAGEMENT BY PROJECTS AND PROGRAMS

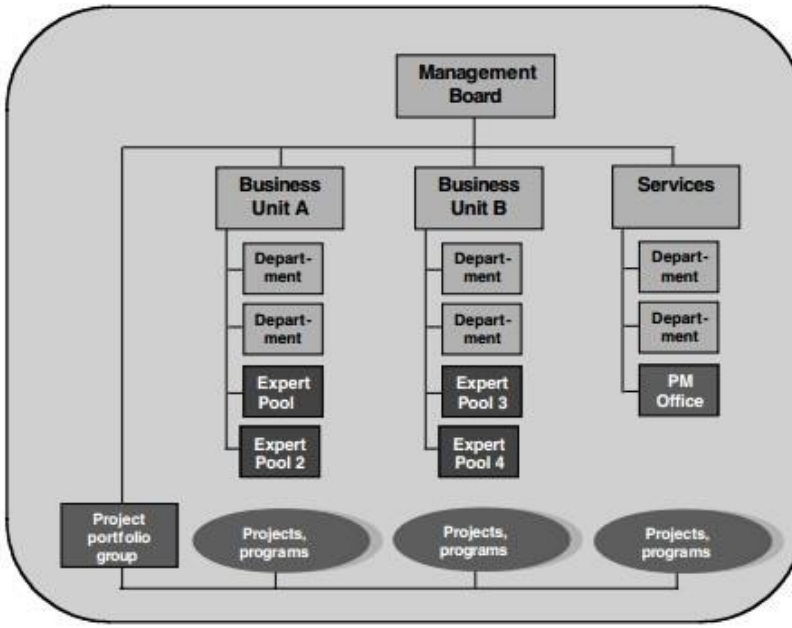
Since the World Congress of the International Project Management Association (IPMA) with the general topic "Management by Projects" took place in June 1990 in Vienna, the vision to deal with the complexity and growing dynamics of project-oriented companies has become reality (Gareis, 2004). Nowadays, management by projects is one of the most convenient practices in many industries (Sears, 2011). Project-oriented companies not only consider projects as tools for performing business processes of mediocre or huge scope but mainly as a strategic choice for the organizational design of a whole company.

When the company applies the approach described as managing projects, it is crucial to pursue following objectives:

- "Organizational differentiation and decentralization of management responsibility
- Quality assurance by project teamwork and holistic project definitions
- Goal orientation by defining and controlling project objectives
- Personnel development in projects
- Organizational learning by projects" (Gareis, 2004, p. 124).

The importance of the projects has to be highlighted and all the employees of the organization need to be aware of planned measures. The organizational structure must show not only the part of the permanent organization, but it is crucial to implement a structure of the temporary organization. The example of the organization chart of a project oriented company can be seen in the following figure.

Figure 4.1 Organization chart of a project oriented company



Source: Gareis, 2004, p. 125

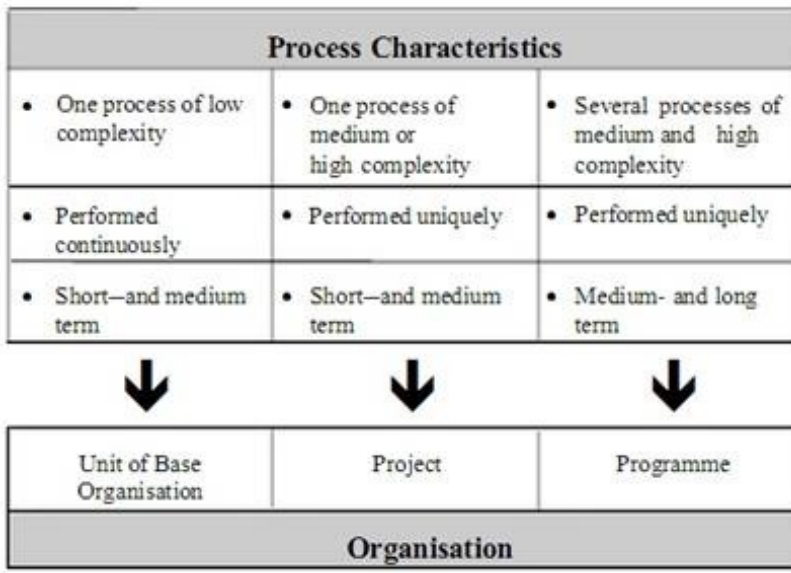
When implementing management by projects, the company should exactly develop a job description for managers at all the levels of organizational hierarchy and furthermore include a statement on the strategic importance of project management in the mission statement of a company (Figure. 4.1). The necessary step which needs to be undertaken in order to successfully transform the company into project-oriented one is put the importance on promotion and marketing of such changes.

In projects, it is also possible to integrate very often separated, isolated or sometimes even competing leadership models of Management by objectives, Management by Motivation or Management by Delegation, etc. For instance, management by projects as its leadership strategy uses the motivational nature of projects, as well as opportunities for personal development (Gareis, 2005).

4.1. Program and Program Management Definition

In order to reach processes of distinctive complexities, different organizations are appropriate. To realize several processes of medium and high complexity, the particular program uses on the one hand projects, as the instruments of differentiation, and on the other hand a program office, program steering group, process owners, and so forth.

Figure 4.2 Adequate organizations for the performance of processes of different complexity



Source: Project Management Institute, 2013

The program consists of various projects, subprograms, and activities, which are carefully connected by mutual objectives and rules. They are managed in a coordinated way in order to reach benefits that could not be available from managing individually (Project Management Institute, 2013). It is the application of knowledge, skills, tools, and techniques into the program, so the requirements of the program will be meet. We can assume that sometimes,

particular projects within a certain program are performed simultaneously and on the other hand, some of them are performed sequentially, depending on various factors.

Gareis (2004) claims that process of program management has the same structure as project management process. Therefore the subprocesses becoming with the starting, followed by coordinating, controlling and closing down the program, and alternatively resolving of program discontinuities. (Figure 4.2)

It is important to realize that project might be or, on the contrary, may not be a part of the program, however, the program will always include projects. Moreover, projects within a certain program are related to the common goal and outcome or collective capability. Therefore, program management focuses on the interdependence of projects and bases on it helps to determine and apply the appropriate approach for managing projects. Program management should include actions such as dealing with the resource constraints or conflicts affecting projects within a program, aligning strategic direction, which affects the achievement of program objectives, or resolving problems and issues with the management of change within a common government structure.

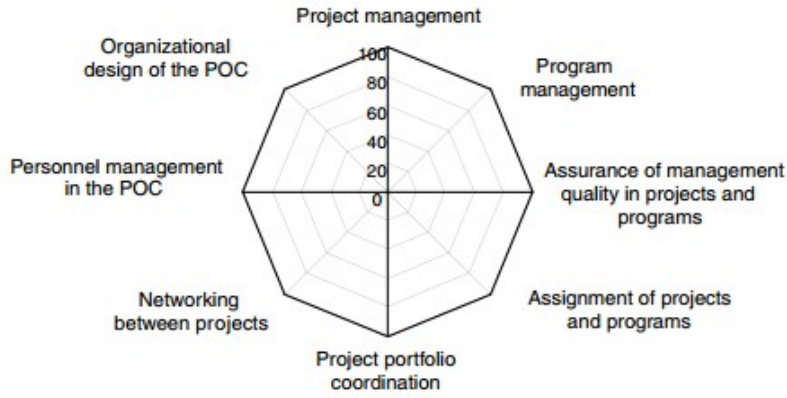
4.2. Specific Business Processes of the Project-oriented Organization

The project-oriented organization is described by its specific business processes. Gareis divides these processes into following groups (Gareis, 2005):

- Processes related to assignments of projects and programs
- Processes related to project and program management
- Processes related to management
- Processes related to assurance of management quality of projects and programs
- Processes towards the coordination of project portfolio
- Processes related to networking between projects
- Processes regarding organizational design
- Processes linked to the personnel management.

To visualize the complex specific business processes of the project-oriented company, following spider web graph has been chosen (Figure 4.3):

Figure 4.3 The project oriented company maturity model based on Roland Gareis Management of the Project-Oriented Company ®



Source: Gareis, 2004, p. 128

The objectives needed to be taken into consideration in the project management processes are not only the project cost and schedule or the scope of the work but also its objective, expected income from the project, its organization and culture and context dimensions (Gareis, 2004).

One way, to perceive project management is it to be a business process of project oriented company. It starts with the formal project assignment and finishes with the formal approval of the project's results by the owner of the project. This process consists of certain subprocesses, such as the beginning of the project, consequently continuous project coordination, project controlling, project discontinuity and its resolution, and of course, project closedown (Gareis, 2004). He defines project discontinuity as a "discontinuous development of a project". When managers have to face the existential threat of a project, he defines this situation as a "project crisis". In the Gareis´ work another type of discontinuity can be found – so called "project change". This type of project discontinuity requires a change of project identity – its objectives, strategies, culture, and organization.

The most important part of a project is its beginning. The reason why it is so is basically the fact, that the basis for all the other subprocesses is established in this part. It encompasses plans for the project, communication structures, specifies the relationships to the relevant environments, etc. Usually, the objectives,

methods, functions, responsibilities and expected outputs for subsequent processes are described in this part as well. This is the first step to ensuring the quality of projects and to put the basis that can be measured later.

According to Gareis (2004), the objectives of the processes of project management are following:

- To perform the project successfully according to the objectives set at the beginning of the projects
- To contribute to the optimization of the business case for the investment that is initialized by the project
- Efficiently manage the complexity and the dynamics of the project
- Be prepared to adjust the project boundaries according to the current situation · Manage the relationships related to the project.

The success of the project is natural to the desire of all the parties involved in the process of the project.

Concerning the second objective, the project idea needs to be developed for proper understanding. The optimization of the business case of the investment initialized by the project is completely different in distinctive types of projects. For instance, when the project is focused on the capital investments, such as new factories or offices, this can influence the business case of investment too much larger extent than compared to, for example, contracting projects. Thus the responsibility of project managers regarding this objective has to be taken and should not be underestimated.

To ensure the sufficient degree of complexity of the particular project, it needs to be managed in relation to its environment. For a proper understanding of building up complexity, we can mention examples, such as the dividing of responsibilities, creation of teams, as well as consideration of various functional disciplines and setting up the hierarchical levels of the particular project team in order to build up the project complexity.

There are several project management methods. Either it is projected environmental analysis, work breakdown structure, schedule or the costs and resources plan, basically using the different methods simultaneously contributes to the building and developing of the project complexity.

Abovementioned reduction of the complexity of the project is caused by the standards and agreements of project management. Moreover, debates and agreements between the part of project owners and project team determine the way and direction towards which the whole project will be oriented.

Finally, the project boundaries what will be in fact determined by the project scope and by the beginning of the project and its end. It is essential for defining

and planning of the pre-project phase as well as post-project phase, in order to set limits and demarcation of project context.

4.3. Project Management Office

A Project Management Office (generally used abbreviation PMO) is a management structure, which the main purpose is to standardize the governance processes related to projects and ease the sharing of resources, tools, and techniques. Depending on an organization, the responsibilities of PMO may range from the providing project management support only to take full responsibility for one or more projects.

According to the Project Management Institute, there are three types of PMO structures in organizations. Each of them varies in the degree of control and also in the influence that they have on projects.

- **Supportive PMO**
  This type of PMOs provide projects by consultations, supply them with templates, recommend the most appropriate practices, suggest training procedures, using the information learned from other projects, etc. It serves as a repository of projects.
  Supportive PMO only provides an organization with the low control.

- **Controlling PMO**
  Controlling PMOs provide more significant support compared to the supportive type of PMOs. It requires compliance through several means. Compliance may encompass adopting of project management methodologies or frameworks, as well as using of particular templates and tools.

- **Directive PMO**
  This type of PMO takes control over the projects by directly managing them. The degree of control provided by directive PMOs is high.

One of the purposes of PMO is to integrate information and data from strategic corporate projects and consequently evaluate whether the strategic goals are achieved. PMOs represent an important link between portfolios, programs, projects and measurement systems of the company. Depending on the type of the PMO, it may dispose of with the authority to act as an integral stakeholder and make important decisions related to projects, make

proposals and recommendations or remain aligned with the main business objectives.

Project Management Institute describes the primary function of PMO to be supporting project managers in several ways, such as:

- Managing resources
- Identification and development of the best practices of project managers, the most convenient management methodology and standards
- Mentoring and coaching
- Training and oversight
- Monitoring of the compliance with management procedures, standards, and policies
- Developing and managing commonly shared procedures, standards, policies and documentation
- Coordinating the communication among the people involved in projects.

PMOs and project managers pursue distinctive goals and therefore are driven by different requirements. However, both put their effort in order to fulfill the strategic needs of project organization. According to the Project Management Institute, differences between the roles of PMOs and project managers thus may include:

- While the project managers focus on the specific objectives of project, PMOs deal with the most important program scope changes, that represent opportunities for more efficient achievement of business goals
- The project managers control the resources of the project in order to best meet its objectives, whilst the PMOs focus on optimization of shared organizational resources across the projects
- Another role of project managers is to manage the constraints of the specific project, while the PMOs role is to manage the standards, methodologies, opportunities, and risks, as well as manage the interdependencies among all the project at the level of the enterprise.

4.4. Project-oriented Organization – Strategy, Structure, and Culture

The project-oriented organization can be defined as an organization which organizational strategy is managed by projects, implies temporary organization to the business performance process, however at the same point has

specific permanent organization units, e. g. project portfolio group, project management office, etc. It is usually always managing project portfolio of different project types. Gareis (1989) also conclude that such company also must perceive itself to be project-oriented. According to Hobday (2000) project-oriented company is able to effectively cope with emerging properties in production and moreover respond with flexibility to both required organizational changes and client needs. Stein (2002) concludes that project-oriented company is also effective in coping with the risks arising from project implementing and deal with the uncertainty related to challenging projects. To highlight the advantages of such organization, Elton and Roe (1998) pointed on the effectiveness with what these companies integrate different types of knowledge and skills.

The project management focus on an organization shot and emphasizes how to most effectively design and control the structure of the organization, so the company could achieve the greatest efficiency for the delivery of the project (Pollack, 2006). This can be supported also by Cleland and King (1968) who said that project-oriented organizations are the ones directed towards achieving certain shared and understood goal. Achievement of this goal is perceived to be "at the heart" of a particular organization.

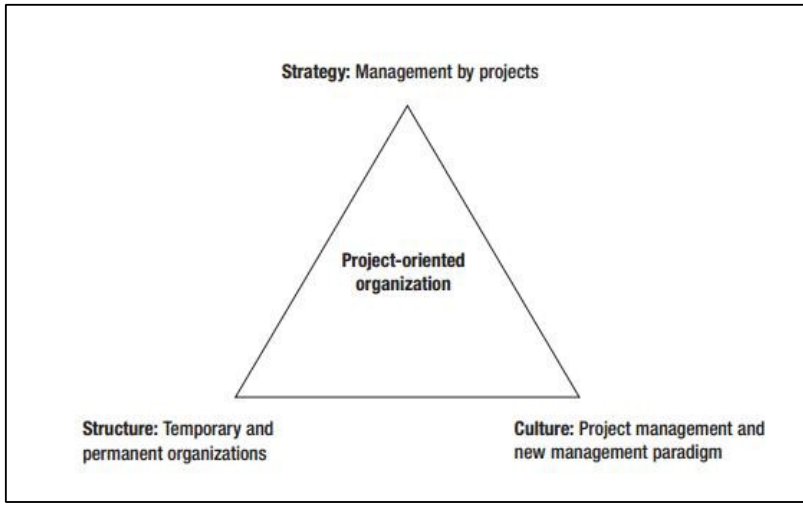
Basically, all the characteristics can be summarized in a diving by Gareis (2004). He defines the project oriented company as one that:

- defines management by projects as an organizational strategy
- adopts temporary organizations for the performance of complex processes
- manages a project portfolio of different project types
- has specific permanent organizations to provide integrative functions
- applies a „new management paradigm
- has an explicit project management culture
- perceives itself to be project-oriented.

The impeccable project-oriented company is very often profiled as a flat organization with a strong culture of project management. Moreover, one of the most important features defining a company as a project-oriented is that it perceive itself as being project-oriented company and consequently craft and shape all the practices and strategies for doing business, create its organizational culture and move towards the challenges accompanying managing projects. There is no specific industry for companies managed by projects because they are to be found in many distinct industries. Organizations may also differ in degree of the process of their project-orientation, depending on many factors, such as size, a number of projects, types of projects, etc. According to Gareis

(2005), the organization may decide whether the project-orientation is appropriate for the company as a whole, or if it is suitable only for certain organizational units.

Figure 4.4 Strategy, structure and the culture of the project oriented organization



Source: Gareis, 2004

The permanent organization of organization or company is designed in the way that allows the performing of repetitive processes. This organizational structure, as well as business processes performed within it, should specific and clear task definitions and the division of responsibilities. In general, these kinds of objectives can be met by the typical, stable and hierarchical organizational structure. However, in project organizations, which continuously perform new projects, especially with diverse content, with different level of complexity and scopes, it is inevitable to have flexible and interconnected organizational structure.

In companies which are at the initial or lower stages of project orientation, projects are only used additionally to their line, hierarchical organizational structure. However, the impact of the using of projects will result in the changes of organizational structure towards more flexible and a flatter one.

4.5. Summary

When the communication in an organization is enlarged and enhanced, numerous levels of the organizational hierarchy become redundant and unnecessary. That is the result of flattening. Using the advantages of temporary organizations, projects, and programs is one of the best ways to reach organizational flexibility.

5. INTEGRATED MODEL OF BUILDING A PROJECT-ORIENTED ORGANIZATION

When searching for new approaches and methods for the overall improvement of the entire organization effectiveness, moving towards maturity, the project-oriented organization becomes the important issue in grand strategy (Higgins, 1991) of an organization and way of strategic thinking of its top managers.

The project-oriented organization is characterized by technological and organizational innovations, as well as by generating a new managerial culture in the organization when designing and implementing projects. Preferentially, the project orientation has to be fully supported by top management of the enterprise. The strategic thinking of executives must be a basic presumption.

The building of project-oriented organization is a complex process, which should be conducted in several cross-sectional areas of activities of an organization. A model of developing a current organization to mature one consists of five areas and five levels. This model contains results from research of small, medium-sized and large enterprises in terms of application building of project orientation. Levels of project orientation were examined on the ground of the below mentioned „Integrated model of transformation process leading to the project-oriented organization".(Table 5.1)

Sustainable development of society brings harmony between both economic progress and protection (preservation) of living environment. In the area of business management, this is expressed by effective activities of business organizations generating profit concurrently with being regardful to nature around (environmental behavior of organizations). One of the means to ensure effective activities in business organizations is the application of project management and the gradual building of a project-oriented organization. The majority of projects designed and implemented within businesses especially focused on manufacturing, respect environmental issues and pay attention to living environment.

Modern concepts of management emphasize project management, which is carried out by the high quality of information. The project is not only a tool for technological or organizational change but also a tool for the generation of new knowledge within the organization (Marsina, 2007). The most important information needed for managing projects (from which the corporate knowledge arises) is located in the memory and experiences of employees (tacit

information, tacit knowledge). A good project-oriented organization strives to use modern information technologies for the formalization of tacit knowledge as much as possible in order to be downloaded into the information system. Thereby it can be used as a basis for gaining new information by using advanced techniques (data mining, knowledge extraction, knowledge discovery). This new information can facilitate competitiveness or predict further development of an enterprise.

Developing only project management within the organization would lead to a situation when certified project managers have no partners in preparation and implementation of any project. That is why next areas of overall activities (no functional processes as marketing, accounting, production, etc.), which support the project management development should be developed. (Marsina, 2009)

Development of project management and supporting areas of activities of an organization introduced in the integrated model of the transformation process leading to the project-oriented organization, which shows five developing areas of an organization from current through mature in five levels can be seen in Table 5.1.

The model examines following areas: Communications, Knowledge development, Project management development, Training and development of employees, and Organizational standards & norms. Communications are fundamental for effective management, especially when modern applications of Business Intelligence and Collective Intelligence are employed. Shared tacit knowledge within the project teamwork gives a chance to enhance the overall organizational culture.

Project Management development is a backbone of the building process. Training and development provided meaningfully as a program supports the enhancement of qualifications. The development of standards and norms formalizes all achievements into formal documents serving especially for controlling.

Application of the model is useful for organizations not only because of finding the actual evolution level on which they are within the particular area but also because the model offers what activities should be done to reach the next level. A higher level of project orientation means the most effective operation of the organization as a whole in profit creation, saving sources and more responsibility in terms of living environment.

Partial research activities within our research project were focused on finding the real state of using project management in business organizations and level of their project orientation. The means of gaining data is a questionnaire,

where methods of statistical apparatus are applied. The questionnaire consists of two main parts. The first part gains information about organization structure of respondent and its utilization of projects and project management in domestic and international context. The second part is specifically focused on „Integrated model of the transformation process leading to the project-oriented organization". The interviewed organizations revealed levels where they were situated in the individual area of activity.

5.1. Research Framework and Description of Selected Activity Areas

The research framework included the creation of a model of measured indicators, questionnaire survey, and evaluation of received data, comparison, and formulation of results. The research process model is shown in Figure 5.1.

The reached maturity level of enterprises in project orientation has been tested by means of developed model and questionnaire. The questionnaire was focused on typical characteristics of above-mentioned areas according to Table 5.1. During the assessment a model of calculation was applied, on the basis of which, consequently, it was possible to align enterprises to individual levels of the maturity model.

Criteria, which were used for recognition of the project orientation maturity level within individual cross-sectional activity areas of an organization, were assigned as follows:

- In the area of communication development, we examined the existence of communication gaps between functional units, ICT development, improvement of vertical and also horizontal communication, development of communication by means of project teams, and enhancement of communication that is supported by Project Management Office (indicators A1 through A5).
- In the knowledge management development area we examined, whether the employees' knowledge involves only their profession and position in the organization, whether knowledge development overlaps with the frame of profession in the organization, whether environment for sharing tacit knowledge within the organization is created, whether multidisciplinary knowledge is acquired in the project team, and eventually, whether sharing knowledge of project professionals is carried out within projects or the Project Management Office – PMO (indicators B1 through B5).

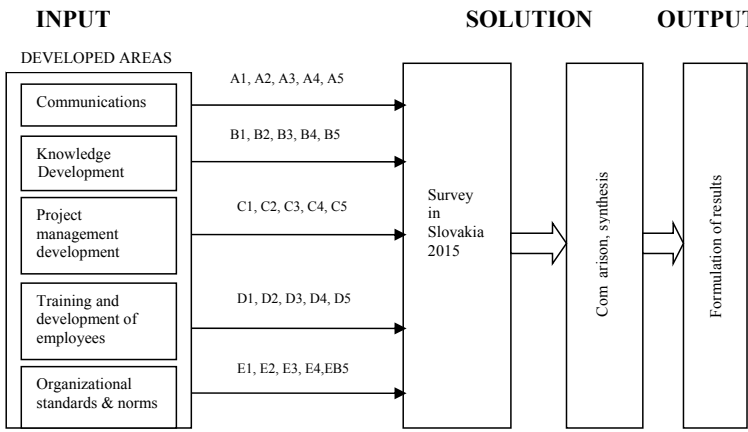
Table 5.1 Integrated model of transformation process leading to the project-oriented organization

Initial state	Developed area	1st level	2nd level	3rd level	4th level	5th level	Desired state
Current organization	**Communications**	Communication gaps between professional areas and managerial levels	Identification of activities to be supported by IS/ICT	Increased horizontal and vertical cooperation, start of implementing BI applications	Development of communication within the project teams; optional use of Business Intelligence applications	Communication of project professionals organized by PMO	Mature project-oriented organization
	Knowledge Development	Knowledge related to profession and position in the organization	Knowledge related not only to profession in the organization	Creating environment for interchanging of tacit knowledge	Multidisciplinary knowledge acquired on the project	Shared knowledge of PM professionals (PMP**) within the projects or PMO (+ Journal)	
	Project Management development	Projects, if any, designed and implemented by external experts	Projects are designed and implemented prevailingly by external experts	Projects are designed and implemented prevailingly by internal experts	Internal experts are gradually certified as PM professionals and Project managers	PMO administers design and implementation of projects including pool of PM experts	
	Training and development of employees	T&D only in the profession given by external trainers	T&D only in profession given prevailingly by external trainers	T & D of mixed expertise given prevailingly by external trainers	T & D of mixed expertise given prevailingly by internal trainers or is given within the project	T & D of mixed expertise given prevailingly by internal trainers lead to PMP certification	
	Organizational standards & norms	Standards & norms for routine processes	In general, organizational norms support operation of ICT and T&D of employees	Organizational norms include the project administration	Organizational norms specified for PM include utilization of Business Intelligence apps and outsourcing of selected ICT	Specific norms developed for the Project management office (PMO*)	

Source: Marsina et al., 2015

- In the area of project management development we examined, whether projects within the organization are designed and implemented by external or internal experts, whether internal experts are gradually certified as project management professionals (PMPs) or project managers, or, whether PMO mediates preparation and realization of projects including own certified PMPs (indicators C1 through C5).
- In the area of career development of employees, we examined whether T&D is carried out regularly or irregularly on request of individual managers, whether T&D is carried out by external or internal trainers, whether T&D is focused on individual or mixed professions, and, whether PMO participates in T&D (indicators D1 through D5).
- In the area of organizational standards and norms we focused on these facts: whether organization issues standards and norms only for securing routine operations, whether organization standards and norms support T&D of employees, whether they include also administration of project teams, whether selected organization standards and norms are oriented to project management, and whether selected organization standards and norms deal with effective operation of PMO (indicators E1 through E5).

Figure 5.1 Research process model



Source: Prepared by author

Research Instrument

A questionnaire was developed by building on the previous theoretical basis to ensure content validity. The research was conducted between February and April 2015. Empirical data were collected through a survey in Slovak small, medium-sized and large organizations. The respondents were Slovak managers of the enterprises.

Respondents had a choice to decide about each indicator by means of 7 ordered Likert scale, which consisted of these levels: (1 – strongly disagree, 2 – disagree, 3 – partially disagree, 4 – neither agree nor disagree, 5 – partially agree, 6 – agree, 7 – strongly agree).

Measures

The measurement model is shown in Table 5.2.

Table 5.2 Model of measurement indicators

Indicator	Meaning
A1	Communication gaps between professional areas and managerial levels
A2	Identification of activities to be supported by IS/ICT
A3	Increased horizontal and vertical cooperation, start of implementing BI applications
A4	Development of communication within the project teams; optional use of Business Intelligence applications
A5	Communication of project professionals organized by PMO
B1	Knowledge related to profession and position in the organization
B2	Knowledge related not only to profession in the organization
B3	Creating environment for interchanging of tacit knowledge
B4	Multidisciplinary knowledge acquired on the project
B5	Shared knowledge of PM professionals (PMP**) within the projects or PMO (+ Journal)
C1	Projects, if any, designed and implemented by external experts
C2	Projects are designed and implemented prevailingly by external experts
C3	Projects are designed and implemented prevailingly by internal experts
C4	Internal experts are gradually certified as PM professionals and Project managers
C5	PMO administers design and implementation of projects including pool of PM experts
D1	T&D only in the profession given by external trainers
D2	T&D only in profession given prevailingly by external trainers
D3	T & D of mixed expertise given prevailingly by internal trainers

D4	T & D of mixed expertise given prevailingly by internal trainers or is given within the project
D5	T & D of mixed expertise given prevailingly by internal trainers lead to PMP certification
E1	Standards & norms for routine processes
E2	Organizational norms support operation of ICT and T&D of employees (in general)
E3	Organizational norms include the project administration
E4	Organizational norms specified for PM include utilization of Business Intelligence apps and outsourcing of selected ICT
E5	Specific norms developed for the Project management office (PMO*)

Source: Prepared by author

Data Collection

Data was collected from randomly selected companies operating in Slovakia. The selection of companies was not influenced by any particular factor. The managers of these companies were requested to complete a structured questionnaire. The questionnaire consisted of open questions as well as assessment statements according to a given rating scale (these are shown in Table 5.2). The sample was characterized by company size (measured by the number of employees and domestic/vs. foreign ownership (Table 5.3).

Table 5.3 Sample Characteristics

Company Size	**% of companies**
Small (S)	40.74
Medium (M)	37.04
Large (L)	22.22
Ownership	**% of companies**
100 % foreign ownership	27.78
Major foreign ownership	4.63
100 % domestic ownership	52.78
Major domestic ownership	11.11
Public Ownership	3.70

Source: Prepared by author

Table 5.4 Descriptive Statistics (only areas Knowledge development and Training and development of employees

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Company size	163	2	1	3	1.82	.772	.596
Ownership	163	6	1	7	2.89	1.945	3.784
B1	163	6	1	7	4.22	1.802	3.247
B2	163	6	1	7	4.03	1.702	2.897
B3	163	6	1	7	3.86	1.823	3.323
B4	163	6	1	7	3.55	1.766	3.120
B5	163	6	1	7	3.36	2.035	4.139
C1	163	6	1	7	2.31	1.698	2.883
C2	163	6	1	7	2.23	1.567	2.456
C3	163	6	1	7	5.32	1.660	2.757
C4	163	6	1	7	3.68	1.905	3.627
C5	163	6	1	7	3.32	1.971	3.887

Source: Prepared by author

Results:

When evaluating the certain level of maturity, we selected only accordant answers (strongly agree, agree) because of others, mostly uncertain, were not relevant for stating appropriate levels of maturity. The evaluation was realized by means of statistical apparatus using tools of descriptive statistics and frequency tables. The result shows the percentual share of enterprises on individual levels of the maturity model. Among „not included" there belong those enterprises, which did not express explicit consent with any indicator or enterprises which expressed accordant attitude with more than one level.

The goal of our research in the year 2015 was to find out the level of project orientation on the sample of Slovak small, medium-sized and large enterprises. The share of enterprises on individual levels of the maturity model in percentage is shown in Table 4. The evaluation is focused on two areas of the model – Knowledge development and Training and development of employees.

Table 5.5 Results

Developed area	1st level	2nd level	3rd level	4thlevel	5th level	Not included	Agree with more levels
Communication	23.46	9.88	25.93	19.75	14.81	6.17	0
Knowledge Development	31.20	23.90	24.70	11.90	22.00	0	13.70
Project management development	9.20	6.40	52,30	14.70	14.70	2.70	0
Training and development of employees	28.40	14.70	24.80	24.70	15.60	0	8.20
Organizational standards & norms	23.00	32.10	16.50	12.90	11.90	3.60	0

Source: Prepared by author

In the area of Knowledge development, 31.2 % of enterprises declared, that the knowledge is shared only within profession and position in the organization. Not only within the profession, the knowledge is shared in 23.9% of enterprises. The environment for sharing tacit knowledge is created in 24.7% of enterprises, and 11.9% of enterprises stated that the multidisciplinary knowledge is acquired on the project. The knowledge of PM professionals within the project or PMO is shared in 22% of enterprises.

However, these numbers are partially biased by the reality that 13.7% of enterprises expressed consent with more than one level of the maturity model. There can be various reasons for it – from airy filling the questionnaire up to misunderstanding differences between individual levels of maturity.

This fact confirms that these enterprises do not comprehend the project management, the creation and sharing knowledge, and just for these enterprises the project orientation is a good solution.

In the area of Training and development of employees 28.4% of enterprises stated, that the T&D is provided only within the profession and given by external trainers, 14.7% of enterprises declared that the T&D is provided within profession and given prevailingly by external trainers, 24.8% of enterprises stated that the T&D of mixed expertise is given prevailingly by external trainers, the 24.7% of enterprises declare that the T & D of mixed expertise is given prevailingly by internal trainers or is given within the project, and 15.60% of enterprises reach the highest level in this area, i.e. T & D of mixed expertise is given prevailingly by internal trainers and leads to PMP certification.

In the case of Training and development of employees similarly, as it is in the area of Knowledge development 8.2% of enterprises stated their positions on more than one maturity model level.

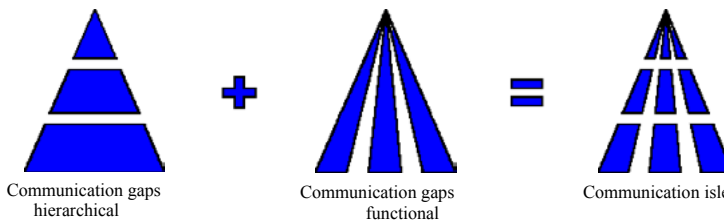
5.2. Description of Activity Areas of an Organization

The main effect of the Integrated model of transformation process leading to the project-oriented organization leans on the idea, that development only project management activity area is not sufficient for being mature project-oriented organization. This would lead to enhancement of project specialists´ knowledge and expertise and these experts would stand alone without a proper partner for any projects. These partners create a project team of specialists. The highly qualified project manager should have to lead not sufficiently prepared specialists. This situation would end by the departure of PM experts from the organization for benefit of competitor firm.

5.2.1. Communication Area Explanation

Communication problems in the organization can be viewed from horizontal and vertical perspective. Figure 5.2 shows a model of hierarchical and functional problems in communications within the organization coming from implications of bad hierarchical and functional communications in the organization.

Figure 5.2 Model of communication gaps within the organization



Source: Adapted by Kerzner, 2006

Both phenomena – the hierarchical and functional communication gaps work commonly. The result is the creation of communication islands within which specialists operate. At first glance, it is clear that to improve the mutual behavior

of partners in the supply chain in specific situations means actually a change of behavior of individual partners, i.e. a change of their culture. Definitely, it is a key process and not a short-term one. For example, the developed communication system should remove communication gaps which are shown in Figure 5.2.

Evolution in communication area brings achievements described in Table 5.6.

Table 5.6 Development of the communication area of activities

Evolution	Description of activities	Achievements
Initial state		*Communication isles identified throughout the organization*
1st step	Mapping of communication gaps	Gaps described
2nd step	Analysis of results	Recommendations for executives
3rd step	Taken appropriate measures, increasing of horizon/vertical communications	Colleagues within the horizontal line – partners
4th step	Development of com. especially within the project teams	Project team members share information
5th step	C. of project professionals via PMO	Regular meetings in PMO
Desired state		*PMO – center for communication*

Source: Marsina, 2009

5.2.2. Knowledge Management Development

Knowledge development inevitably occurs concurrently with the development of a culture of communications and the training and development of employees.

If we want someone to learn a procedure that leads to fulfilling a goal effectively and efficiently, this person should be trained – to get clear and accurate information, i.e. 'explicit knowledge' (Mládková, 2005). If we want somebody to be skilled, i.e. to use repeatedly acquired explicit knowledge, the person must work with accurate information. He or she will acquire his/her experience. This is a 'tacit knowledge' (Mládková, 2005). This kind of knowledge is difficult to measure. It is in the heads of people who are members of the organization. They are called knowledge workers. If we want to improve interoperability, people involved need to share 'tacit knowledge,' at least partly. The chance for interoperability to flourish is nurtured via a developed communication system. This means not only using ICTs, but a new culture of regular meetings (some of them casual/tieless), workshops, the use of special terminology, especially as related to projects, and so forth.

Early on (stage one), employees' knowledge is exclusively connected with their own profession. They have little idea about what their colleagues in the next functional area actually do. For example, people working in a technical function are not interested generally in what their colleagues in finance do and vice versa. The expectation that these specialists can engage in solving problems of a multidisciplinary nature on their own is highly unlikely. The third stage talks about the introduction of the interdisciplinary approach of people working in professionally different areas. In the fourth stage, multidisciplinary knowledge is acquired during project preparation and/or implementation. Multidisciplinary work on projects and intensive communications then enables participants to learn much about the partner's role within the project team. The supporting role of top management to make communications in teams effective is expressed by Yeatts:"*The managers' behaviors and what they said were the means of conveying this support.*" (Yeatts, Hyten, 1998) The fifth stage describes managed activities by the project management office where specialists share professional information with their partners. The project management office then becomes a consulting center for the organization. It can be even the publisher of a professional journal issued regularly, say, once a year at a minimum. Evolution of knowledge management within the transformation process leading to the project-oriented organization is visible in each of the following steps:

Table 5.7 Development of knowledge management area

Evolution	Description of activities	Achievements
Initial state		*Knowledge limited by profession, low support by the organization*
1st step	Mapping of professional knowledge	Map of professional knowledge
2nd step	Analysis of results from the K-map	Recommendations for executives
3rd step	Taken approx. measures for a share of knowledge – the horizontal/vertical cooperation	Colleagues within the horizontal line, i.e. partners
4th step	Development of rules for share of knowledge especially within the project teams	Project culture changed the share of knowledge
5th step	Building of Project Management Office	Regular meetings of professionals in Project Management Office
Desired State		*Project Management Office as a knowledge center*

Source: Marsina, 2009

5.2.3. Project Management Development, Training and Development of Employees and Development Standards and Norms

The function of the Project Management Office as a training and development center now evolves significantly. It graduates from simple employee job training, led by external trainers, to more complex, mixed expertise provided increasingly more by internal trainers, and eventually to formal Project Management Professionals (PMP) certification provided by in-house specialists. The Training and Development Centre can further enhance its function by holding international video conferences and congresses on special topics that could include, for example, the participation of universities, scientific centers from home and abroad, as well as business partner organizations.

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Knowledge acquired has to be saved and stored properly for the use of others later on. It has to be standardized and normalized across the enterprise. The development of an organizational Standards and Norms function will formalize the effort of optimizing this new-found knowledge. Resulting instructions, rules, and regulations will clarify and unify procedures, methods, and techniques that have arisen from best practices to help people at their work. They also serve as the basis for appropriate controls and for continuous improvement.

The development of project management methodology is a specialty, maybe not belonging organically to other mentioned areas. But, there is a question: How better to learn and acquire tacit knowledge than by practice, in the day-to-day work of the project team? Through its project management office (PMO), the mature, project-oriented organization (Watkins, 2008) actually creates an optimal environment for developing all other areas. The PMO can then serve as a consulting center, as a center of best practices and as the place for formal and informal exchanges among knowledge workers.

Implementation of project management techniques and methods within the transformation process leading to the project-oriented organization is visible from the Table 5.8:

Table 5.8 Project management area development

Evolution	Description of activities	Achievements
Initial state		*Projects are used ad-hoc*
1st step	Projects, if any, designed and implemented by external experts	Projects become results of strategic decisions
2nd step	Development of strat. thinking in the new ways of strategy implementation	First project professionals identified
3rd step	Projects are designed and implemented prevailingly by external experts	Increased number of project professionals
4th step	Projects are designed and implemented prevailingly by internal experts	Increased project culture in internal projects
5th step	Project professionals establish PMO	Established PMO
Desired state		*PMO – center for programming and project administration*

Source: Marsina, 2009

The development of project management methodology is a specialty, maybe not belonging organically to other mentioned areas. But, there is a question: How better to learn and acquire tacit knowledge than by practice, in the day-to-day work of the project team? Through its project management office (PMO), the mature, project-oriented organization actually creates an optimal environment for developing all other areas. The PMO can then serve as a consulting center, as a center of best practices and as the place for formal and informal exchanges among knowledge workers. Project development in Table 6.8 starts from the state when projects, if any, are designed and implemented by external experts. No special organizational unit is concerned with this area. In most cases, this calls for the competence of one top manager or his/her functional designate. Through the gradual involvement (and growth) of internal personnel, the enterprise establishes its own unit, a project management office, to administer the design and implementation of projects all on its own.

Each step of the evolution of standardization area within the transformation process leading to the project-oriented organization can be seen in Table 5.9:

Table 5.9 Standards and norms area development

Evolution	Description of activities	Achievements
Initial state	*Standards and norms set-up if needed*	*Standards and norms are not managed sufficiently*
1st step	Developing standards and norms just for routine works and legal needs	Standards and norms cover just part of company
2nd step	Organizational norms support Training and development	Set-up rules for Training and development
3rd step	Organizational norms are including the project administration	Organizational norms support project administration
4th step	Organizational norms specified for Project Management include performance appraisal & rewarding	Organizational norms support the project teams' development
5th step	Developing of organizational norms for Project Management Office	Organizational norms support Project Management Office
Desired state		*Organizational norms create a skeleton for the sustainability of achieved results*

Source: Marsina, 2009

5.3. Summary

Our research revealed, that the Slovak enterprises are not enough effective in the utilization of projects for their business activities. Only lower number of enterprises can declare (Table 5.5) that they operate on the 5th level of the maturity model. There are 14.81% in the area of Communication, 22% in the area of Knowledge development, 14.70% in the area of Project management development, 15.60% in the area of Training and development of employees, and 11.90% in the area of Organizational standards & norms. Sufficient can be considered those enterprises, which were identified on the 4th level of the maturity model. The majority of enterprises are located on lower levels, which means that in need of making more effective their business activities the project orientation and its principles can be significantly helpful.

Very interesting seems to be 52.30% of enterprises on the 3rd level of the project management development area. This figure presents a fact, that high percentage of Slovak enterprises assesses their approach to project management on the average.

The next interesting group of enterprises from the aspect of project orientation are those enterprises which did not align themselves to any level (6.17% in area of Communication, 2.70% in area of Project management development, and 3.60% in area of Organizational standards & norms), or enterprises, which aligned themselves into more than one level (13.70% in area of Knowledge development and 8.20% in area of Training and development of employees). These enterprises declared their neutral attitude to utilization the area of project management. Along with enterprises situated on lower levels, they represent a potential for training and development and consultations in this area. Concurrently, their identification creates an opportunity for further testing and research.

6. APPLICATION PERSPECTIVES OF THE PROJECT ORIENTATION MODEL

The organization is recognized as a good supply chain partner when its organizational units or departments interoperate successfully. Though this may be true, the current operational climate does not look quite like this. More often, we see conflicting goals between functional departments as the current phenomena in manufacturing firms.

This work addresses potential improvements to organizational interoperability within the supply chain, generally through the 'Integrated Model of Communication Systems, Knowledge and Project Management Development, as well as Training and Development of Human Resources and the development of Organizational Standards & Norms of the partner organizations.' This integrated model can help organizations survive even bad times or economic recessions. The model is going to be analyzed and adapted for the automotive industry.

6.1. Terms and Concepts of the Organizational Interoperability

The term "Organizational Interoperability" is used mainly in a technological context, concerning software, data standards, and networks, for example developing frameworks for interoperable digital geospatial libraries, or for developing a standard inter-organization protocol which expresses the way in which organizations have to communicate and share data; or for Collaborative product development (CPD), where it has been widely accepted as an advanced collaboration paradigm that combines geographically distributed product development teams to develop products collaboratively and efficiently. Interoperability of cross-organizational workflows is important for CPD to facilitate the successful execution of the whole product development process across the enterprise boundaries.

Organizational interoperability can be found not only at transaction-level sharing of standards, drawings, process plans and orders but also in more human-oriented contexts, e.g., in creating a common communications culture:

interoperability in crisis management. There, negotiations between representatives of the many politically diversified sides have to be executed face-to-face. In this case, interoperability means not only technical and political compatibility, but also refers to the will and the means to communicate, to cooperate, and to collaborate: in short, sharing a common culture of communication. As we well know, when systems are not politically, organizationally, or technically interoperable, information becomes 'stove piped' within a single organization and systems cannot easily collaborate.

6.2. Organizational Interoperability within the Supply Chain

We can expect organizational interoperability within the supply chain where there is a sharing of a common understanding of the situation and context required for coordinating different activities and priorities all along the chain. Organizational interoperability provides for the capability and capacity for cooperating in an efficient way for both partners over time, including the way to face unexpected events.

Large companies within the supply chain try to define rather strict criteria for selecting their partners according to such concerns. ISO 9000/14000 certification, risk management procedures, project management, process analysis, problem-solving and linked organizational methods and tools can be framed as setting the basis of organizational interoperability, based, at least partly, on the combination of such organizational rules, values, and methods.

This organizational framework helps to define, at least partly, the same organizational 'vocabulary' and use the same 'grammar'. However, sharing such basis in common does not mean that the priorities and objectives are the same. They have to be discussed and regularly re-evaluated according to the on-going emergent process and its situated context. The main point of language is so the actors can "see" a situation in a common frame. Seeing is dependent on having an appropriate scheme to attach ideas too, and to serve as domains which can be developed further by developing proximal knowledge for example by training and experience. An appreciation of representations for time and space is a pre-requisite for more advanced rationales.

More recently, Palaneeswaran categorizes the integrative forces in a supply chain into hard and soft factors. (Palaneeswaran, Kumaraswamy, 2003) The hard factors cover binding needs to achieve contractual agreements, short-term benefits, and contractual commitments for liability. The soft factors are the relational binding forces, which can be developed from sources such as trust,

involvement, mutual respect, sharing risks and rewards, effective communication, transparency, ethics and discipline and other non-contractual measures. These can be observed also in supply chains in the automotive industry. Beside the hard factors, soft factors are necessary to make the supply chain work. This analysis represents a wider interpretation beyond simply an information processing model. The richness of the personal interaction dimension is central.

When looking at some trends in the automotive industry it is evident that the supplier company partnering in the supply chain is obviously a firm with a low-cost strategy. But nowadays, this is not enough for being chosen by the Original Equipment Manufacturer (OEM) into the supply chain structure. There are new criteria to be met to be considered as a partner – a mature firm with developed other features like product and process innovation, human resource development, and other kinds of strategies and systems (communications, knowledge transfer, project management, standardization & normalization, and so forth). One of the significant features for an SME to be chosen by a multinational corporation into its supply chain is its capability in continuous innovation and its links to R&D institutions as well as to universities. This provides the OEM with a competitive advantage for a longer period of time.

Because module suppliers have not only one customer (OEM) it is difficult for them to standardize processes and organization. Despite the fact that there are standards like ISO TS 16949 or guidelines from the VDA (Association of German Automotive Industry) for information exchange, every customer has its own preferences and in-house procedures for supply chain planning, operations, and optimization. The module suppliers are usually in a weak position to get their standards accepted by their customers. Typical for innovation are the suppliers of tools and equipment in the automotive industry who must develop and produce, almost exclusively, originals for the manufacturers of parts, systems, or modules, as well as for OEMs equipment for final assembly.

The potential improvement of interoperability can be found at Stevenson (2005), who analyzes the effectiveness of the supply chain through five key steps. They are as follows:

- Develop strategic objectives and tactics. These will guide the process.
- Integrate and coordinate activities in the internal portion of the chain. This requires overcoming barriers caused by functional thinking that lead to attempts to optimize a subset of a system rather than the system as a whole and transferring data and coordinating activities.
- Coordinate activities with suppliers and with customers. This involves addressing supply and demand issues.

- Coordinate planning and execution across the supply chain. This requires a system for transferring data across the supply chain and allowing access to data to those who engage in operations to which it will be useful.
- Consider the possibilities of forming strategic partnerships. Strategic partnering occurs when two or more business organizations that have complementary products or services that would strategically benefit the others agree to join so that each may realize a strategic benefit.

One of the several aspects of the interoperability improvement is optimizing. Stevenson tries to explain optimizing of the supply chain as a maximizing shareholder and customer value. This is achieved by fully integrating all members of the supply chain, collaboratively balancing resources of chain members, and optimizing the flow of goods, services, and information from source to end customer. To do this, it is necessary to maximize the velocity of information transfer and minimize response time.

6.3. Organizational Interoperability of the Individual Supplier – the Supply Chain Partner

It is hard to believe that without good interoperability of functional departments an organization would be capable of interoperating along the supply chain successfully. But, the reality of day-to-day operation of an organization does not look like this. Table 6.1 shows conflicts of goals between functional departments in a manufacturing company. The differing goal is a normal situation but it should not lead to misunderstanding or even to the ignoring of the organization's goals as a whole. Conflicts of goals between functional departments in the manufacturing company are analyzed by Schulte (1994).

If we analyze goals of functional departments, they naturally differ because of the different professional orientations of people working on different kind of tasks there. Professionals behave as if they are enclosed in their departments and are partially separated from other professions in the organization. Actually, this is the result of specialization. As shown in Table 6.1, different goals mean different interests and this situation can lead to conflicts. If those conflicts are not under control they weaken the effort of the organization as a whole. Overriding the interests of specialists with the interests of the organization as a whole is a task of generalists, i.e. managers. Training and development is a good support mechanism for them by which to do this.

Table 6.1 Conflicts of goals between functional departments in the manufacturing company

Goals of functional departments			Endeavour of the functional department	versus	Interests of other departments	Logistic goals
Research & Development	High level design and technology	>	Frequent changes of design & tech	vs	Low frequency of changes / stability	Low inventories
		>	Diversification of products and components	vs	Minimal assortment and standardization	
Marketing & Sales	Market research	>	Product diversification	vs	Reduction of diversification	+
	Customer services	>	High responsiveness & timeliness	vs	Prolonging lead time	High turnover
Production	High & balanced usage of capacity (people, machines and equipment)	>	Reduction of excessive production capacity	vs	Flexibility of production capacities	
		>	Maximizing of lot sizes and inventories	vs	Production for individual customer	+
Purchase	Quantity discounts	>	Big amount of ordered materials	vs	Frequent and little lot sizes	Timeliness
	Terms of delivery	>	Share risks with many suppliers	vs	Repetitive order from only supplier	

Source: Adapted by Schulte, 1994

How to best achieve the interoperability of all departments to make sense for the overall effort of the organization and create operational synergies? One of the simplest ways is teamwork as a new managerial frontier.

In today's more complex multinational and technologically sophisticated environments, the group has re-emerged with a broader definition. Team building can be defined as a process of taking a collection of individuals with different needs, backgrounds, and expertise and transforming them into an integrated, effective work unit. In this transformation process, the goals and energies of individual contributors merge and focus on specific objectives and desired results that ultimately reflect project performance.

This may sound straightforward, but today's project complexities introduce many subtle variables. Not too long ago, project leaders could ensure successful integration for most of their projects by focusing on properly defining the work, timing, and resources and by following established procedures for project

tracking and control. Today, these factors are still crucial. However, they have become threshold competencies, critically important but unlikely to guarantee project success by themselves. Today's complex business world requires project teams that are fast and flexible and can dynamically and creatively work toward established objectives in a changing environment. This requires effective networking and cooperation among people from different functional departments, different organizations, support groups, subcontractors, vendors, government agencies, and customer communities. It also requires the ability to deal with uncertainties and risks caused by economic, technological, political, social, and regulatory factors. In addition, project leaders have to organize and manage their teams across organizational lines and international borders. Dealing with resource sharing, multiple reporting relationships, and broadly based alliances is as common in today's business environment as e-mail, flexible work hours and home offices. In addition, managers in these environments must have the human and interpersonal skills, known collectively as emotional intelligence, to meet these complex demands.

Team building is an ongoing process that requires strong leadership skills and an understanding of the organization, its interfaces, authority, power structures, and motivational factors. This process is particularly crucial in environments where complex multidisciplinary or transnational activities require the skillful integration of many functional specialties and support groups with diverse organizational cultures, values, and intricacies. Team building can lead to the "project-orientation" of an organization, which offers a chance to develop people in teams.

The process of interoperability improvement by the systematic building of project-oriented organizations is depicted as an integrated model in Table 5.1. The whole transformation process is decomposed into five areas – training and development of human resources, communications, knowledge, project management development, and the development of norms & standards. These areas of activities affect each other, and they do not stand alone.

Development of activities in these areas can potentially help to achieve desired interoperability of an organization. To achieve the desired state requires a process. The model suggests the process of transformation in five stages – from the initial state of an organization with undeveloped systems to a mature, project-oriented organization.

To perceive an organization as a project-oriented company or as a project-oriented business unit is a social construction. Project-oriented organizations are those that perceive themselves as being project-oriented, they define their organizational strategy as "management by projects"; they apply projects

and programs for the performance of complex processes, they manage a project portfolio of different internal and external project types, and they have specific permanent organizations such as project portfolio groups or project management offices to provide integrative functions.

6.4. Summary

As proven by European research on planning, scheduling, and control within supply chain partnership, the module suppliers have not only one customer (e.g. OEM, assembling company); therefore it is sometimes difficult for them to standardize processes and organization. The organization involved in supplying hierarchy should respect chain partners and partially also their internal standards. Development of standards and norms for project orientation maturity, therefore, should take into account the business environment. This is particularly difficult for small and medium-sized business organizations. The size of a company determines its capability for applying the new models. In general, smaller companies do not trust a lot to research, methodologies, or models. All these phenomena might be considered as obstacles and constraints in developing organizational interoperability by means of project orientation development.

Improvement of organizational interoperability in supply chain management can help a company be selected as a supplier by the industrial customer. The integrated model of five activity areas and their development comes from the idea that only overall effort can develop human resources and ensure better interoperability within the organization. The building of project teams and developing project orientation in an organization can significantly support this effort. Developing the processes suggested above are of long-term duration, but at the end, they result in reaching a status of Mature Supply Chain Partner. With that outcome, the previously- mentioned obstacles and constraints seem to be lesser.

7. CONCLUSION

Knowledge development inevitably goes concurrently with the culture of communication development and the training and development of employees. At first, the knowledge of employees is exclusively connected with their profession. They have no idea about what is done by their colleagues in the next functional area. For example, people in the technical area have no concern to the economy and vice versa. The solution of the multidisciplinary problem is almost impossible. The third step says about the interdisciplinary approach of people working in professionally different areas. In a fourth step, the multidisciplinary knowledge is acquired during the project preparation and/or implementation. The multidisciplinary work on the project and intensive communications enable participants to learn much about the profession of a partner within the project team. The supporting role of top management to make communications in team effective is expressed by Yeatts: *„The managers' behaviors and what they said were the means of conveying this support"*.(Yeatts, Hyten, 1998) The fifth step describes managed activities of the project management office when specialists share professional information with partners. The project management office is becoming a consulting center of the organization. It can become even a publisher of a professional journal issued regularly minimum once a year.

The function of the training and development center evolves from the simple training of employees in their profession led by the external trainers up to the mixed expertise given prevailingly by internal trainers leading to the Project management professional certification given prevailingly by internal specialists. The training and development center can hold e.g. international video conferences and congresses on special topics including participation of the universities, scientific centers from home and abroad, as well as business partner organizations.

Knowledge acquired has to be saved and stored properly for using of others later on. These are the tasks of standardization and normalization within the enterprise.

The project development in the Table 5.8 starts from the state when projects, if any, are designed and implemented by external experts. No special organizational unit cares for this area. In most, this is a competency of one top manager or the functional manager authorized by him/her. Through the gradual involvement of internal personnel, the enterprise establishes its own

unit, a project management office, for the administration of design and implementation of projects all on its own.

The main goal of the Part I was to give knowledge about concepts of program, project and project management, their importance in the permanently changing business environment. There was introduced the new model of building a project-oriented organization as a supporting tool for gradual building the organizational high maturity in managerial culture, especially readiness to use program and projects immediately when it is needed. The new model was tested in the year 2015 and 2016 within the research project VEGA No. 1/0933/14 and results were published in many international conferences and journals. Overall research proved the idea to improve suggested five cross-sectional activity areas in an organization as right one.

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PART II
ICT SUPPORT OF PROJECT – ORIENTED ORGANIZATION

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INTRODUCTION

Information and communications technology applications can be found in practically every area of life; they shape our private lives and our work. But while there is extensive and detailed media coverage of the changes in private communication, the significant and frequently far-reaching impact that ICT has on the world of work receives far less attention. ICT is also becoming increasingly important on a macroeconomic level. Not only is the ICT industry a steadily growing sector with a high economic significance, ICT-based solutions and technologies also make a valuable and very important contribution to value creation in other sectors, and of course also in the project-oriented organizations.

The success of most companies is based on successfully implemented innovative projects. Innovative projects often bring risks that can cause problems in the implementation phase. When companies want to gain higher effectiveness of project management, they use software project management support. We distinguish between several instruments, whether desktop, web – based, single user, multiple users, etc., while it should be noted that software support is no guarantee that the project will be managed and successful in practice. Information and Communication technologies are introducing several digital modes of managing project every day. Depending on how project managers strategically plan and utilize ICT can prove them to be either productive or counterproductive to the project.

The second part of this publication follows the characteristics of the project-oriented organization, its meaning and practical application of project management covered in the first part. Its primary focus is on individual components of the ICT support, especially on Business Intelligence Systems and Project Management software tools.

PART II is focused on:

- Analysis of the ICT support based on PMBOK® Guide,
- Decision support software tools called on Business Intelligence Systems in Project Management context,
- Specific types of Project Management Software,
- Presentation of chosen research results of Project Management Software utilization and Business Intelligence systems utilization in Slovak enterprises and organizations.

8. TECHNOLOGICAL AND INFORMATION REQUIREMENTS OF PROJECT-ORIENTED ORGANIZATION BASED ON PMBOK® GUIDE

The specification of information and technology requirements in a project-oriented organization is based on one of the project management's fundamental documents „A Guide to the Project Management Body of Knowledge" (PMBOK® Guide) published by Project Management Institute (PMI, 2013). PMI global standards provide guidelines, rules and characteristics for a project, program, and portfolio management. These standards are widely accepted. When consistently applied, they help the organization achieve professional excellence.

8.1. Project Data

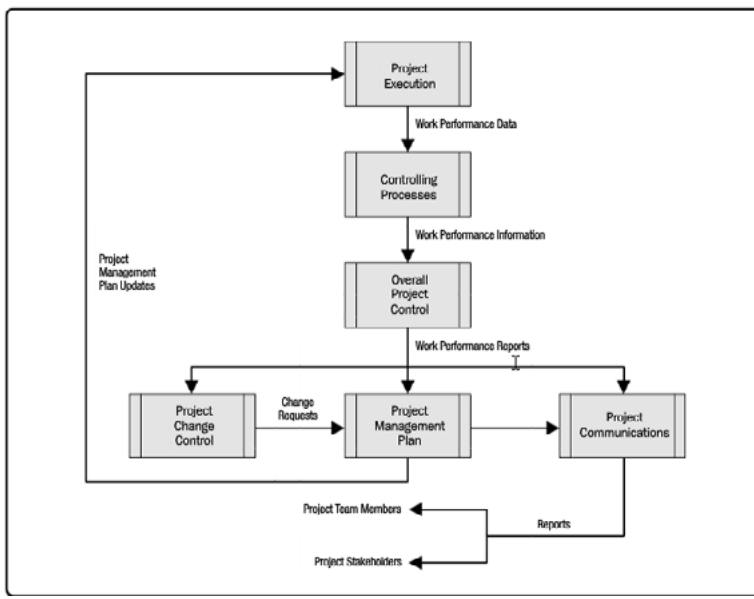
Standards are also dealing with the definition of the areas of acquisition and processing of project data and information, with which the information requirements of a project-oriented organization are defined. Project data and information are characterized as work performance data, work performance information, and work performance reports (PMI, 2013, p. 57).

Throughout the life cycle of the project, a significant amount of data and information is collected, analyzed, transformed, and distributed in various formats to project team members and other stakeholders. Project data are collected as a result of various executing processes and are shared within the project team. The collected data are analyzed in context and aggregated and transformed to become project information during various controlling processes. The information may then be communicated verbally or stored and distributed as reports in various formats.

The project data are continuously collected and analyzed during the dynamic context of the project execution. As a result, the terms data and information are often used interchangeably in practice. The indiscriminate use of these terms can lead to confusion and misunderstandings by the various project stakeholders. It is, therefore, necessary to define the terms what will then results in communications unification and thereby it will minimize the misunderstandings within the project team. Definitions of basic types of data are:

- **Work performance data** are the raw observations and measurements identified during activities performed to carry out the project work. Examples include reported the percent of work physically completed, quality and technical performance measures, start and finish dates of scheduled activities, the number of change requests, the number of defects, actual costs, actual durations, and so on.
- **Work performance information** – the performance data collected from various controlling processes, analyzed in context and integrated based on relationships across areas. Examples of performance information are the status of deliverables, implementation status for change requests, and forecasted estimates to complete.
- **Work performance reports** – the physical or electronic representation of work performance information compiled in project documents, intended to generate decisions or raise issues, actions, or awareness. Examples include status reports, memos, justifications, information notes, electronic dashboards, recommendations, and updates.

Figure 8.1 Project Data, Information and Report Flow



Source: PMBOK® Guide, p. 58

8.2. Project Management Processes Knowledge Areas

Project Management closely related to Business Process Management. The 47 project management processes identified in the PMBOK® Guide, are further grouped into ten separate knowledge areas. A characteristic feature of the business management process is effective knowledge management. The knowledge that is necessary for the process and its efficient operation, should be appropriately identified, acquire, retain, transform and capitalize (Bodiš, 2014).

A knowledge area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization. These ten knowledge areas are used on most projects most of the time. Project teams should utilize these ten knowledge areas and other knowledge areas, as appropriate, for their specific project. The knowledge areas are Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management and Project Stakeholder Management. Each Knowledge Area within the PMBOK® Guide is contained in a separate section. Each of ten knowledge areas contains some or all of the project management processes,.contains the processes that need to be accomplished within its discipline in order to achieve effective project management and each of these processes also falls into one of the five process groups, creating a matrix structure such that every process can be related to one knowledge area and one process group.

The knowledge areas are:

1. **Project Integration Management:** the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities within the project management process groups.
2. **Project Scope Management:** the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully.
3. **Project Time Management:** the processes required to manage the timely completion of the project.
4. **Project Cost Management:** the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.
5. **Project Quality Management:** the processes and activities of the performing organization that determines quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken.

6. **Project Human Resource Management:** the processes that organize, manage, and lead the project team.
7. **Project Communications Management:** the processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information.
8. **Project Risk Management:** the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project.
9. **Project Procurement Management:** the processes necessary to purchase or acquire products, services, or results needed from outside the project team. Processes in this area include procurement planning, solicitation planning, solicitation, source selection, contract administration, and contract closeout.
10. **Project Stakeholders Management:** the processes required to identify all people or organizations impacted by the project, analyzing stakeholder expectations and impact on the project, and developing appropriate management strategies for effectively engaging stakeholders in project decisions and execution.

8.3. ICT Tools in Project Management Processes Knowledge Areas

The „Guide to the Project Management Body of Knowledge" contains a detailed description of the various knowledge areas, including ICT tools and technologies that support the various knowledge areas. These ICT tools and technologies include project management information system, project management software, work performance information, analytical data, and analytical technologies, historical databases, forecasting, charts, reports, performance reviews, information management system, communication technology, communication models and communication methods.

ICT coverage of knowledge areas of project management is shown in Table 8.1. The numbers in the cells represent the various sub-headings of „Guide to the Project Management Body of Knowledge," which contain the listed ICT tools.

Table 8.1 ICT coverage of knowledge areas of Project Management

ICT tools/Area of Knowledge	Integration	Scope	Time	Cost	Quality	Human Resource	Communications	Risk	Procurement	Stake-holders
Project management information system	4.3.2.3 4.4.2.3						10.2.1.3			
Project management software			6.4.2.5 6.7.2.2	7.2.2.8 7.4.2.5						
Work performance information	4.4.1.5	5.5.3.3 5.6.3.1	6.7.3.1	7.4.3.1	8.3.3.4		10.3.1.4 10.3.3.1			13.4.3.1
Analytical data, analytical technologies	4.4.2.2 4.6.2.2	5.2.2.11	6.1.2.2 6.5.2.5 6.5.2.6	7.1.2.2 7.2.2.10	8.1.2.1 8.1.2.6 8.3.2.2	9.2.2.5		11.1.2.1 11.2.2.3 11.2.2.4 11.4.2.2	12.1.2.1 12.2.2.6	13.1.2.1 13.2.2.3
Historical databases				7.1.1.4 7.2.1.7 7.3.2.4	8.1.1.6	9.4.3.5	10.2.1.4			
Forecasting			6.7.3.2	7.4.2.2			10.2.2.5 10.3.3.4			
Charts	4.1.3.1 4.2.1.1	5.2.1.4 5.2.2.10 5.3.1.2			8.1.2.3 8.2.2.1	9.1.2.1		11.2.2.5		
Reports	4.4.3.2						10.2.2.5		12.3.2.4	
Performance Reviews				7.4.2.4						
Information management system							10.2.2.4 10.3.2.1			13.4.2.1
Communication technology Communication models Communication methods							10.2.2.1 10.2.2.2 10.2.2.3			13.3.2.1

Source: Prepared by author

8.4. Detailed Description of Selected ICT Tools Utilization

a) **Project management information system**, which is part of the environmental factors, provides access to tools, such as a scheduling tool, a work authorization system, a configuration management system, an information collection, and distribution system, or interfaces to other online automated systems. Automated gathering and reporting on key performance indicators (KPI) can be part of this system. Project Management Information System is related to Project Integration Management and Project Communication Management Knowledge Areas.

b) **Project management software** is related to Project Time Management, Project Cost Management, and Project Quality Management areas. In different knowledge areas it represents:
   - Scheduling software tool has the capability to help plan, organize, and manage resource pools and develop resource estimates. Depending on the sophistication of the software, resource breakdown structures, resource availability, resource rates, and various resource calendars can be defined to assist in optimizing resource utilization.
   - Scheduling software, which provides the ability to track planned dates versus actual dates, to report variances to and progress made against the schedule baseline, and to forecast the effects of changes to the project schedule model
   - Software applications, computerized spreadsheets, simulation, and statistical tools are used to assist with cost estimating. Such tools can simplify the use of some cost-estimating techniques and thereby facilitate rapid consideration of cost estimate alternatives.
   - This software is often used to monitor the three EVM (Earned Value Management) dimensions (Planned Value – PV, Earned Value – EV, and Actual Cost – AC), to display graphical trends, and to forecast a range of possible final project results.

c) **Work performance information** is related to Project Integration, Scope, Time, Cost, Communications and Stakeholders Management. It means:
   - The performance data collected from various controlling processes analyzed in context and integrated based on relationships across areas. Thus, work performance data has been transformed into work performance information. Data cannot be used in the decision-making process as it has only out-of-context meaning. Work performance information, however, is correlated and contextualized and provides a sound foundation for project

decisions. Work performance information is circulated through communication processes. Examples of performance information are the status of deliverables, implementation status for change requests, and forecasted estimates to complete.

- Information about project progress, such as which deliverables have started, their progress, which deliverables have finished, or which have been accepted.
- Information produced included correlated and contextualized information on how the project scope is performing compared to the scope baseline. It can include the categories of the changes received, the identified scope variances and their causes, how they impact schedule or cost, and the forecast of the future scope performance. This information provides a foundation for making scope decisions.
- Information, which calculated SV (Schedule Variance) and SPI (Schedule Performance Index) time performance indicators for WBS (Work Breakdown Structure) components the work packages and control accounts, are documented and communicated to stakeholders.
- Information, which calculated CV (Cost Variance), SV (Schedule Variance), CPI (Cost Performance Index), SPI (Schedule Performance Index), TCPI (To-Complete Performance Index), and VAC (Variance at Completion) values for WBS components the work packages and control accounts, are documented and communicated to stakeholders.
- The performance data collected from various controlling processes analyzed in context and integrated based on relationships across areas. Examples include information about the project requirements fulfillment such as causes for rejections, rework required, or the need for process adjustments.
- Work performance data can include details about which communications have been distributed, feedback on communications, survey results on communication effectiveness, or other raw observations identified during communication activities.
- Information organizes and summarizes the performance data gathered. This performance data typically provides status and progress information on the project at the level of detail required by the various stakeholders. This information is then communicated to the appropriate stakeholders.

d) Analytical data, analytical Technologies are dealing with all knowledge areas, except the Project Communication Management. This include:

- Analytical techniques to forecast potential outcomes based on possible variations of the project or environmental variables and their relationships

with other variables. Examples of analytical techniques used in projects are: regression analysis, grouping methods, causal analysis, root cause analysis, forecasting methods (e.g., time series, scenario building, simulation, and so on), failure mode and effect analysis (FMEA), fault tree analysis (FTA), reserve analysis, trend analysis,,earned value management, and variance analysis.

- Document analysis is used to elicit requirements by analyzing existing documentation and identifying information relevant to the requirements. There is a wide range of documents that may be analyzed to help elicit relevant requirements. Examples of documents that may be analyzed include, but are not limited to: business plans, marketing literature, agreements, requests for proposal, current process flows, logical data models, business rules repositories, application software documentation, business process or interface documentation, use cases, other requirements documentation, problem/issue logs, policies, procedures, and regulatory documentation such as laws, codes, or ordinances, and so on.
- Analytical techniques for scheduling methodology, scheduling tools and techniques, estimating approaches, formats, and project management software. The schedule management plan may also detail ways to fast track or crash the project schedule such as undertaking work in parallel. These decisions, like other schedule decisions affecting the project, may affect project risks. Organizational policies and procedures may influence which scheduling techniques are employed in these decisions. Techniques may include but are not limited to, rolling wave planning, leads and lags, alternatives analysis, and methods for reviewing schedule performance.
- Analytical techniques for team-based approaches, such as brainstorming, the Delphi or nominal group techniques, are useful for engaging team members in improving estimate accuracy and commitment to the emerging estimates. By involving a structured group of people who are close to the technical execution of work in the estimation process, additional information is gained and more accurate estimates obtained. Additionally, when people are involved in the estimation process, their commitment towards meeting the resulting estimates increases.
- Reserve analysis may include contingency reserves, sometimes referred to as time reserves or buffers, into the project schedule to account for schedule uncertainty. Contingency reserves are the estimated duration within the schedule baseline, which is allocated for identified risks that are accepted and for which contingent or mitigation responses are developed. Contingency reserves are associated with the "known unknowns," which may be

estimated to account for this unknown amount of rework. The contingency reserve may be a percentage of the estimated activity duration, a fixed number of work periods, or may be developed by using quantitative analysis methods such as Monte Carlo simulation.

- Analytical techniques for developing the cost management plan may involve choosing strategic options to fund the project such as self-funding, funding with equity, or funding with debt. The cost management plan may also detail ways to finance project resources such as making, purchasing, renting, or leasing. These decisions, like other financial decisions affecting the project, may affect project schedule and/or risks. Organizational policies and procedures may influence which financial techniques are employed in these decisions. Techniques may include (but are not limited to): payback period, return on investment, internal rate of return, discounted cash flow, and net present value.
- Cost-benefit analysis – the primary benefits of meeting quality requirements include less rework, higher productivity, lower costs, increased stakeholder satisfaction and increased profitability. A cost-benefit analysis for each quality activity compares the cost of the quality step to the expected benefit.
- Statistical sampling involves choosing a part of a population of interest for inspection (for example, selecting ten engineering drawings at random from a list of seventy-five). Sample frequency and sizes should be determined during the Plan Quality Management process so the cost of quality will include the number of tests, expected scrap, and so on. There is a substantial body of knowledge on statistical sampling. In some application areas, it may be necessary for the project management team to be familiar with a variety of sampling techniques to assure the sample selected represents the population of interest.
- Multi-criteria decision analysis – selection criteria are often used as a part of acquiring the project team. By use of a multi-criteria decision analysis tool, criteria are developed and used to rate or score potential team members. The criteria are weighted according to the relative importance of the needs within the team.
- Analytical techniques for to understand and define the overall risk management context of the project. Risk management context is a combination of stakeholder risk attitudes and the strategic risk exposure of a given project based on the overall project context. For example, a stakeholder risk profile analysis may be performed to grade and qualify the project stakeholder risk appetite and tolerance. Other techniques, such as the use of strategic

risk scoring sheets, are used to provide a high-level assessment of the risk exposure of the project based on the overall project context. Depending on these assessments, the project team can allocate appropriate resources and focus on the risk management activities.

- Checklist analysis risk identification – checklists are developed based on historical information and knowledge that has been accumulated from previous similar projects and from other sources of information. The lowest level of the RBS (Resource Breakdown Structure) can also be used as a risk checklist. While a checklist may be quick and simple, it is impossible to build an exhaustive one, and care should be taken to ensure the checklist is not used to avoid the effort of proper risk identification. The team should also explore items that do not appear on the checklist. Additionally, the checklist should be pruned from time to time to remove or archive related items. The checklist should be reviewed during project closure to incorporate new lessons learned and improve it for use on future projects.
- Assumptions analysis – every project and its plan are conceived and developed based on a set of hypotheses, scenarios, or assumptions. Assumptions analysis explores the validity of assumptions as they apply to the project. It identifies risks to the project from inaccuracy, instability, inconsistency, or incompleteness of assumptions.
- Quantitative risk analysis and modeling techniques – commonly used techniques use both event-oriented and project-oriented analysis approaches, including sensitivity analysis. Sensitivity analysis helps to determine which risks have the most potential impact on the project. It helps to understand how the variations in project's objectives correlate with variations in different uncertainties. Conversely, it examines the extent to which the uncertainty of each project element affects the objective being studied when all other uncertain elements are held at their baseline values. One typical display of sensitivity analysis is the tornado diagram (Figure 8.5), which is useful for comparing relative importance and impact of variables that have a high degree of uncertainty to those that are more stable.
- Expected monetary value (EMV) analysis is a statistical concept that calculates the average outcome when the future includes scenarios that may or may not happen (i.e., analysis under uncertainty). The EMV of opportunities is generally expressed as positive values, while those of threats are expressed as negative values. EMV requires a risk-neutral assumption—neither risk-averse nor risk seeking. EMV for a project is calculated by multiplying the value of each possible outcome by its probability of occurrence

and adding the products together. A common use of this type of analysis is a decision tree analysis (Figure 8.6).

- Make-or-buy analysis is a general management technique used to determine whether particular work can best be accomplished by the project team or should be purchased from outside sources. Sometimes a capability may exist within the project organization but may be committed to working on other projects, in which case, the project may need to source such effort from outside the organization to meet its schedule commitments. Budget constraints may influence make-or-buy decisions. If a buy decision is to be made, then a further decision of whether to purchase or lease is also made. A make-or-buy analysis should consider all related costs—both direct costs as well as indirect support costs.
- Analytical techniques procurements involve defining a need in such a way that vendors can bring value through their offerings. To ensure that the need can be and is met, analytical techniques can help organizations identify the readiness of a vendor to provide the desired end state, determine the cost expected to support budgeting, and avoid cost overruns due to changes. By examining past performance information, teams may identify areas that may have more risk, and that need to be monitored closely to ensure the success of the project.
- Stakeholder analysis is a technique of systematically gathering and analyzing quantitative and qualitative information to determine whose interests should be considered throughout the project. It identifies the interests, expectations, and influence of the stakeholders and relates them to the purpose of the project. It also helps to identify stakeholder relationships (with the project and with other stakeholders) that can be leveraged to build coalitions and potential partnerships to enhance the project's chance of success, along with stakeholder relationships that need to be influenced differently at different stages of the project or phase.

e) **Historical databases** are related to Project Cost, Quality, Human Resources and Communications Management:

- Historical information and lessons learned knowledge bases.
- Historical relationships that result in parametric estimates or analogous estimates involve the use of project characteristics (parameters) to develop mathematical models to predict total project costs.
- Historical information used to develop the model is accurate. Parameters used in the model are readily quantifiable, and Models are scalable, such that they work for large projects, small projects, and phases of a project.

- Historical databases; and lessons learned from previous phases or projects.
- Historical information and lessons learned documentation.

f) **Forecasting** is related to Project Time, Cost and Communications Management. It includes:

- Schedule forecasts are estimates or predictions of conditions and events in the project's future based on information and knowledge available at the time of the forecast. Forecasts are updated and reissued based on work performance information provided as the project is executed. The information is based on the project's past performance and expected future performance, and includes earned value performance indicators that could impact the project in the future.
- Forecasting as the project progresses, the project team may develop a forecast for the estimate at completion (EAC) that may differ from the budget at completion (BAC) based on the project performance. If it becomes obvious that the BAC is no longer viable, the project manager should consider the forecasted EAC. Forecasting the EAC involves making projections of conditions and events in the project's future based on current performance information and other knowledge available at the time of the forecast. Forecasts are generated, updated, and reissued based on work performance data that is provided as the project is executed. The work performance information covers the project's past performance and any information that could impact the project in the future.
- Performance reporting is the act of collecting and distributing performance information, including status reports, progress measurements, and forecasts. Performance reporting involves the periodic collection and analysis of baseline versus actual data to understand and communicate the project progress and performance as well as to forecast the project results. Performance reporting needs to provide information at an appropriate level for each audience.
- Project documents update – may be updated as a result of the control communications process. These updates may include but are not limited to forecasts, performance reports, and issue log.

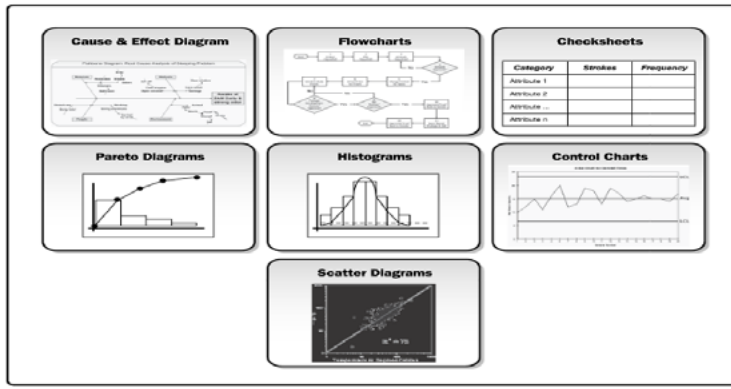
g) **Charts** are related to Project Integration, Scope, Quality, Human Resources, and Risk Management. These are:

- The project charter is the document issued by the project initiator or sponsor that formally authorizes the existence of a project and provides the project manager with authority to apply organizational resources to project

activities. It documents the business needs, assumptions, constraints, the understanding of the customer's needs and high-level requirements, and the new product, service, or result that it is intended to satisfy, such as: project purpose or justification, measurable project objectives and related success criteria, high-level requirements, assumptions and constraints, high-level project description and boundaries, high-level risks, summary milestone schedule, summary budget, stakeholder list, project approval requirements (i.e., what constitutes project success, who decides the project is successful, and who signs off on the project), assigned project manager, responsibility, and authority level, and name and authority of the sponsor or other person(s) authorizing the project charter.

- The size of the project charter varies depending on the complexity of the project and the information known at the time of its creation. At a minimum, the project charter should define the high-level boundaries of the project. The project team uses the project charter as the starting point for initial planning throughout the Initiating Process Group.
- The project charter is used to provide the high-level description of the product, service, or result of the project so that detailed requirements can be developed.
- The context diagram is an example of a scope model. Context diagrams visually depict the product scope by showing a business system (process, equipment, computer system, etc.), and how people and other systems (actors) interact with it. Context diagrams show inputs to the business system, the actor(s) providing the input, the outputs from the business system, and the actor(s) receiving the output.
- The project charter provides the high-level project description and product characteristics. It also contains project approval requirements. If a project charter is not used in the performing organization, then comparable information needs to be acquired or developed and used as a basis for the detailed project scope statement. Organizations that do not produce a formal project charter will usually perform an informal analysis to identify the content necessary for further scope planning.
- The seven basic quality tools, also known in the industry as 7QC Tools, are used within the context of the PDCA Cycle to solve quality-related problems. The seven basic quality tools are cause and effect diagram, flowcharts, checksheets, Pareto diagrams, histograms, control charts, and scatter diagram (Figure 8.2).

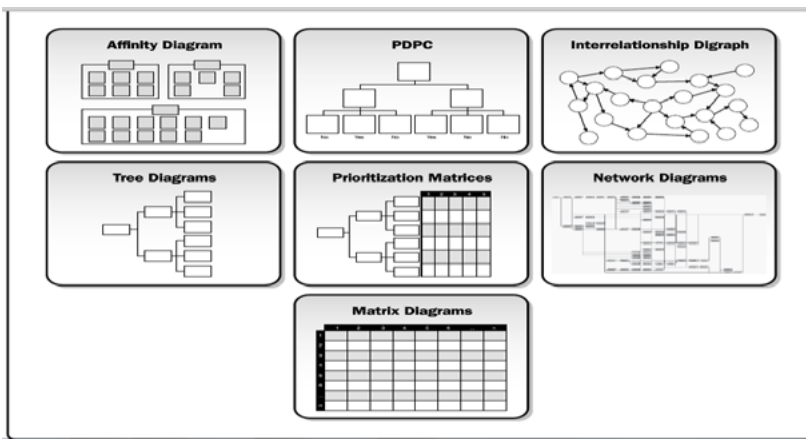
Figure 8.2: Seven basic quality tools



Source: PMBOK® Guide, p. 238

- Charts for quality management and control tools are for example affinity diagram, PDPC, interrelationship graph, tree diagram, prioritization matrices, network diagram, matrix diagram (Figure 8.3, Figure 8.5, Figure 8.6).

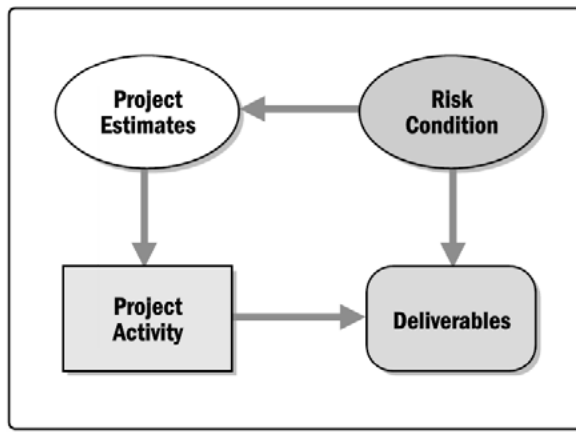
Figure 8.3 Charts for illustrating Quality Management



Source: PMBOK® Guide, p.. 246

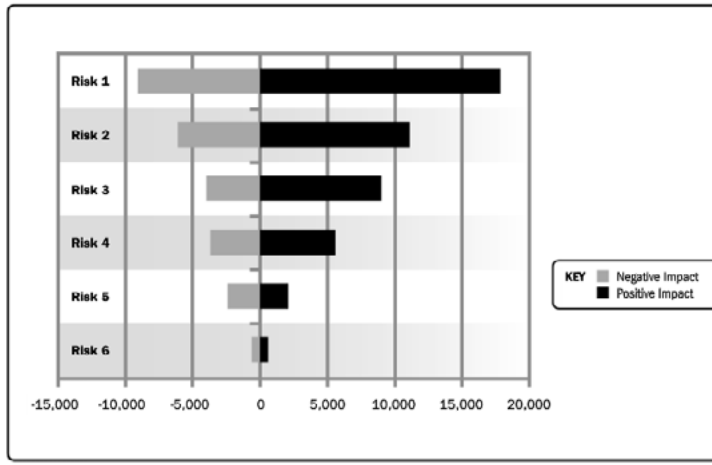
- Organization charts and position descriptions – various formats exist to document team member roles and responsibilities. Most of the formats fall into one of three types: hierarchical, matrix, and text-oriented. Additionally, some project assignments are listed in subsidiary plans, such as the risk, quality, or communications management plans. Regardless of the method utilized, the objective is to ensure that each work package has an unambiguous owner and that all team members have a clear understanding of their roles and responsibilities. For example, a hierarchical format may be used to represent high-level roles, while a text-based format may be better suited to document the detailed responsibilities.
- risk diagramming techniques may include:
  i) Cause and effect diagrams. These are also known as Ishikawa or fishbone diagrams and are useful for identifying causes of risks.
  ii) System or process flow charts. These show how various elements of a system interrelate and the mechanism of causation.
  iii) Influence diagrams. These are graphical representations of situations showing causal influences, time ordering of events, and other relationships among variables and outcomes, as shown in Figure 8.4.

Figure 8.4 Influence diagram



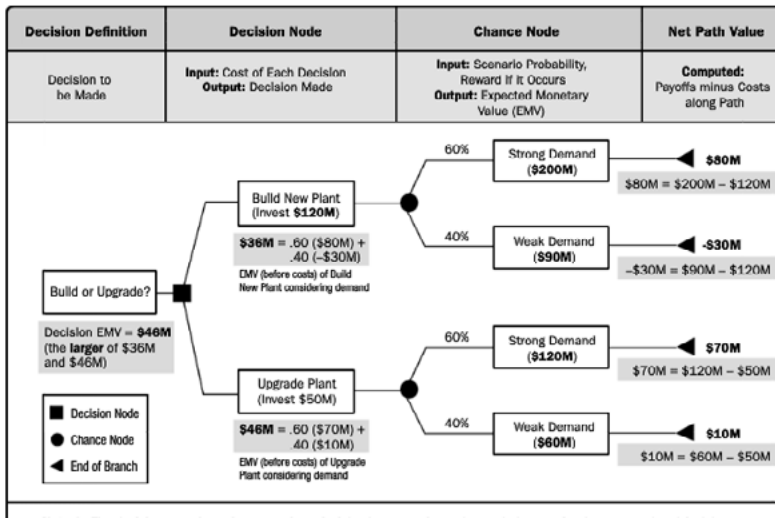
Source: PMBOK® Guide, p. 326

Figure 8.5 Tornado diagram



Source: PMBOK® Guide , p. 337

Figure 8.6 Decision tree



Source: PMBOK® Guide, p. 338

h) Reports are typical especially for Project Integration, Communication, and Procurement Management. These contain:

- Work performance reports, which are the physical or electronic representation of work performance information compiled in project documents, intended to generate decisions, actions, or awareness. Project information may be communicated verbally from person to person. However, to record, store, and sometimes distribute work performance information, a physical or electronic representation in the form of project documents is required. Work performance reports are a subset of project documents, which are intended to create awareness and generate decisions or actions. Specific work performance metrics may be defined at the start of the project and included in the normal work performance reports provided to key stakeholders. Examples of work performance reports include status reports, memos, justifications, information notes, recommendations, and updates.
- Performance reporting – is the act of collecting and distributing performance information, including status reports, progress measurements, and forecasts. Performance reporting involves the periodic collection and analysis of baseline versus actual data to understand and communicate the project progress and performance as well as to forecast the project results. Performance reporting needs to provide information at an appropriate level for each audience. The format may range from a simple status report to more elaborate reports and may regularly be prepared or on an exception basis. A simple status report might show performance information, such as percent complete or status dashboards for each area (i.e., scope, schedule, cost, and quality). More elaborate reports may include: analysis of past performance, analysis of project forecasts (including time and cost), the status of risks and issues, work completed during the period, work to be completed in the next period, the summary of changes approved in the period, and other relevant information.
- Work performance data and reports supplied by sellers are evaluated against the agreement requirements. Work performance information from this evaluation is then reported as appropriate. Performance reporting provides management with information about how effectively the seller is achieving the contractual objectives.

i) Performance Reviews are related to Project Cost Management

- Performance reviews compare cost performance over time, schedule activities or work packages overrunning and underrunning the budget, and estimated funds needed to complete work in progress.

j) **Information management system** is related to Project Communication and Stakeholders Management:
- Project information is managed and distributed using a variety of tools, including hard-copy document management (letters, memos, reports, and press releases); electronic communications management (e-mail, fax, voice mail, telephone, video and web conferencing, websites, and web publishing); electronic project management tools (web interfaces to scheduling and project management software, meeting and virtual office support software, portals, and collaborative work management tools).
- Information management system provides a set of standard tools for the project manager to capture, store, and distribute information to stakeholders about the project's costs, schedule progress, and performance.
- Some software packages allow the project manager to consolidate reports from several systems and facilitate report distribution to the project stakeholders. Examples of distribution formats may include table reporting, spreadsheet analysis, and presentations.
- Graphics capabilities can be used to create visual representations of project performance information.
- Information management system also allows the project manager to consolidate reports from several systems and facilitate report distribution to the project stakeholders. Examples of distribution formats may include table reporting, spreadsheet analysis, and presentations.

k) **Communication technology** is typical for Project Communication Management
- The choice of communication technology is an important consideration in the manage communications process.
- As this can vary significantly from project to project and also throughout the life of a project, the focus is to ensure that the choice is appropriate for the information that is being communicated.

l) **Communication models** is also typical for Project Communication Management:
- The choice of communication models is an important consideration in this process.
- As the components in the communications all contribute toward an effective and efficient communications process, the focus is to ensure that the choice of the communication model is appropriate for the project that is undertaken and that any barriers (noise) are identified and managed.

m) Communication methods are related to Project Communication and Stakeholders management. They include:

- The choice of communication methods is an important consideration in this process. As there can be many potential barriers and challenges during this process, the focus is to ensure that the information that has been created and distributed has been received and understood to enable response and feedback.

The methods of communication identified for each stakeholder in the communications management plan are utilized during stakeholder engagement management. Based on the stakeholders' communication requirements, the project manager decides how, when, and which of these communication methods are to be used in the project.

8.5. Summary

This chapter contains an analysis of the „A Guide to the Project Management Body of Knowledge ". We identified and described the information and technology requirements of a project-oriented company. The ICT has to be used in all knowledge areas. The greatest emphasis is on analytical data and analytical technologies where the area of Project Communication Management is the most covered one by information technology (see Table 8.1).

From a technological view, these requirements are met by the decision support systems – DSS (Decision Support Systems), which can also be identified as Business Intelligence systems.

9. BUSINESS INTELLIGENCE SYSTEMS – TECHNOLOGICAL SUPPORT OF PROJECT-ORIENTED ORGANIZATIONS

In the previous chapter, we have described information technology in detail, which is contained within the standard of project management, PMBOK® Guide. In general, we can say that this technology provides information necessary for project management, thus technology for data collection, technology for the creation of various types of analysis, technology for the creation of outputs and reports, communication technology. Typical information systems of this type are systems of Business Intelligence, therefore we analyzed closely in this chapter.

9.1. Business Intelligence Systems in General

Problems associated with the limitations of transaction systems in terms of providing information necessary for management are resolved by the implementation of Business Intelligence Systems. The role of BI systems is to extract the data from transaction systems, to interconnect and to create the environment in which it will be possible to gain relevant answers through multidimensional technology (OLAP), Data Mining technology, as well as by simple ad hoc queries which can be utilized in the implementation of various strategic decisions, evaluation of trends or application of various types of analysis based on the records contained in corporate reports.

9.1.1. Definition of Business Intelligence

The terminology of Business Intelligence is being gradually built and specified in the publications by experts from universities and scientific institutions, as well as analysts from worldwide consulting organizations. Due to a short existence of this term so far has not been any unified definition favored by some organization engaged with the standardization (ANSI, 2005; ISO, 2005). To be able to compare there we present a definition and a view of multiple sources on the issue of Business Intelligence.

The concept of Business Intelligence was first introduced by Howard J. Dresner in 1989, an analyst at the Gartner Group company, who described is a "set of concepts and methods for improvement of decision-making in enterprises (Dresner, 2008)". He stressed the importance of analytical, reporting and query tools which help users to perform data analysis and reporting of large amounts of data stored in corporate databases.

According to TechTarget dealing with the Data Management and Data Warehousing, Business Intelligence systems represent a category of applications and technologies for collecting, storing, analyzing and accessing data, designed to help users in businesses to make better decisions. The applications of Business intelligence include the functionality of systems supporting decision-making, queries and reporting, statistical analysis, forecasting and data mining (Business Intelligence best practices, 2005).

A company engaged in Information Management at the Northwestern University in Chicago defines Business Intelligence as follows: "Business Intelligence is formed by the knowledge of the enterprise gained by various hardware and software technologies, which enable the organization to transform the data into information (Business Intelligence Channel. 2005)". This definition considers technologies only as a tool, not the essence of Business Intelligence.

According to the publication Business Intelligence by authors O. Novotný, J. Pour and D. Slánsky (Novotný et al., 2005) and the Czech Society for System Integration (Management dictionary, 2005) the Business Intelligence systems are defined as Business Intelligence is a set of processes, applications and technologies designed to effectively and efficiently support the decision-making processes in an enterprise. They support analysis and planning activities of enterprises and organizations they are based on principles of multidimensional views on a business date."

The authors Steve Williams and Nancy Williams in "The profit Impact of Business Intelligence "(Wiliams and Wiliams, 2007) first characterize the elements that cannot be considered as BI. They argue that Business Intelligence is not created by separate software products that after installation solve all problems of an enterprise or other organisation, they are not even independent technologies, even though that a several technologies are an essential part of BI, it is not the current methodology of implementation of BI is "BI pathway". To successfully implement and use BI it is necessary to combine the methodology, appropriate technology solutions, and organizational changes. Therefore, they define BI systems as follows:

„Business Intelligence combines software tools, technology, and methods with the aim to obtain key information to increase profits and business performance."

In addition to foreign sources, the term Business Intelligence is defined also by an economic dictionary of the Slovak portal of EuroEkonom as: "Business Intelligence is a wide category of application programs and technologies that are used for collection, storage, analysis, and data acceptability. It includes activities within the framework of decision support, query and reporting, OLAP technologies, statistical analysis, forecasting and data mining." (Ekonomický slovník, 2012).

Individual BI definitions are not mutually exclusive, one can argue, that they are complementary to each other. As the most accurate we consider the authors O. Novotný, J. Pour, and D. Slánský, as well as the definition of the authors S. Williams and N. Williams, and we identify also with the definition contained in the economic dictionary.

In general, the argument that BI is utilized to obtain information necessary for the management, analysis associated with key business processes that result in improved business performance. BI means mainly the utilization of information actives in key business processes to improve business performance. These activities include obtaining new information about an enterprise and about analysis making that are used in the conduct of key business processes, they serve to support decision-making and lead towards the improvement of business performance.

The solution of Business Intelligence is a combination of various components where the shape, size, and complexity are set by the needs and conditions of that enterprise or institution. There is no standard or predominant solution.

9.1.2. Business Intelligence Tools

Business Intelligence tools can be characterized as technological components of BI Systems by which these systems acquire, transform, store information from data sources and provide necessary outputs for end users. Accordingly, we distinguish tools as transformative, integration, database, analysis– reporting, instruments for data mining and those which protect the data quality and metadata management. More detailed characteristics of individual instruments of Business Intelligence we can specify as follows:

- Operational source systems, mostly of transaction character generating source databases (these systems are not directly part of Business Intelligence solutions, they are sources of data),
- Transformation tools (ETL – Extraction, Transformation, Loading), data pumps providing transformation and storage of data between operational databases, interim Data Staging Area (DSA), Operational Data Storage (ODS), Data Warehouse (DWH) and Data Marts (DMA),

- Enterprise Application Integration (EAI) serve to immediate update of data warehouse and thus enable the creation of "Data Warehouse in real time",
- Data Staging Area (DSA) – serve for immediate storage of data and their conditioning before their transformation into the data warehouse,
- Operational Data Store (ODS) with the instant data, images is determined to define ad hoc queries,
- Data Warehouses (DWH) of enterprise-wide character,
- Data Marts (DMA) oriented to selected units (division, etc.) or areas of enterprise management,
- OLAP (On-Line Analytical Processing) databases which contain OLAP cubes that are characteristic of aggregated data and short response time,
- Reporting tools to generate output overviews, reports and so on,
- EIS (Executive Information Systems) represents the users' application of data warehouses or OLAP cubes,
- Data Ming tools due to the implementation of well-structured analysis,
- Tools to provide data quality,
- Tools for metadata management,
- Decision support systems (DSS) and expert systems.

The above-mentioned definitions show that Business intelligence systems are oriented to the actual utilization of information in management and decision-making and not on the basis of data processing and execution of common operations, financial and further transactions. The utilization of all options of Business Intelligence systems affects the performance and quality of enterprise management and in this regard also the overall success and competitiveness of enterprises.

Business Intelligence systems are closely interconnected with the other applications IS/IT drawing their input data and the latest systems even return the data into selected enterprise applications. Therefore, the quality of Business Intelligence system solutions depends on the quality of OLTP (Online Transaction Processing) applications, in particular, the quality of data in operational databases.

9.1.3. The General Concept of Architecture of Business Intelligence Systems

The concept of the architecture of BI systems is labeling systems, application and management processes that ensure the data transfer from source systems, their storage, processing, and transformation of information and the knowledge designed to support decision-making.

The basic elements of the architecture are technologies that provide:

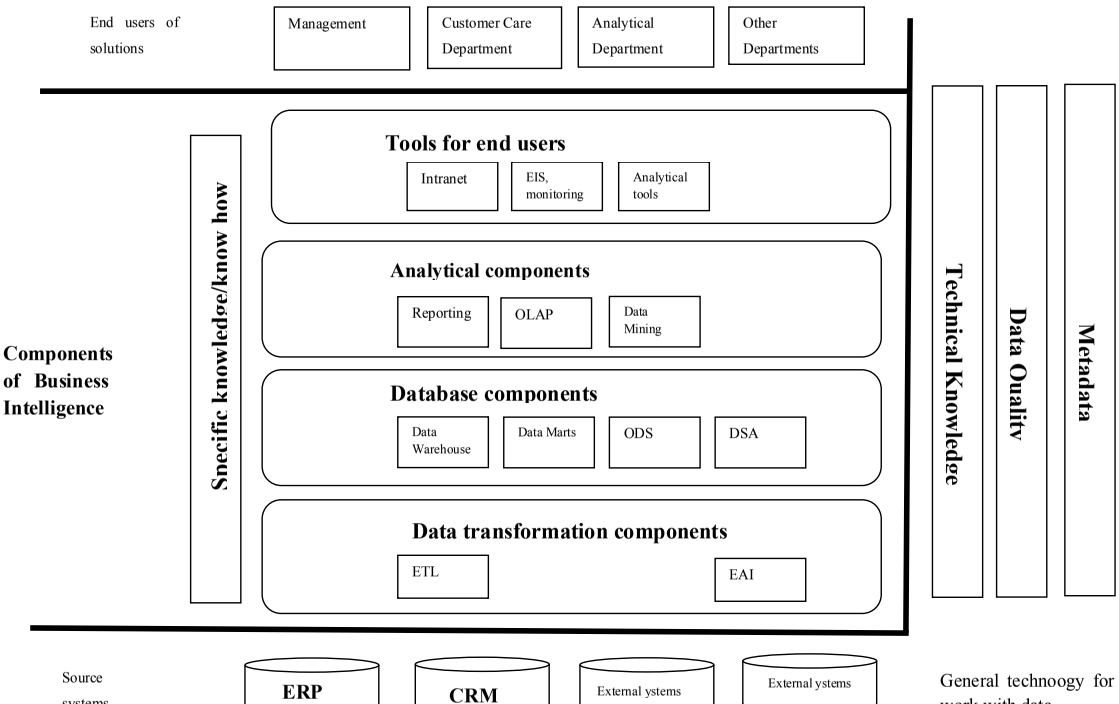
- Data management with the aim to provide timely and correct information,
- Transformation processes with the task to clean, validate and transform data to a unified format,
- Datastore which is designed to effectively and safely store data including metadata,
- Analytical tools and applications including OLAP tools, statistical and quantitative algorithms, data mining tools, text mining tools and simulation tools,
- Datastore which is designed to effectively and safely store data including metadata,
- Analytical tools and applications including OLAP tools, statistics and quantitative algorithms, data mining tools, text mining tools and simulation tools.

During the development of the general concept of architecture Business Intelligence solution gas been stabilized. The variety of issues solved using the BI tools, as well as a variety of the actual tools leads towards the fact that the general architecture and the application significantly differ under real conditions. (Figure 9.1).

Within the general concept there can be described these levels of Business Intelligence:

- Level of extraction, transformation, cleaning and data entry (data transformation), which covers the area of collection/transfer of data from source systems
- ETL (Extraction, Transformation, Loading) systems for the extraction, transformation, and transmission of data,
- EAI (Enterprise Application Integration) systems for the integration of applications,
- Level to store data (database components) that provide the process of storing, updating and data management,
- Data Warehouses – the basic database component,
- Data Marts – subject-oriented analytical databases, part or an addition to data warehouse,
- Operational Data Store – supporting analytical databases,
- Data Staging Area – databases for a temporary data store before their processing into the database components,
- Level of data analysis (analytical components) covering the activities related to data disclosure and analysis,

Figure. 9.1 General Concept of Business Intelligence



Source: Novotný et al., 2005

- Reporting – analytical level focused on standard or ad hoc query processes in the database components,
- OLAP systems (On Line Analytical Processing) – level focused on advanced and dynamic analytical tasks,
- Data Mining – systems focused on sophisticated analysis of large amounts of data,
- Presentation level (end user tools), providing communication of end users with other components of Business Intelligence solutions, in particular, the collection of queries for analytical operations and the subsequent presentation of results by:
- Portal applications based on website technology,
- EIS systems – Executive Information Systems,
- A variety of analytical applications,
- Level of expert knowledge (expertise/ know-how) comprising expert knowledge and so-called best practices of implementing Business Intelligence solutions for a specific organization,
- Components for administration and manipulation with data:
- Data quality tools (data must accurately reflect reality),
- Metadata management tools dealing with the description and documentation of systems and ongoing processes,
- Technical knowledge comprising programming and technology dependent skills of the implementation team.

9.1.4. Database Components of Business Intelligence Systems

According to the general concept of BI architecture, an important part of a BI system is the level of data storage consisting of a number of components. The professional literature describes several approaches to the building of this level, thus we will deal with the specific components in particular Data Warehouse, individually.

Database components of BI systems, process data from enterprise transaction database systems, as well as external sources. They provide the storage processes, updating and data administration necessary for BI solutions. They consist of Data Warehouse, Data Marts, Operational Data Staging Areas and Temporary Data Staging Areas.

Characteristics of the Components of Database Level

Data Warehouse

In Business Intelligence Architecture Data Warehouse is presented primarily as a data storage. The concept Data Warehouse is presented as a set of interconnected activities related to the proposition, implementation and the utilization of data storage of this kind. Data Warehouse is the general concept of BI architecture of the interface between OLTP systems and analytical tools of Business Intelligence, whereas the main task of a data warehouse is to provide entry data OLAP applications.

The terminology similarly as in the case of Business Intelligence is created and modified by experts at the universities and scientific institutions, as well as by analysts of international consulting companies. For comparison, there are mentioned definitions from several sources.

According to the definition of W. Inmon from the late 80's the data warehouse can be defined as "Subject-oriented, integrated, a little time-variable set of data of stable structure primarily focused on decision-making support. In Data Warehouse there are stored atomic as well as summary data "and "Data Warehouse is a specific database which is organized to serve as a neutral data area." (Inmon, 2005).

This definition was applied also by M. Kokles and A. Romanová, who defined Data Warehouse as following: "Data Warehouse can be defined as a simple, complete and consistent storage of data where are stored and organized data obtained from various sources and created by various users which are used in various processes. Data Warehousing can be defined as a process for collecting and managing these data with the aim to gain simple or detailed views on processes of an enterprise" (Kokles and Romanová, 2005).

Ralph Kimball defined Data Warehouse as follows: „Data Warehouse is a copy of transaction data with a specific structure used for querying and creating outputs." (Kimball and Ross, 2002).

The definition of the Dataspace Incorporated Consulting company from the USA is: "Data Warehouse is a computer program designed to provide permanent access to information for the decision-makers in enterprises. Data Warehouse is subject-oriented, integrated, time variable and non-erasable data collection focused on support of decision-making of company management. The input data to the warehouse come mostly from the environment of operational systems" (SQL Server7. Data Warehousing, 2005).

The common features of all previous definitions constituting the basic features or characteristics of Data Warehouse are:

– Data Warehouse is used as a mean to support of decision-making in a company,
– subject-oriented,
– comprises a copy of data from business operation systems,
– data while being stored being revised and filtered,
– data from data warehouse are not erased,
– data are stored in a different time; a data warehouse is time varying,
– the data structure is altered compared to the data model of operational databases,
– data in the warehouse has various levels of aggregation.

In addition, of common features, the differences in the concept of data warehouses are expressed in different approaches to the building of the data warehouse architecture.

According to C. Vercellis (Vercellis, 2009), there are a number of characteristic features which predetermine task of data storage of Business Intelligence systems for the Data Warehouse:

- Integration – Business Intelligence systems work with data groups several sources. In such a heterogeneity integration and unification of data is necessary within the transformation processor or on the level of data warehouse, so it is possible to access the final information more effectively within a single data storage,
- Quality – the data transferred into data warehouse are pre-adjusted. This help to prevent errors and irregularities in final analyses,
- Efficiency – delivery of complex database queries with the participation of data warehouse, focused on extraction of information for the purposes of BI solutions would be time inefficient, therefore in case of BI solutions the administration of queries directed to the data warehouse are conducted by OLAP tools,
- Expandability – the amount of data stored by transaction systems increases with time and due to the limitations on the available size of the storage, it is necessary to remove the data from the OLTP system after some time and to store them on an external medium. For the reason of getting BI systems to access all data, this functionality is provided by data warehouse by storing of historical data.

Data Marts

In addressing the BI it shows that accordance with the scale of data warehouse it is not appropriate that the end users are directly connected to the warehouse.

Due to these reasons, the Data Marts were created from the Data Warehouse. The principle of Data Mart is similar to Data Warehouse, except that Data Marys are only for a limited range of end-users, e.g. department, division, branch, factory, and so on.

Š. Čarnický and P. Mesároš characterize Data Marts as follows: "Data Marts represent decentralized problem-oriented Data Warehouses determined to cover particular issues of the circle of users and which allow flexible "ad hoc" analysis. The result of the creation and use of the data marts is the shortening of the payback of investments, cost reduction and significant risk reduction in their implementation" (Čarnický and Mesároš, 2009).

Operational Data Store

Operational Data Stores are characterized as supporting analytical databases. There are several approaches to this type of database design. The first approach by D. Cicman (Cicman, 2011) is based on the concept that ODS is created as a single point of data integration, or as a source of consolidated information (working in real time) for individual operational applications with EAI tools (e.g. call centre may require a customer's profile, volume of realised transactions, ordered and shipped products, and so on). Data in ODS are consolidated, consistent, subject-oriented and complemented by aggregation.

The second approach by Novotný, Pour and Slánský (Novotný et al., 2005) is based on the concept where operational data stores represent database designed to support relatively simple queries from a small amount of current analytical data. Accordingly, the ODS is derived from already existing data warehouse whilst it contains only the current records of the selected amount of data. Under this approach, ODS works only with data from the data warehouse and does not contain data processed from source systems in real time. Unlike a data warehouse, the ODS contains only the current data frame, therefore not all history.

Data Staging Area

Data Staging Area is used for primary staging of non-transformed data from source systems. This temporary data storage is often used due to load pressure of source systems. As a result of limited hardware capabilities, network resources, the impact of time and geographical factors, the data from all primary systems cannot be integrated at the same time. Before all data are stored in data warehouse, they must be consistent and integrated with data from all sources, e.g. data from SCM daily recorded are in DSA until they are extended by data from the financial department that are extracted only one time per month.

Another reason for the introduction for DSA can be inappropriate data format, e.g. text files, which need to be converted. The authors Novotný, Pour, Slánský (Novotný et al., 2005) describe data stored in DSA as: data are detailed (not aggregated), consistent with data from other source systems, current, i.e. do not contain history data, because in transfer of data warehouse, they are removed from DSA and DSA receives another dose of current, not yet processed data, instead, they are identical with the original data structure from the source system.

Architecture of Database Layer of Business Intelligence Systems

First data warehouses were established at the turn of the 80's and 90's of the 20th century. They were created as an alternative to relational databases. They were used to the greatest extent in the enterprise information systems, thus also in the decision-making support systems. Fulfilling the data warehouses by data was conducted by one of two ways:

- Snapshots – capturing of the status of data from all source systems at one point in time and storing them in a data warehouse at regular intervals, e.g. one time per week or month. This way it is appropriate at the initial filling of the data warehouse, it is less useful in re-filling of the data warehouse due to the need to export of large amounts of data.
- Increment – incremental filling of a data warehouse is when we deal only with data that have been changed in source systems since the last export. The requirement for the use of the incremental way is the ability to identify changes in data from source systems, therefore to identify new, changed and deleted records.
- The current architecture of data warehouses is based on two original proposals by Bill Inmon and Ralph Kimball. These proposals are:
- Corporate Information Factory (CIF) – centralized data warehouse by Bill Inmon (Inmon, 2012)
- Data Warehouse Bus (DWH Bus) – by Ralph Kimball (Kimball and Ross, 2002)

Both proposals are mutually contradictory, Inmon enforced centralized and normalized architecture, Kimball presented data warehouse as a cluster of independent data marts. They vary also in another two important areas, in the way how the logic model of the presentation layer is created and in the interpretation of the term data mart. The CIF Architecture uses an entity – relational model of presentation layer and the DWH Bus uses a dimensional layer of the presentation layer. The term data mart is the CIF Architecture understood as problem-oriented subset of data presentation layer, where owners

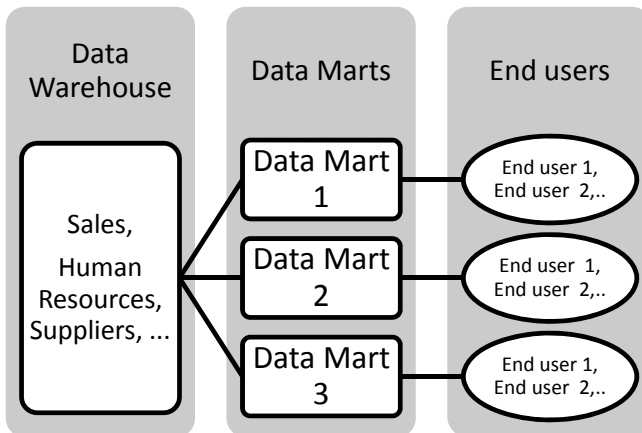
are individual departments of an organization, data marts are filled with data from the presentation layer. IN the DWH Bus Architecture refers to data marts as a procedure-oriented subset of entities of the presentation layer, whereas presentation layer is formed by the unification of procedure-oriented data marts. Development of architecture of data warehouses is heading towards such solutions which enable providing of information on the implementation of analyses in real time. These architectures of data warehouses are called Real Time Data Warehousing, or Active Data Warehousing.

Data Warehouse Architecture by B. Inmon (CIF)

Bill Inmon has brought the concept of architecture which is a centralized data warehouse. The essence of centralized architecture is the fact that a data warehouse is a sole repository determined for all necessary data in the process of Business Intelligence and it eliminates the separation of information by data marts that in this case do not contain any data.

This architecture uses data marts only as a provider of data in the way of the interface. Data warehouses serve to reduce the burden of the data warehouse in this case. This way end- users access data stored in a centralized data warehouse. With centralized architecture, any end user of the system has the possibility to access any data collected in a data warehouse (Figure 9.2).

Figure 9.2 Architecture by B. Inmon



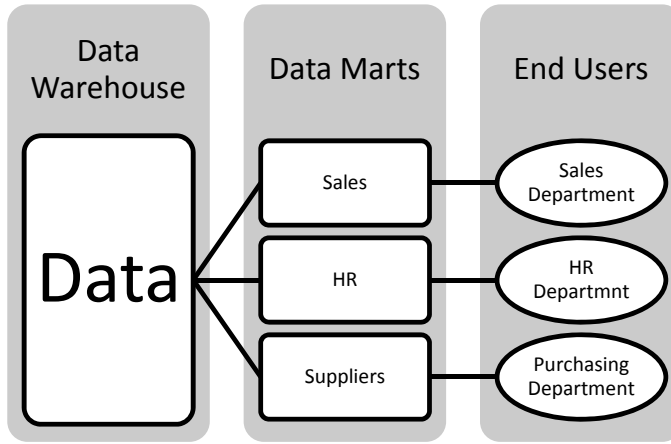
Source: Prepared by author

Data Warehouse Architecture by R. Kimball (DWHBus)

According to Kimball's Architecture, the data warehouse consists of several separate data marts connected each other by a bus. The bus is composed of dimensions defined uniformly for the whole organization. Data mart is defined as a separate data warehouse containing a specific subset of data for a limited circle of users.

Each data mart contains exclusive data pertaining to an area of enterprise (e.g. data for the Sales Department or employee data). Individual data marts are built gradually and can be accessed by end users with assigned access rights. The architecture of the data warehouse as a unification of data marts is illustrated in Figure 9.3.

Figure 9.3 Architecture by R. Kimball



Source: Prepared by author

Users have limited access to stored data because each data mart is determined to the specific user group. An employee of a marketing department is able to obtain from a data mart, e.g. detailed information about the revenue of ongoing projects. To access the employee data, it would be necessary to address the demand to separate data mart containing the relevant data to which the user does not need an access (Bouman and van Dongen, 2009).

Comparison of Data Warehouse Architectures by B. Inmon and R. Kimball

The basic difference between the approach of B. Inmon and R. Kimball is the concept of building a data warehouse. The architecture of Inmon characterizes data warehouse as data storage globally, whereas Kimball presented data warehouse based on decentralized principle. However, there exist several other features that differ both approaches.

- The advantage of introducing decentralized architecture is a simple implementation of data marts and therefore reduction of initial investment in Business Intelligence systems. This architecture also enables effectively connect additional data marts in the future. Establishing centralized data warehouse is significantly more complex and the subsequent expansion poses a difficult task for the enterprise.
- According to Kimball, the data marts contain data for specific purposes, but centralized data warehouse integrates all available data. In the case of centralized architecture, the end users have access to all data, whereas by using data marts they could use only its subset. Thus, with Kimball's architecture, a situation may arise when the results of users' analyses may differ.
- Implementation of separate data marts as individual storages brings a risk that data marts will contain different data about the same business entities. This discrepancy between the stored data may cause that final analysis will differ in relation to individual data marts. Data warehouse as central data store eliminates this risk.
- Gradually building of data marts brings redundancy of stored data and many data become superfluous. Centralized data store eliminates data redundancy because it is the sole data store for purposes of Business Intelligence.

Real Time Data Warehouse (Active Data Warehouse)

The concept Real Time Data Warehouse (Active Data Warehouse) solves the problem of exponentially decreasing the value of information in relation to the time of providing the information, therefore the aim is to provide information necessary for management in real time. With certain limitations, these requirements may be satisfied also by solutions which use the classic concept of data marts and the concept operational data stores included in data warehouse architecture.

Restrictions in case of classic concept of data marts included in data warehouse architecture is based on time delay that is caused by the fact that the activity of BI tools at all layers lasts a specific amount of time when other tools are tools (e.g. during transformation processes the access to data in data warehouse

is blocked). This concept can be used only in cases when the delay is for the end user insignificant.

Restriction in the case of the use of ODS is related to the accuracy of information provided by individual ODS. Several authors criticize this concept and argue that ODS are individual data marts therefore in real time they can lead to incorrect results of analyses.

The New Trend – Active Data Warehouses

The traditional data warehouse was designed to store and analyze historical information on the assumption that data would be captured now and analyzed later. System architectures focused on scaling relational data up with larger hardware and processing to an operations schedule based on sanitized data. Yet the velocity of how data is captured, processed, and used is increasing. Companies are using real-time data to change, build, or optimize their businesses as well as to sell, transact, and engage in dynamic, event-driven processes like market trading. The traditional data warehouse simply was not architected to support near real-time transactions or event processing, resulting in decreased performance and slower time-to-value.

The concept of Active Data Warehouse is based on the interconnection of enterprise-wide data warehouse and operational systems in application layer in a way that individual client applications (analytical and presentation BI tools) can be use data directly from operational systems in case if necessary. This connection must be transparent for the end user. The end- user does not care where his client application obtains data, he or she is interested only in correct results.

Active Data Warehouse Technology is characterized by the possibility to use updated and detailed data and to provide information for:

1. Strategic decisions (decisions of long-term character usually involving enterprise-wide issues),
2. Tactical decisions (short-term character of effect of the decisions, usually focused on some business area),
3. Operational decisions (reactions to certain events).

The background information for strategic decisions is gained on the basis of analyses made by historical, invariable data. The main source of data for analysis is the company-wide data warehouse or data marts. Obtaining documents for tactical decision-making requires access to historical and invariable data, as well as current data, although perhaps also to partially variable data. Obtaining of background information for operational decision-making will not work without the access to data in real time.

The concept Active Data Warehouse advances the meaning of data warehouse towards operational systems, whereas it is necessary to solve the problem of correct integration of data warehouse with other services provided by operational systems.

Summary of Database Components of BI systems

Data warehouses are in enterprises built as central data stores that integrate data from transactional information systems and adapt them to the needs of solutions of analytical tasks.

Currently, data warehouses may be considered as a generator of new information (Active Data Warehouse) (Hager, 2005). This argument is controversial from the very beginning since it is applied that data warehouses gain data from operational information systems, but do not create new data." The main idea of an active data warehouse is that by data consolidation from various sources, storing of historical data in the warehouse and their analysis we can discover new information about the company, behavioral processes, market, and so on. This way the contribution of the data warehouse has shifted and it is not only a possibility for ad-hoc queries and for the creation of outputs anymore. The true value is in the possibility of such a view on contained data that the result will affect a particular process of an enterprise or strategic decisions of an organization." (Ballard et al., 1998).

9.2. Business Intelligence Systems in the Project Management Context

Business Intelligence is an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies. The major objectives of Business Intelligence are to enable interactive access to data and to give business managers the ability to conduct analysis and make better decisions. Decision support systems are computer-based information systems that combine models/methods and data to solve semi/non-structured decision problems with extensive user involvement through a friendly user interface. Business high-level decisions are often semi/non-structured and require an increased level of intelligence and technical support when they become rich in data. Decision support systems can be integrated with variable Business Intelligence techniques to support related decision problem solving. This subject introduces business intelligence, decision support systems, group decision

support, intelligent decision support, web-based support systems, decision optimization technologies, personalized recommender systems. the subject also covers how to design, implement and integrate business intelligence techniques with methods to support business decision-making.

The importance of the BI tools in project management are described in publications as "Mistrovství v Microsoft Project 2010" (Dvořák,2011), "BI and the Project Lifecycle" (Tressler, 2013), "What is Business Intelligence" (Marr, 2016) and websites which deal with project management, and decision support systems (Project Management, 2016), (Advanced Performance Institute, 2016).

AP institute (Advanced Performance Institute, 2016) characterizes the basic structure and basic parts of BI systems as following: The basic components of Business Intelligence are gathering, storing, analyzing and providing access to data.

Gathering data is concerned with collecting or accessing data which can then be used to inform decision making. Gathering data can come in many formats and basically refers to the automated measurement and collection of performance data. For example, these can come from transactional systems that keep logs of past transactions, point-of-sale systems, website software, production systems that measure and track quality, and so on. A major challenge of gathering data is making sure that the relevant data is collected in the right way at the right time. If the data quality is not controlled at the data gathering stage then it can jeopardize the entire BI efforts.

Storing Data is concerned with making sure the data is filed and stored in appropriate ways to ensure it can be found and used for analysis and reporting. When storing data the same basic principles apply that you would use to store physical goods – say books in a library – you are trying to find the most logical structure that will allow you to easily find and use the data. The advantages of modern databases (often called data warehouses because of the large volumes of data) are that they allow multi-dimensional formats so you can store the same data under different categories – also called data marts or data-warehouse access layers. Like in the physical world, good data storage starts with the needs and requirements of the end users and a clear understanding of what they want to use the data for.

The next component of BI is **analyzing** the data. Here we take the data that has been gathered and inspect, transform or model it in order to gain new insights that will support our business decision making. Data analysis comes in many different formats and approaches, both quantitative and qualitative. Analysis techniques include the use of statistical tools, data mining approaches as well as visual analytics or even analysis of unstructured data such as text or pictures.

In order to support decision-making, the decision makers need to have access to the data. Access is needed to perform analysis or to view the results of the analysis. The former is provided by the latest software tools that allow end-users to perform data analysis while the latter is provided through reporting, dashboard and scorecard applications.

9.2.5. The Use of Business Intelligence Systems in the Project Lifecycle

Business Intelligence is used in project management to improve performance and focus efforts on activities that garner positive results for the organization (Tresler, 2013). Although Business Intelligence should shape project manager's efforts throughout the planning and implementation phases, we are focusing on the two phases that get the quickest and most easily measured results for organizations – project initiation and project closeout.

Project Initiation

Before a project is ever commissioned, the managers have an idea they believe will provide some benefit to the organizations. In reality, many enterprises act on ideas without a great deal of research or supporting data. This makes measuring the success of a project difficult, to say the least. Early in the project initiation phase is the time to ask the hard questions like "Why?", "How do you know that?" and "Where is the supporting data?"

Addressing these and other questions is especially important when a project sponsor endeavors to prescribe a solution rather than an objective. By requiring a well-thought-out business case, charter and scope that include Business Intelligence, managers can clearly identify the opportunity, gap or problem to be addressed and define from the beginning what a successful outcome looks like. A clear set of objectives determined using unbiased Business Intelligence makes it much easier to maintain focus through the planning and implementation phases where we answer the question, "How do we deliver these results?"

Project Closeout

In the case of using Business Intelligence tools from the project initiation phase, is easier also its closeout and handing over a clear set of measures to the end user. In the project initiation phase, the accurate and clearly verifiable measurement indicators were defined, and we can compare the level of their completion. In the project, closeout is important by Business Intelligence tools to

evaluate and present also new particular measurement indicators and actions, which were detected during the project lifecycle.

Through the use of Business Intelligence within the project lifecycle, organizations increase the probability of successfully addressing the opportunity, gap or problem that prompted the project in the first place. Organizations accomplish this by providing the data-driven means by which to measure success, appropriate metrics, and a clear set of instructions for doing so. In a nutshell, you have set the business unit manager up for success.

These same principles can be applied to managing the project portfolio. Business Intelligence combined with clear criteria for ranking projects provides the framework for a data-driven Decision Support System.

9.2.6. Business Intelligence as Project Management Decision Support

PPM (Project Portfolio Management) is a formal approach that an organization can use to orchestrate, prioritize and benefit from projects (PPM, 2016). This approach examines the risk-reward of each project, the available funds, the likelihood of a project's duration, and the expected outcomes. A group of decision makers within an organization, led by a Project Management Office director, evaluates the returns, benefits, and prioritization of each project to determine the best way to invest the organization's capital and human resources. Project Portfolio Management (PPM) is the centralized management of the processes, methods, and technologies used by project managers and project management offices (PMOs) to analyze and collectively manage current or proposed projects based on numerous key characteristics. The objectives of PPM are to determine the optimal resource mix for delivery and to schedule activities to best achieve an organization's operational and financial goals while honoring constraints imposed by customers, strategic objectives, or external real-world factors.

Project portfolio management software is one of the hot new trends in project execution. (Jordan, 2013). In recent years, the tools have become much more powerful, they have integrated the powerful new functionality and with SaaS (Software as a Service) models, they have become much more accessible. The promise of PPM has been out there for more than a decade, but finally, it is becoming reality. This theme concerns a combination PPM database with BI tools.

Using Business Intelligence can project manager easier to solve current problems and determine the optimal resolution procedures. for example moving tasks around, adding resources, overlapping tasks that should be dependencies.

Next analysis is still required in an environment with BI, but the project manager will have access to the answers to a number of key questions:

- On past projects, what type of tasks responded best to additional resources?
- Of the resources that we have access to, is there one who has had a bigger impact in recovering tasks when they are assigned as an additional resource?
- Do we generally see more success from overlapping dependent tasks or adding resources?
- How big a recovery can we expect to get on a single task?
- Is there generally a better outcome from adding resources to separate work streams, or should we focus the extra resources in one particular area?

9.3. Summary

This section is dedicated to Business Intelligence systems in detail. Business Intelligence Systems are designed to Decision Support Systems. They eliminate the disadvantages of transaction systems that cover the operational functions of the organization. The role of BI systems is to extract data from transaction systems, to interconnect this data and to create BI environment for creating a multidimensional database and OLAP analysis. Next BI systems to analyze and present the data (Reporting, Data Mining).

Business Intelligence is used also in project management to improve performance and focus efforts on activities that garner positive results for the organization. It is used for analysis in each phase of the project lifecycle and as Project Management Decision Support with Project Portfolio Management databases.

10. PROJECT MANAGEMENT SOFTWARE

A project management software helps organizations in planning and scheduling, resource management, project cost control, automating communication and providing visibility into project progress. Project management software makes it easier for companies in effective planning and management of projects.

10.1. The History of Project Management Software

The project management elements and tools, and software tools developed together in the past. Timeline of individual instruments PM and relevant software tools are processed by https://project-management-software.financesonline.com/#history. Table 10.1 shows the tools which most affected the further development of the project management and that are typical for each period.

Table 10.1 History of Project Management Software

Year	Project Management/ Software tools	Description
1896	HARMONOGRAM	Polish economist Karol Adamiecki devices the „harmonogram", which is a floating bar chart used to show resources or tasks laterally over time.
1912	GANTT CHART	Engineer Henry Gantt creates the „Gantt Chart", which breaks down tasks into a well-designed schedule structure. This diagram was used in World War I to design ships and in 1931 for the Hoover Dam. It is an essential feature of project management software today.
1954	„PROJECT MANAGEMENT" TERM	US Air Force General Bernard Schrieve comes up with the phrase „Project Management".
1956	AACE	The American Association Engineers (AACE International) is created
1957	CRITICAL PATH METHOD (CPM)	Remington Rand and DuPont design this method, which calculates the work required to complete a project and the duration of each phase.
1958	PROGRAM EVALUATION REVIEW TECHNIQUE (PERT)	This approach was designed for the US Navy's Polaris missile submarine program. It evaluates the task type and the minimum amount of time required for each task.

Year	Project Management/ Software tools	Description
1962	WORK BREAKDOWN STRUCTURE (WBS)	The US department of Defense devices this method to break down projects into smaller parts and organize them into hierarchical tree structures.
1965	FORMATION OF IPMA	The International Management Systems Association (renamed the International Project Management Association) is formed in Europe.
1969	PMI	The Project Management Institute (PMI) is formed for the promotion of project management as a profession. The institute offers certificates to professionals.
1970	WATERFALL METHOD	Winston Royce creates this model in which each phase must be finished and perfected before you start the next.
1977	EMERGENCE OF PROJECT MANAGEMENT SOFTWARE	Many vendors start offering project management software including Oracle (1977), Artemis (1977), Scitor Corporation (1979)
1986	CAPABILITY MATURITY SOFTWARE	Carnegie -Mellon University's Software Engineering Institute develops „Capability Maturity Software", which is a five-level method of increasingly mature process.
1988	EARNED VALUE MANAGEMENT	The „Earned Value Management" method which combines measurements of scope, cost and the schedule is added to project management.
1996	PRINCE2	This seven-process PM method becomes popular in the UK.
2001	AGILE PROJECT MANAGEMENT	This approach is designed to manage complex software projects. It puts emphasis on adaptive planning and flexible response to change
2006	TOTAL COST MANAGEMENT	The AACE creates a framework to control and reduce costs. This approach is used in all areas of a company including project management
2008	SAAS-BASED PROJECT MANAGEMENT	SaaS – based apps start becoming popular providing great flexibility to project managers and their teams.
2009	IN DEMAND SKILL	U.S. News selects „project management" among the top fives skills needed to get a good job.
2010	CLOUD BECOMES POPULAR	Cloud-based systems start gaining popularity providing anytime, anywhere access. As a result, more companies start using virtual project teams.
2012	MOBILE APPLICATIONS	The advent of mobile applications helps users to access project management software on the go.
2016	INTERNET OF THINGS	As a result of this trend, project management software vendors would need to develop their products to meet customer demand for new hardware and software testing techniques, new development tools, and better cyber security measures.

Source: Adapted from https://project-management-software.financesonline.com/#history)

10.2. Types of Project Management Software

It is possible to find in the literature the distribution of project management software by different sets of software. Therefore this part consists a breakdown of the different sources.

a) The website http://zilicus.com/project-management-software/ (Zillicus, 2016) states the characteristics of Project management software according to availability from vendors and service providers:

Desktop – organizations can buy it as a desktop package, and this typically gives the most responsive and graphically-intense style of interface. Desktop project management applications typically store their data in a file, although some can collaborate with other users, or to store their data in a central database. Multiple users can share file-based project plans or data held on a database if only one user accesses it at a time.

Client Server – server-based collaborative project management applications. These are designed to support multiple users who are working on different parts of a project. Server-based project management systems hold data centrally and can also incorporate collaboration tools so that users can share knowledge and expertise.

Web-based – project management software can be implemented as a web application. This is accessed through an intranet or extranet, or the internet itself, using a web browser. Benefits of web-based project management applications include the fact that they can be accessed from any type of computer without installing software. The software is also automatically updated and maintained by the service provider, and the nature of the system makes it naturally multi-user. Also, web-based software tends to come with a monthly charge which is cheaper than buying and maintaining the application yourself. However, web-based project software tends to be slower to respond than desktop applications, and project information is not available when the user is offline.

Integrated – an integrated system combines project management or project planning, with many other aspects of company activities. For example, projects can have bug tracking issues assigned to each project; or the list of project customers can become a customer relationship management module, with each person on the project plan having their own task lists, calendars, and messaging functionality associated with their projects.

b) V. Bolek (Bolek, 2016) divides Project management software according to the availability of applications for customers into two groups:
Commercial – it is software with closed source code, sold for profit and it is not possible to distribute it further (it includes programs as Microsoft Project, Oracle Primavera, Clarizen, Daptiv PPM).
OpenSource – software that is easily and available for free on the internet (it includes OpenProj, Project.net, Project-Open, OpenWorkbench, DotProject).

c) The same author divides Project management software according to a number of users to:
Single-user applications – intended for a single user at one site, cooperation of more users is possible only after connection to database server.
Multi-user applications – due to authentication they can be used by more users, users collaborate on one task or individually on different tasks.

d) Another source (6 PM software Features, 2016) divides Project management software according to application functionality:
Project planning – software is used for project mapping, tasks, and their visual interface, they provide an effective way of project definition, critical way and allocation of human resources. These include e.g. the programs MS Project, OmniPlan, OmniGraffe.
Project management – software must be able to define tasks, assign it to someone,to create time interval and to know when it will be completed.
Documentation sharing – software provides central location and sharing of documentation what is important for effectivity increase and time sparing. There are DreamTeam, Central Desktop, GoPlan, ProjectDesk, DotProject, Microsoft SharePoint aLiveOffice.
Sharing of calendars and contacts – software used to manage time schedule and a list of contacts, what is important for productivity increase and time sparing. It includes software tools as Microsoft Outlook, Microsoft Exchange, Basecamp, GoogleCalendar.
Problem management – the project must be controlled, must monitor threats and solve these problems. The software helps to share problem solutions, as Excel, DoneDone, Unfuddle, Kayako.
Task tracking from time perspective – software is used for task tracking from time perspective or we create a process that we would like to use in the future. It includes programs as Toggl, Harvest, OpenAir, ClickTime, SlimTimer.

e) Related software categories to Project Management software (according to https://project-management-software.financesonline.com/#why) are:
Agile Project Management Software enables project managers to hit important milestones and provides executives with fast and accurate project status. It offers greater visibility and continuous feedback, which helps agile PMOs to react quickly to change and obstacles in the project development process.
Enterprise Project Management Software offers companies the features they need to competently manage projects at an enterprise level. The system enables you to look at projects from a strategic viewpoint and helps managers to prioritize the projects and assign resources appropriately.
Project Portfolio Management (PPM) Software helps project managers to analyze the potential return on a doing a project. It assists project portfolio managers to provide forecasting and business analysis for companies looking to invest in new projects.
Task Management Software helps with the process of managing a task through its life cycle. It assists in planning, testing, tracking, and reporting tasks.
Time Tracking Software allows users to record time spent on tasks. This system used in many industries, including hourly workers and also professionals who bill their customers by the hour, such as accountants, freelancers, and lawyers.
Visual Project Management Software helps to manage your projects as visual workflows online. The solution provides a number of advantages across the discipline, especially as the demand grows for data-driven planning and real-time analysis.

10.3. Project Management Software Procurement

Because software has a strategic role in organizations (Romanová, 2007), it is very important to pay great attention to its procurement. From a technological point of view, Project management software is related to special application software. Basic types of application software are **Standard application software** (SASW) is designed to meet requirements of a vast number of customers (organizations) and **Individual application software** (IASW) is designed to meet requirements of a single customer (organization). The application is based on the whole complex of information and communication technologies and data, or databases". Services delivered by the suppliers of the applications (internal

employees or external suppliers) to the users are also the part of the applications. These are services like consultation services, analytics, development, and other services. (Černý, 2014).

10.3.1. Software Requirements Specification

A software requirements specification (SRS) is a description of a software system to be developed. It lays out functional and non-functional requirements and may include a set of use cases that describe user interactions that the software must provide.

Software requirements specification establishes the basis for an agreement between customers and contractors or suppliers (in market-driven projects, these roles may be played by the marketing and development divisions) on what the software product is to do as well as what it is not expected to do. Software requirements specification permits a rigorous assessment of requirements before design can begin and reduces later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules. (Bourgue and Farley, 2014). The software requirements specification document enlists enough and necessary requirements that are required for the project development. (Belitsoft, 2016).

10.3.2. Evaluation of Application Software Selection Criteria

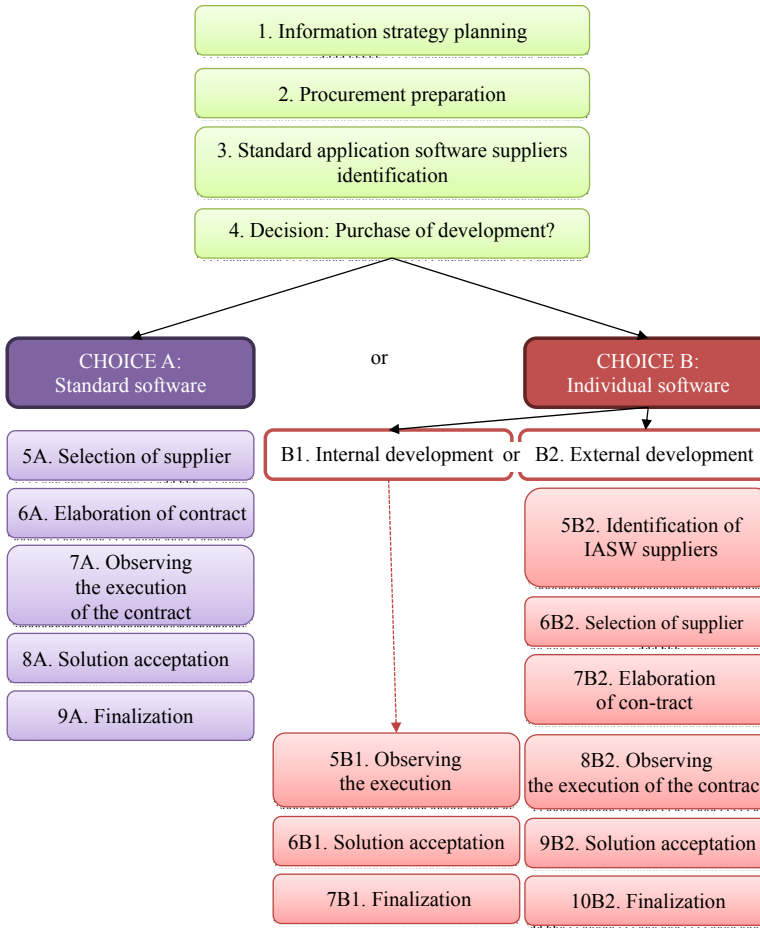
M. Černý states criteria for evaluation of application software selection as follows (Černý, 2014):

- Criteria for supplier evaluation: supplier – client's base and references; alliances; the geographical sphere of influence, Quality – technical experiences; a branch of business, Market – vision; quality management; financial stability.
- ASW evaluation: Costs – in this area, it is important to state what is contained in the price of the solution, e.g. training of users, support, updates; Reliability; Functionality; Simplicity of usage; Adjustment options; Implementation.

10.3.3. Application Software Procurement

M Černý created the diagram of Application Software Procurement, which consists of 4 strategic decisions, and next of part A (Standard software procurement) and part B Individual software procurement (Figure 10.1).

Figure 10.1 Applications Software Procurement



Source: Černý, 2014

10.4. The Project Management Business Intelligence Solution

Business Intelligence system solutions is a structure of several applications mentioned in the 9th Chapter. Source information systems (input databases of the projects) and project-oriented data warehouse are an assumption for specific BI systems. An example of the data model for project management is shown in Figure 10.2. (Wiliams, 2015).

The issue of using BI systems in Project Management solve also another author, for example (Dvořák, et al., 2011).

All managers managing any process need clear view about the status of the processes. Systems providing a simple way of getting information about the context and potential problems for the adoption of following actions are classified in the category of Business Intelligence systems. The need for the deployment of these systems does not avoid even organizations managing a portfolio of projects.

In ICT terminology, they are regarded as so-called dashboards, that display required data clearly. The dashboards provide information from various levels of the system, or organization, where individual indicators get from the lowest level to the top – towards the single view on the organization. Currently, it is highly demanded requirement to combine the indicators from various systems to one site, and this way to create a central dashboard of the organization. Comprehensive Business Intelligence solutions that fulfill this vision and at the same time it is easy to integrate it with the Enterprise Project Management solution is based on these pillars (SQL Server BI, 2016):

- Microsoft SQL Server Reporting Services
- Microsoft Performance Point Services
- Excel Services, Visio Services (part of Microsoft SharePoint Server)
- Microsoft Power Pivot (part of Microsoft Excel).

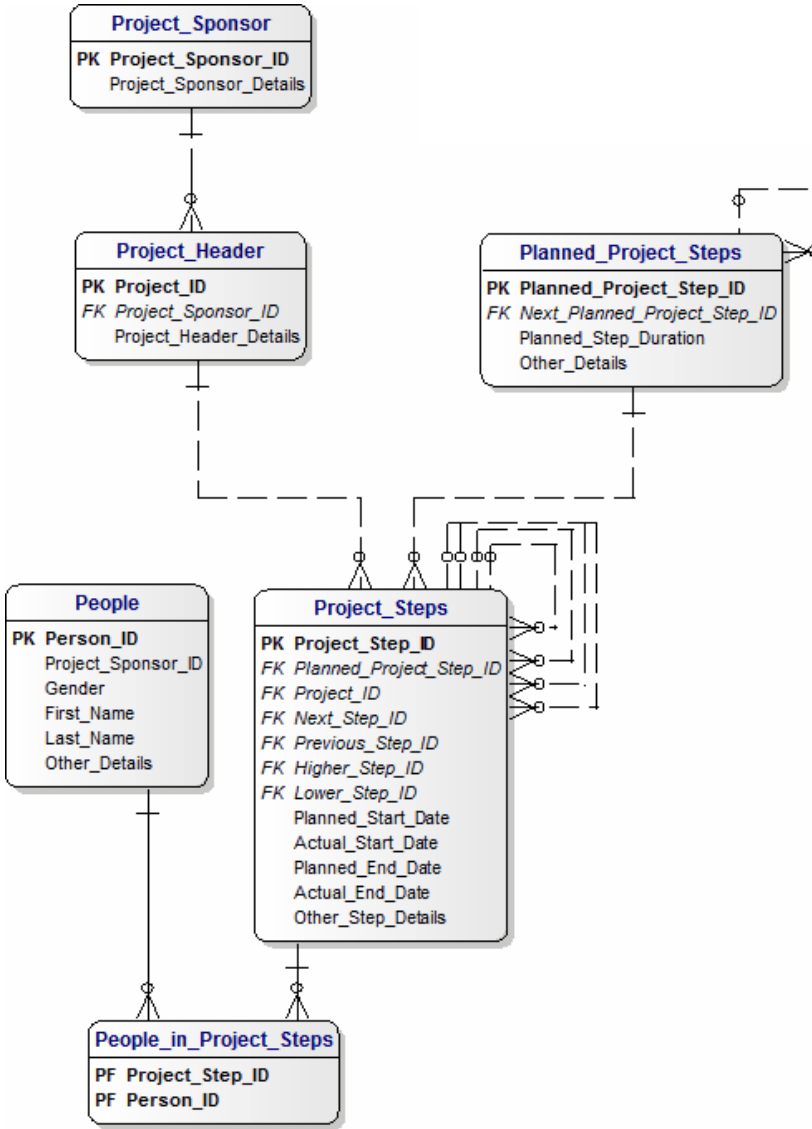
In the case of project management, it is typically monitored the status of these three basic entities:

- **Projects** – their status from the initialisation perspective, fulfillment of the objectives or cost utilization, risk evaluation, milestones achievement, etc.
- **Sources** – their utilization, costs, or filling out time sheets.
- **Processes** – workflow state.

For a successful implementation and subsequent operation of meaningful data analysis it is necessary to follow these steps:

- Requirements for systems of data analysis is important to collect before the actual system implementation. At the same time, it is necessary to clear out

Figure 10.2 Data Model for Project Management



Source: Wiliams, 2015

which data and in what form are required by the organization management, project office or individual project managers.
- Subsequently, it is possible to build the whole system With respect to required output data or required classification of the data analysis. It is necessary to realize that the changes after the end of implementation are often difficult to implement or very expensive.
- Further, it is necessary to make a clear identification of system data, which are used as a basis for data analysis and findings of how data are obtained.

If BI system is deployed correctly, then can allow the OLAP analysis, to create standard and ad-hoc reports for a project manager. List of standard reports is shown in the Table 10.2.

Table 10.2 List of standard reports

Report	Description
Deliverables	Shows a list of supplies of the workspace from project workspace, through the entire project portfolio, including details.
Issues and Risks	Shows problems and risks of workspace projects through the entire project portfolio, including details
Milestones due this Month	List of tasks labeled as milestones through the entire project portfolio
Rejected project list	List of rejected projects divided into individual phases of workflow
Resource capacity	List of capacity and source allocation by months (from report databases)
Simple project list	List of all projects with their owner, start date, end date, and last modification date
Timesheet actuals	List of updates entered in
Top projects	List of ten projects according to priority
Workflow chart	List of individual phases of workflow and number of projects in each phase
Workflow drill down	Detailed overview on all projects and phases and their workflows

Source: Adapted from Dvořák, et al., 2011

10.5. Summary

This chapter deals with project management software, states its characteristic, history, types, project management procurement and its utilization especially focused on Business Intelligence tools.

Projects can be complex and dependent on many different factors, departments, and outcomes. As such, project software can help to determine which events depend on one another, how exactly they depend on each other, and what happens if things change or go wrong. In addition, they can schedule people to work on various tasks, and detail the resources – physical, financial or anything else – that are required, and this is called resource scheduling. People also use project management software to deal with uncertainties in the estimates of the duration of each task; arrange tasks to meet various deadlines; and juggle multiple projects simultaneously, as part of an overall objective.

11. RESEARCH RESULTS

Within the VEGA 1/0933/14 project, own survey was executed which was focused on one hand on the level of project orientation of companies, specific types of software as well as usage of Business Intelligence systems in the context of project management.[1]

11.1. Research Sample

A questionnaire was developed by building on the previous theoretical basis to ensure content validity. The research was conducted between February and April 2015 and in the first half of 2016 (Bolek, 2016). Empirical data was collected from randomly selected companies operating in Slovakia. The selection of companies was not influenced by any particular factor. The managers of these companies were requested to complete a structured questionnaire. The questionnaire consisted of open questions as well as assessment statements according to a given rating scales:

- from 1 to 5 for software usage 0 – not in use until 5 – in full use.
- from 1 to 100 for determining the working skill level with types of software, where 100 determined a full skill level.
- from 1 to 7 for determining the communication area: (1 – strongly disagree, 2 – disagree, 3 – partially disagree, 4 – neither agree nor disagree, 5 – partially agree, 6 – agree, 7 – strongly agree).

The sample was characterized by company size (measured by the number of employees and domestic/vs. foreign ownership (Table 11.1).

[1] Some results are already published in subsection 5.2

Table 11.1 Research sample characteristics

Company Size	**% of companies**
Small (S)	40.74
Medium (M)	37.04
Large (L)	22.22
Ownership	**% of companies**
100 % foreign ownership	27.78
Major foreign ownership	4.63
100 % domestic ownership	52.78
Major domestic ownership	11.11
Public Ownership	3.70

Source: Prepared by author

11.2. Results of Project Management Software Usage

Respondents were queried on the level of usage of different application software presented by us which can be used in project management. The scale of the usage was on scale 0 – not in use to 5 – in full use. Results are displayed in the Table 11.2.

Mostly used application is the office package MS Office M = 4.45, STDEV = 1.07, wich is caused due to the high availability of this solution. It is based on MS Excel, which is being used by respondents for analyzing, planning, tracking expenses, graphical display of time plans, resource planning, and so on. Without the need of programming skills, it is possible to prepare a template in Excel which constantly works with all aspects of the projects, tasks, resources, expenses and time. It is possible to track the project flow and its variances from the original plan with the graphical display. MS Excel is the most used application in project management. The second most used software solution is a specific software for application in project management Microsoft Office Project Server M = 1.57, STDEV = 1.79. Among one of its basic functionalities belongs e.g. Gantt chart, time and task management, task linkages, resources planning and management, utilization, workload reporting, approval process support, milestones and project deadlines tracking, project templates, MS Office integration, and others. Currently, there

is a version Microsoft Project Server 2016 on the market with application software which is a flexible local solution for administration of project portfolio and day-to-day practice. Project Server 2016 is a part of SharePoint 2016 (groupware, software for a team collaboration which allows sharing), which enables team members, project members or managers quickly start projects, set priorities for investing within project portfolio and bring expected business value practically from everywhere. This application software introduces a specific solution for project management. The third one in usage is Business Intelligence NEO M = 1.10, STDEV = 1.56, which is a software for creation of different types of data analysis providing support for project management. SAP RPM-M = 1.60, STDEV = 1.91 is the fourth in the usage of software in project management. Information system SAP is a complex ERP system, which is used especially by medium and large companies and is built as a whole-business information system. It belongs to the group of ERP systems, which enable to manage a large range of activities within information structure in a company. They are tools to decrease cost and make the whole production process more effective and enable managers to make more qualified decisions in order to create the right base for project management. SAP integrates tools for project management.

The least used application software solutions from the offered solutions are ProMan M = 0.31, STDEV = 0.82, which is specifically focused on project management and incident tracking. It offers users functionalities: project portfolio, integration with MS Outlook, integration with MS Project, workload tracking, access management and role management, incident management, resource planning and management, utilization, budget management of a project, customer, suppliers and contacts records, business support, dashboards, time and task management, milestone tracking, deadline tracking, approval process support, forecasting of project evolution, assessment of project parameters in figures.

Table 11.2 Usage level of application software in project management

Descriptive Statistics	N	Mean	Std. Deviation	Variance
MS Office	163	4.4537	1.07313	1.152
Microsoft Office Project Server	163	1.5727	1.79176	3.210
Business Intelligence NEO	163	1.0969	1.56266	2.442
SAP RPM	163	.9824	1.55991	2.433
PRO management	163	.8282	1.31415	1.727
@Task	163	.7269	1.37143	1.881
Cognos	163	.5507	1.07705	1.160
Easy Project	163	.5463	1.03536	1.072
HP PPM center	163	.5419	1.02696	1.055
eWay	163	.5242	1.13398	1.286
Planview Enterprise	163	.4493	.97800	.956
Easy Projects .NET	163	.4405	.97297	.947
Planisware	163	.4317	.94469	.892
Primavera	163	.4141	.91949	.845
Mariner	163	.3921	.84693	.717
Instant Team	163	.3921	.92676	.859
Elaine MC	163	.3789	.93935	.882
PSNext	163	.3656	.85872	.737
CA Clarity	163	.3568	.86755	.753
ProMan	163	.3084	.82122	.674

Source: Prepared by author

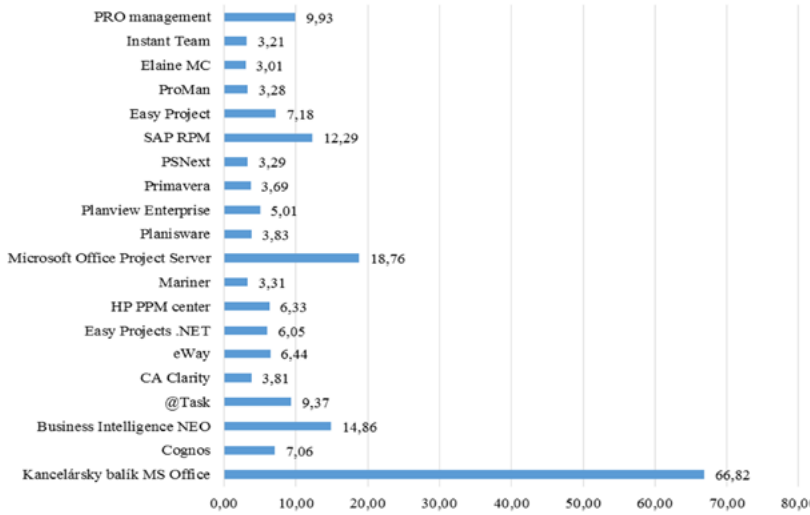
11.3. Results of Examination of Skill Level of Working with Software Applications

Individual respondents were queried on the skill level with working with particular presented software solutions that can be used in project management. Results of the analysis are displayed in Figure 11.1. Respondents answered by self-assessment using a scale from 0-100, where 100 was the highest skill level.

The best kills were recorded for the work with MS Office package, especially with MS Excel M = 66.82 points. Followingly it is was work with Information system SAP = 25.26 points and then with Microsoft Office Project Server

M = 18.76 points. The skill level of respondents proportionally matches with the level of usage of particular software solutions. The lowest skill level respondents feel with work with software Elaine MC M = 3.01 points. Elaine MC is a specific software solution which can be used in project management. It introduces a system for project management and among its functionalities belong: project portfolio, access and roles management, dashboards, resources planning and management, project cost management, tracking of project milestones and deadlines, workload reporting.

Figure 11.1 Skill level of chosen software solutions



Source: Adapted from Bolek, 2016

11.4. Data Mining – Cluster Analysis of Data from Communication Area

Examined sample was made of 163 Slovak companies. Due to a need to describe the companies in more exact way we have added to the size of a company (SIZE) and ownership (OWS) additional parameters, which are: organisation's legal form (LF), business activity (BA), and the fact if projects are being used or not (PROJ).

The questionnaire was created in a way to focus on typical characteristics of each area according to the Integrated model leading to the project-oriented organization (Marsina, 2013). We have focused on usage of Business Intelligence systems which make a part of communication area within a particular model.

Criteria used to consider the seniority level of project orientation in the area of communication development were set in the following way: existence of communication gaps between professional areas, ICT development, improvement of vertical and horizontal communication, development of communication through project teams, development of communication supported by project office (parameters from COM1 to COM5 in Table 11.3).

Table 11.3 Meaning of particularly examined parameters

Parameter	Meaning
COM1	Existence of communication gaps between professional areas and management
COM2	Communication in a company is supported by IKT development
COM3	Improvement of vertical and horizontal communication supported by IS, Business Intelligence type
COM4	Development of communication through project teams (with usage of all available IS/IT)
COM5	Development of all means of communication supported by project management office (PMO)

Source: Prepared by author

Research results in the communication area within the project-oriented organizations are summarized in Table 11.4. According to the parameters (COM2, …, COM5) and their assessment using a Likert's scale (1 – strongly disagree, …, 7 – strongly agree), we have expected in an ideal case for starting project oriented organisation assessments with decreasing trend (higher values for parameters COM1, COM2, …) and for a senior project oriented organisation assessments with increasing trend (higher values for parameters COM4, COM5).

According to the Table 11.4, the highest number of companies (48) ended up in the cluster 1 while it relates to the small companies with legal form Ltd., with non-production activity, in major ownership of local owners and not using projects for their business. According to the values of parameters COM1, …, COM5 it relates to organizations on a low level in the area of development of developed project oriented organization. Similarly decreasing values can be observed in cluster 4 (22 large companies, stock companies, with production activity, in local ownership and partially using projects for their business) and in cluster 6 (15 medium companies, Ltd., non-production activity, major foreign ownership, using projects). Table 11.4 shows these clusters highlighted in green.

Increasing tendency in parameters assessments can be observed in the case of clusters 0 and 3. In the case of cluster 0 it relates to 7 medium companies, Ltd., with non-production activity, with major foreign ownership, using projects and in the case of cluster 3, it relates to 31 small companies with the same other attributes as in cluster 0. These 2 clusters represent the most developed companies in the communication area, in Table 2 these are highlighted with orange color.

Other clusters do not show any clear decreasing neither increasing tendency, nor large differences in assessments of particular parameters.

Table 11.4 Total Data Mining results

Attrib.	Full Data	Cluster 0	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
	163	7	48	27	31	22	13	15
LF	LTD	LTD	LTD	LTD	LTD	STOCK	LTD	LTD
BA	Non-production	Non-production	Non-production	Production	Non-production	Production	Non-production	Non-production
SIZE	small	Medium	Small	Large	Small	Large	Large	Medium
OWS	Full local	Full foreign	Full local	Full local	Full local	Full local	Full local	Full foreign
PROJ	Yes	Yes	No	Yes	Yes	Partially	Partially	Yes
COM1	3,80	5,14	3,21	3,85	3,35	5,18	3,62	4,00
COM2	3,45	4,29	3,29	3,63	3,39	3,95	2,85	3,13
COM3	4,26	6,29	3,69	4,19	4,74	4,95	4,77	2,87
COM4	4,06	6,43	3,17	4,30	5,06	4,27	4,08	3,00
COM5	3,44	5,43	2,90	3,15	4,45	3,23	4,08	2,40

Source: Prepared by author

We have reached following results (Table 11.5) from the evaluation of particular parameters COM1,…,COM5:

All the parameters reached average values (from 3.50 to 4.47). The most stable assessment (lowest STDEV value) appeared in the case of COM2 parameter – communication in a company is supported by ICT development which was an expected result due to a general ICT development and increasing of practical skills at ICT usage. Parameters COM3, COM4 which represent ICT usage via information systems show higher average values, however also higher STDEV, which characterizes higher differences between particular companies.

Table 11.5 Evaluation of particular parameters

Indicator	Mean	STDEV
COM1 – Existence of communication gaps between professional areas and management	4.02	0.751559
COM2 – Communication in a company is supported by IKT development	3.50	0.456914
COM3 – Improvement of vertical and horizontal communication supported by IS, Business Intelligence type	4.47	1.000104
COM4 – Development of communication through project teams (with usage of all available IS/IT)	4.30	1.082137
COM5 – Development of all means of communication supported by project management office (PMO)	3.63	0.97055

Source: Prepared by author

At the end we will evaluate chosen extreme values (Table 11.6), where ten highest values (>5) will be highlighted in blue and lowest values (<3) will be highlighted in yellow.

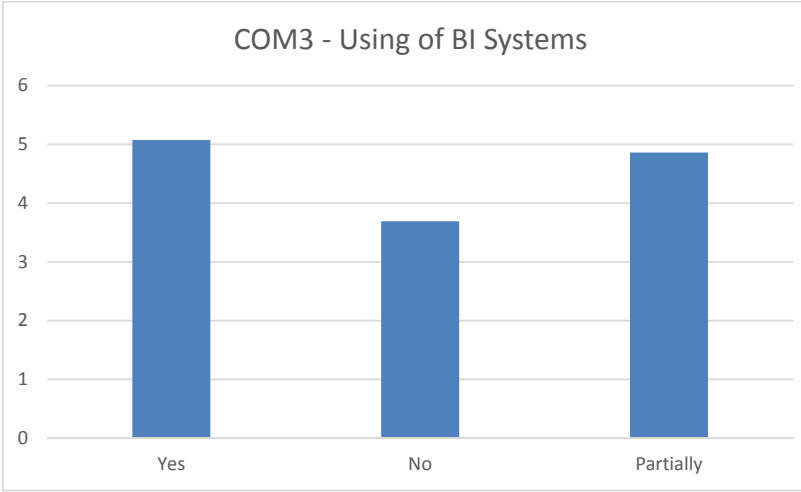
Table 11.6 Total results – extreme values

Attrib.	Full Data	Cluster 0	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
	163	7	48	27	31	22	13	15
LF	LTD	LTD	LTD	LTD	LTD	STOCK	LTD	LTD
BA	Non-production	Non-production	Non-production	Production	Non-production	Production	Non-production	Non-production
SIZE	Small	Medium	Small	Large	Small	Large	Large	Medium
OWS	Full local	Full foreign	Full local	Full local	Full local	Full local	Full local	Full foreign
PROJ	Yes	Yes	No	Yes	Yes	Partially	Partially	Yes
COM1	3.80	5.14	3.21	3.85	3.35	5.18	3.62	4.00
COM2	3.45	4.29	3.29	3.63	3.39	3.95	2.85	3.13
COM3	4.26	6.29	3.69	4.19	4.74	4.95	4.77	2.87
COM4	4.06	6.43	3.17	4.30	5.06	4.27	4.08	3.00
COM5	3.44	5.43	2.90	3.15	4.45	3.23	4.08	2.40

Source: Prepared by author

Highest values in the case of the majority of parameters characterize cluster 0. which represents the higher level of development in the communication area. Values >5 are rarely situated also in cluster 4 (COM1) which was evaluated on the lower level as in cluster 3 (COM4). In this case, however, the total slightly increasing the tendency of values shows the higher level in the communication area. Using of Business Intelligence systems is expressed by the COM3 parameter. Average COM3 Values depending the project utilization are shown in Figure 11.2.

Figure 11.2 COM3 Values depending the projects utilization



Source: Prepared by author

At the end, we can state that the cluster analysis of our research results revealed that only 2 clusters show the higher level in the communication area. Common signs of both clusters are legal form – LTD, activity – non-production, usage of projects – YES. Although there can identify restrictive limits of our research (size of examined sample, error in applied evaluation methods), results confirm the importance of projects for companies‘ activities and thus the importance of leading to a developed project oriented organization.

11.5. Summary

The research results presented in this chapter reflect:

- Mostly used application is the office package MS Office, especially MS Excel used by respondents for analyzing, planning, tracking expenses, graphical display of time plans, resource planning, and so on. The second most used software solution is a specific software for application in project management Microsoft Office Project Server.
- The best skills were recorded for the work with MS Office package, especially with MS Excel. Followingly it is was work with Information system SAP and then with Microsoft Office Project Server. The skill level of respondents proportionally matches with the level of usage of particular software solutions.
- Using Data Mining Clustering Method it was confirmed, that the best results in BI utilization achieved the project-oriented organizations.

12. CONCLUSION

Part II of this publication deals at first with technology requirements of project oriented organization in accordance with PMBOK® Guide. The analysis of individual knowledge areas proved that it is necessary that areas for decision-making support of project managers at all stages. therefore operational. tactical. and strategical. are all supported by these technologies. The reasons are that each manager manages any procedure. he or she needs clear view about its status for his decision-making. The systems which enable simply obtain information about circumstances. potential problems for right decisions. are systems as Business Intelligence. The necessity for the implementation of these systems is related also to organizations which manage a portfolio of projects.

In the next chapter, the Business Intelligence systems are described in detail in a way that Business Intelligence is more than software tools and technology. The term Business Intelligence is often used in a very narrow way to refer to software applications used to analyze an organization's raw data. Terms often associated with Business Intelligence in an ICT sense are data mining. online analytical processing. querying and reporting. In fact, ownership of Business Intelligence is very often only in the ICT functions of companies.

The problem is that despite huge investments in Business Intelligence software and solutions in recent years many organizations are still failing to convert data into strategically valuable knowledge. ICT infrastructure and software alone cannot make this happen – Business Intelligence must be owned by business leaders and managers who are supported by ICT.

Nowadays is the utilization of Business Intelligence tools and technologies in project management a big challenge. Is no longer enough independently to cover by ICT only project management areas . Increasingly to enforce the information systems allowing to manage the project portfolio (PPM tools).

PPM tools are becoming more and more powerful. and they are capable of presenting project data in several different ways. However, while they can store historical information. they are geared around the management of current initiatives. By taking the data that those applications contain and making it available to a BI tool, project managers can create a whole new perspective on our projects that can help them to make the right decisions and provide accurate analysis.

Research results in Slovak enterprises and organizations confirm, they most commonly used project management software is software specifically for separate projects. Utilization of PPM and pertaining to software tools is in its infancy. Pleasing is that project-oriented businesses and organizations have the highest level of use of Business Intelligence software tools.

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