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Knowledge Management in Project-Based Organisations:

The Success Criteria and Best Practises

Master of Science Thesis in the Master's Programme International Project Management

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Department of Civil and Environmental Engineering
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CHALMERS UNIVERSITY OF TECHNOLOGY
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ABSTRACT

This study expounds 31 aspects of knowledge management such as corporate memory, mentorship programs, professional networks, etc., whose impact on successfulness of project delivery was assessed through the survey in 40 project-based organisations. The purpose of the study is to highlight contemporary vision on project success and to justify the fact that appropriate management of knowledge is able to enhance project results. Relying on the theoretical framework the questionnaire was compiled and covered five relevant to knowledge management areas including organisational culture aspects. Questionnaire was used in tandem with interviews to clarify particular parts of the survey. The observation revealed that application of knowledge management practices has influence on project success criteria and can improve the process of successful project delivery. There is also a necessity for further research which arises from certain limitations of the study. Further research should cover those knowledge management practices that have not been investigated in this study and more deeply investigate those practices that showed the most significant correlation with project success.

Key words: Project management; Success criteria; Project-based organisations; Organisational learning; Knowledge management.

Contents

1	INTRODUCTION	1
1.1	Scope of the study	1
1.2	Aim	1
1.3	Parameters to the study	1
1.4	Structure of this paper	2
2	THEORETICAL FRAMEWORK	3
2.1	The problem	4
2.2	Project management context	4
2.2.1	Portfolio management	4
2.2.2	Project management office	6
2.3	Organisation and structure	7
2.3.1	Project-based organisation	8
2.3.2	Organisational project management	9
2.4	Project performance	11
2.4.1	Project success criteria	12
2.4.2	Critical success factors	13
2.5	Knowledge management	14
2.5.1	Knowledge and learning	15
2.5.1.1	Organisational learning	16
2.5.1.2	Communities of practice	18
2.5.2	Knowledge life cycle model	19
2.5.2.1	Explicit and tacit knowledge	19
2.5.2.2	Knowledge creation and acquisition	21
2.5.2.3	Knowledge refinement, transfer and sharing	23
2.5.2.4	Knowledge storage and utilisation	24
2.5.3	KM in an organisational and project context	26
2.5.3.1	Organisational culture: motivation and trust	26
2.5.3.2	KM tools: information and communication systems	28
2.5.3.3	KM success in organisational and project context	30
2.6	Summary and main findings of literature review	31
3	METHODOLOGY	32
3.1	Research approach selection criteria	32
3.2	Research design	32
3.2.1	Quantitative data collection	32
3.2.2	Quantitative data collection	33
3.3	Data analysis	34

4	RESULTS	35
4.1	Organisational culture	35
4.2	Organisational learning	38
4.3	Project management office	40
4.4	KM practices	42
4.5	KM tools	44
5	DISCUSSION	46
5.1	The iron triangle	46
5.1.1	Time	46
5.1.2	Cost	47
5.1.3	Quality	47
5.2	Client satisfaction	47
5.3	Sharing of organisational values and meeting of strategic goals	48
5.4	Learning from experience	48
5.5	High level of innovative solutions	49
5.6	Understanding among departments	49
5.7	Acceptance of change	50
5.8	Avoiding corporate memory loss	50
5.9	Limitations	51
5.10	Contributions and implications	51
6	CONCLUSION	53
6.1	Further research	54
7	REFERENCES	55
8	BIBLIOGRAPHY	63
9	APPENDIX A (INTERVIEWS)	64
10	APPENDIX B (QUESTIONNAIRE)	66

Preface

Over two last decades knowledge management has evolved from an emergent concept and became the common practice in many organisations. It is a paradox that only recently the problem of systematic managing of knowledge started to be addressed within the project management discipline. The author's great interest to the problem relies on his previous experience participation in projects, educational background and desire to investigate the problem of knowledge management in terms of projects more deeply. This study is aimed to develop the question of applicability knowledge management practices for achievement better project results, since this problem has not yet being investigated adequately.

Göteborg September 2010

Alexander Alekseev

Notations

Roman upper case letters

M	Mean values
N	Number of observations
S.d.	Standard deviation, a measure of statistical dispersion

Roman lower case letters

<i>b</i>	Denotes the estimated regression coefficient
<i>r</i>	Denotes the correlation between the independent variable and the dependent variable
<i>t</i>	Value for b
*	$p < 0.15$
**	$p < 0.05$
***	$p < 0.01$

1 Introduction

Projects mainly considered as temporary processes which are, roughly speaking, not existing after they were finished. In turn knowledge management considers the problems of continuous learning, which cause the problem of knowledge inheritance in project context. At the same time, knowledge is an area of arising interest in organisations and a source of competitive advantage for many companies. Appropriate managing of knowledge is claimed to be able to enhance organisational performance. Therefore in order to address the problem of knowledge in projects was used the concept of project-based organisation which being continuous structure still operates with temporary processes. Thus this study intends to investigate the best practices of knowledge management and evaluate their applicability in terms of projects.

1.1 Scope of the study

Through the detailed literature review, this research intends to define project success criteria and highlight best practices for managing knowledge. In order to verify assumptions regarding correlation between those two factors and to build more detailed understanding, an investigation in project-based organisations will be performed. Both a questionnaire-based quantitative method and a qualitative method, based on interviews, will be applied for this purpose.

1.2 Aim

To investigate to what extent knowledge management practices may influence the project in terms of its successful delivery and to identify knowledge management approaches that have most significant impact on successful project management.

1.3 Parameters to the study

The research developed four main questions:

- To identify the best and most-used practices of KM.
- To identify criteria of project success.
- To investigate the correlation between using KM practices and project success.
- To specify what practices are most applicable in PM context.

1.4 Structure of this paper

The textual matter of this thesis consists of six chapters. The current chapter introduces the reader to the area being covered in this research. Chapter 2, theoretical framework, is intended to introduce to the reader to the main theoretical concepts that have been used in this research. The chapter is structured so as to build overall understanding regarding the KM issue in project-based organisations. It contains a general overview of the basic concepts of project management (PM) and organisational structure theory as well as a detailed description of KM theory. Chapter 3 evaluates and explains methods that have been considered and applied for investigation in this research. In Chapter 4, results, the reader will find the main observations and results obtained through the study. Following Chapter 5, discussion, is built from the perspective of project success criteria and analysing which of the KM practices are the most appropriate for achieving better results in each case. Chapter 6 concludes the paper and summarise all findings of this thesis.

2 Theoretical Framework

Living in the second decade of the twenty-first century, surrounded by IT technologies, we often may hear such phrases as ‘information age’ and ‘knowledge society’. In spite of the fact that another well-known phrase – ‘knowledge is power’ – was formulated by Francis Bacon at the end of sixteen century and is frequently used now as a proverb, the managing of knowledge is a relatively new area in academic studies. The increasing importance of knowledge and other intangible intellectual assets in the post-industrial society has sprung from the works of such pioneers as Daniel Bell and it has become the topic of one of the central problems for many modern authors (Nicolini, Yanow and Gherardi, 2003, p. 4). Knowledge itself became an interdisciplinary subject that can be met in a variety of literature from business strategy to health care and it was claimed to be an essential asset and a source of competitive advantage for an organisation that should be managed (Milton et al., 1999, cited in Beveren, 2002, p. 18). In turn, knowledge management (KM) is considered as a tool for achievement of the goal of organisational performing (Halawi, Aronson and McCarthy 2005, p. 75).

Theorists suggest many different perspectives on KM that have been developed in recent years. Titles and keywords of KM articles currently have different variations of terms mixing such as ‘tacit and explicit knowledge’ (Nonaka, 1994), ‘knowledge creation, storage and transfer’ (King, Chung and Haney, 2008), ‘communities of practice’ (Wenger, 1998). KM is often used in the same context as organisational learning, and although theoretical disputes are still going on, there have already been a significant number of attempts to implement knowledge management in practice. Both theorists and practitioners are focused on discovering the concepts that will drive creativity and innovativeness, improve decision making and increase entire organisational performance (Gabberty and Thomas, 2007). The information boom that has been witnessed through recent decades, coupled with the development of science and a number of new IT-based technologies, could be considered as markers of delicate and successful handling of knowledge by some organisations (Cohen, 2008).

Another reality nowadays is the projects. Projects are widely used in modern society for delivery of uncertain and complex tasks (Cicmil, 2005, p. 156). Maylor (2005, p. 4) described a project as a low-volume and high-variety activity undertaken in order to deliver specific objectives within predefined boundaries and restricted by budget and time. The author also highlighted that knowledge about ‘what works where’ is crucial for all projects. In contrast to many other management areas such as finance, marketing and purchasing, the area of project management (PM) has its own Body of Knowledge, which is also remarkable for understanding how knowledge is important in project delivery. At the same time knowledge in projects has a dualistic implication. Bodies of knowledge mainly answer the question ‘how’ projects should be managed, while the answer to the question ‘what’ should be managed often remains unclear. Apart from management skills that are essential for a project manager, he or she, as well as all members who participate in the project, should be accurate and have strong knowledge in the areas that are relevant to the project. Most industries have their own specificity and managing of projects in these industries will also differ. Thus, a set of knowledge and principles that may secure successful delivery of a construction project will be different in an IT context (Wateridge, 1998, p. 60). At the same time some ideas and knowledge that have been obtained through

one project potentially can be further used in other similar projects from the same area. Therefore, KM techniques such as knowledge transfer and knowledge maintenance are relevant and important for PM too. These techniques can be used for sharing knowledge across project teams, securing corporate memory and decision-making improvement (Leseure and Brooks, 2004).

2.1 The problem

At the junction of two management areas arises the problem which was recognised by Thiry and Deguire (2007, p. 649) who argued that project-based organisations have problems with the integration of knowledge. The problem which might be not so important for a singular project becomes a significant issue for organisations that use projects on a regular basis for delivering their strategic objectives. Under detailed consideration, the problem of knowledge integration can be seen as an analogy with an iceberg, have a giant invisible level. For example, Leseure and Brooks (2004) highlighted such issues as corporate memory loss during downsizing or other structural changes; low professional level of employees because of lack of time for training; repeating the same mistakes in different projects; low level of innovative solutions in an organisation; and poor communication between upper and lower management. According to the authors, KM may help in solving or least in reducing some of these issues.

At the same time Kalling (2003) claimed that the link between KM and organisational performance might not always exist even if it is often taken for granted. According to the author researches on KM mainly focussed on investigation of the nature and attributes of knowledge, therefore do not explain what factors make knowledge to contribute to performance. Thus the author argued that more research is needed to investigate relation between knowledge and organisational value.

2.2 Project management context

Projects as part of organisational process cannot be run in isolation from the environmental factors that exist in the organisation. Therefore a modern perspective on project management requires a systematic approach to problem-solving. This chapter describes how organisations can systematically manage projects and what special solutions can be used for this purpose.

2.2.1 Portfolio management

One of the approaches to delivering organisational strategic objectives is portfolio management. The Association for Project Management (APM) (2006, p.8) describes portfolio management as follows. A project portfolio is aggregated information regarding different projects gathered in one source in order to assist in the delivery of organisational strategic objectives. Portfolio management technique implies, inter alia, identifying, prioritising, balancing and controlling multiple projects so as to achieve

concrete business strategies. In the study undertaken by Cooper, Edgett and Kleinschmidt (1999) the authors exemplified how portfolio management is crucial for the successful performance of the organisation and listed the methods used in portfolio management. They highlighted that the portfolio plays an important role in balancing resources among different projects. It avoids too many projects being undertaken if resources are limited or not available. Another important function is ‘making strategic choices’ regarding the selection of appropriate technologies and products in line with long-term organisational development and vision. Thus portfolio management is a tool for delivering organisational goals.

With regard to portfolios it is also important to mention the concept of programme management. In contrast to portfolios a projects programme has a narrower focus and is defined by APM (2006, p.6) as follows. ‘Programme management is the co-ordinated management of related projects, which may include related business-as-usual activities that together achieve a beneficial change of a strategic nature for an organisation’. In some senses a project programme is an additional project which is undertaken to support and/or manage a group of similar projects. The schematic composition of projects, project programmes and project portfolios can be seen in Figure 2.1. Additional concepts of project portfolios and project programmes aim to bridge the gap between separate projects and organisational strategy.

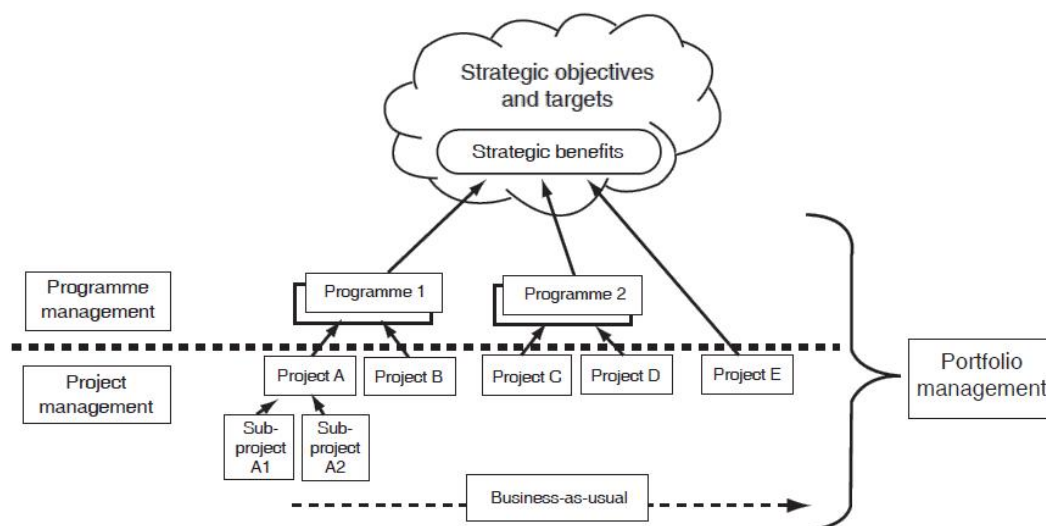


Figure 2.1 The relationship between project, programme and portfolio management (APM, 2006, p. 7)

Investing in a portfolio, according to Kim and Won (2004), can result in important benefits such as cost and time reduction in defining future investment and the improvement of the decision-making process in terms of investments. In their paper these authors also analysed a knowledge-based framework in the portfolio management process. The authors claim that a knowledge-based system in portfolio decision-making, based on previous feedback from managers, significantly helps in decision-making regarding new cases in portfolio management. Therefore, given, the problem of KM in projects it is important to assess if organisations pay attention to accumulating information obtained during portfolio management. A list of questions relating to the availability of information stored during the process of portfolio

management has been added to the questionnaire assessing this problem in the master thesis.

Considering portfolio management it is also important to understand how a single project and general factors of project management can contribute to portfolio management efficiency. A certain correlation between the success factors of a single project and its contribution to achieving portfolio efficiency was identified by Martinsuo and Lehtonen (2007). The authors conducted a survey of 279 firms where, relying on previous researches, they analysed correlation between portfolio efficiency and significant success factors such as clear project goals, information availability, and systematic decision-making. As two additional variables the authors added single project goal achievement and general project management efficiency. An important observation is that achievement of project goals as such does not necessarily increase portfolio efficiency and the strongest correlation was identified between portfolio efficiency and information availability. The fact of information availability was also significant for single project efficiency.

This section has revealed an important role of information and knowledge-based approaches in successful project delivery and efficient portfolio management. The papers reviewed, however, lack concrete examples of the type of information usually stored during the portfolio management process and what part of it is usually used for learning by project managers and team members. This question should therefore be further investigated.

2.2.2 Project management office

A project management office (PMO) is a conceptual and central place for all ongoing projects in an organisation. According to APM (2006, p. 14) a project office has a certain number of functions, starting from simple support functions for the project manager, to bringing organisational strategy at project level. The PMO also plays a role of a place in accumulating different information regarding single projects, programmes and portfolio. While portfolio and programme management can be considered as techniques, a PMO in turn represents an organisational unit, a physical and functional home for project managers. The Project Management Institute (2004, p. 18) gave a short list of functions that are also common to PMOs:

- Identification and development of project management methodology, best practices, and standards;
- Clearinghouse and management for project policies, procedures, templates, and other shared documentation;
- Central office for operation and management of project tools, such as enterprise-wide project management software;
- Central coordination of communication management across projects;
- A mentoring platform for project managers.

These bullet points correspond in a certain way to the view of PMO by Block and Frame (1998, cited in Dai and Wells, 2004, p. 524). The authors highlighted several important functions such as consulting, mentoring, training and encouraging of professional certification that, in their opinion, should be part of PMO activities. This list can be continued by points introduced by Fleming and Koppelman (1998, cited in Dai and Wells, 2004, p. 524). According to the authors, the establishment of PMO leads to higher PM effectiveness through storing information in the PMO for acquisition of knowledge regarding project success and failures and making this information available for different levels of management personnel and team members. Fleming and Koppelman (1998, p. 36) also discussed the high importance of project management software and the necessity of project integration. According to the authors, the easiness in allocation of project documents can significantly improve the process of project delivery via time saving. Therefore, the authors claimed that development of techniques, including development of software for storing and sorting of project documents, should be the number one task.

Furthermore, authors such as Maylor (2005, p. 59) directly make claims about the high role of PMO in managing knowledge. The PMO, according to the author, can be considered as a sort of sponge that absorbs and stores knowledge generated during a project. Therefore, the PMO plays an important role in knowledge transfer. The information flow and relationship between the PMO and the project process can be demonstrated by Figure 2.2. Nevertheless, the author also argued that, in spite of the benefits of running a PMO, it should overhead its costs that are spent on its maintenance.

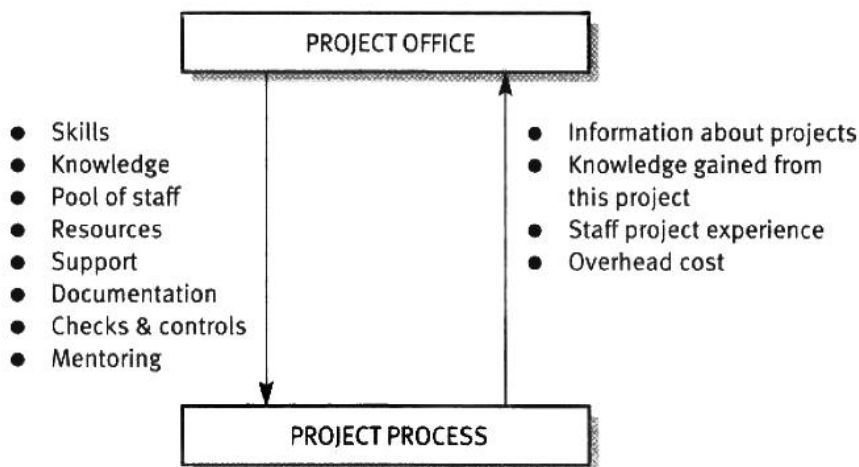


Figure 2.2 Relationship between the project and the project office. (Maylor, 2005, p. 59)

2.3 Organisation and structure

This chapter aims to show the place of a PMO in the organisational structure and to demonstrate the interrelationship between a project and the organisation.

2.3.1 Project-based organisation

In spite of the fact that the definition of a project-based organisation (PBO) seems to be intuitively clear, in the literature can be found several similar yet different comprehensions of this concept. Ajmal, Helo and Kekäle, (2010, p. 157) refer to it as a project-based business, instead of a PBO, and defined it as a firm that is simultaneously engaged in several projects. Koskinen (2010, p. 260) used the term project-based company to describe ‘organizations in which the majority of products are made against bespoke designs for customers’. Thiry and Deguire (2007) outlined different views on the mentioned terminology presented by different authors. Thus, according to Hobday (2000, cited in Thiry and Deguire, 2007, p. 650) there are two types of project organisations: project-led organisations, ‘in which the needs of projects outweigh the functional influence on decision-making and representation to senior management, but some coordination across project lines occurs’ and project-based organisations, where ‘the project is the primary business mechanism for coordinating and integrating all the main business functions of the firm (with) no formal functional coordination across project lines’. In this paper I will use the term project-based organisation (PBO), which appeared to be the most recognisable. Nevertheless there are no limitations and PBO can refer either to the entire company or to a department within a company. In this paper I also use the PBO term in the context of the definition given by Hobday to project-led organisations.

Thiry and Deguire (2007) also exemplified the place of a PMO and portfolio management concept in a PBO. According to the authors, in many cases it can be explained via an evaluation of the traditional pyramidal organisational structure (see Figure 2.3). Being an organisational unit, the PMO is playing an administrative role and serves for monitoring and controlling project performance, developing project management competencies and methodologies. As can be seen from Figure 2.3, project, programmes and portfolios operate on different organisational levels that form a hierarchical structure. The place of the PMO in this hierarchical structure can be divided into the project office which operates at programme level and the programme office which operates at portfolio level. However, in many companies there is no such distinction and the PMO is the only unit that takes care both for projects and portfolio management, which is recognised by Aubry, Hobbs and Thuillier (2007).

In a later paper, Aubry, Hobbs and Thuillier (2008) also discussed that some organisations, in spite of obvious methodological advantages, still prefer to avoid implementation of a PMO. From this perspective it is even more important to recognise a concept of organisational project management.

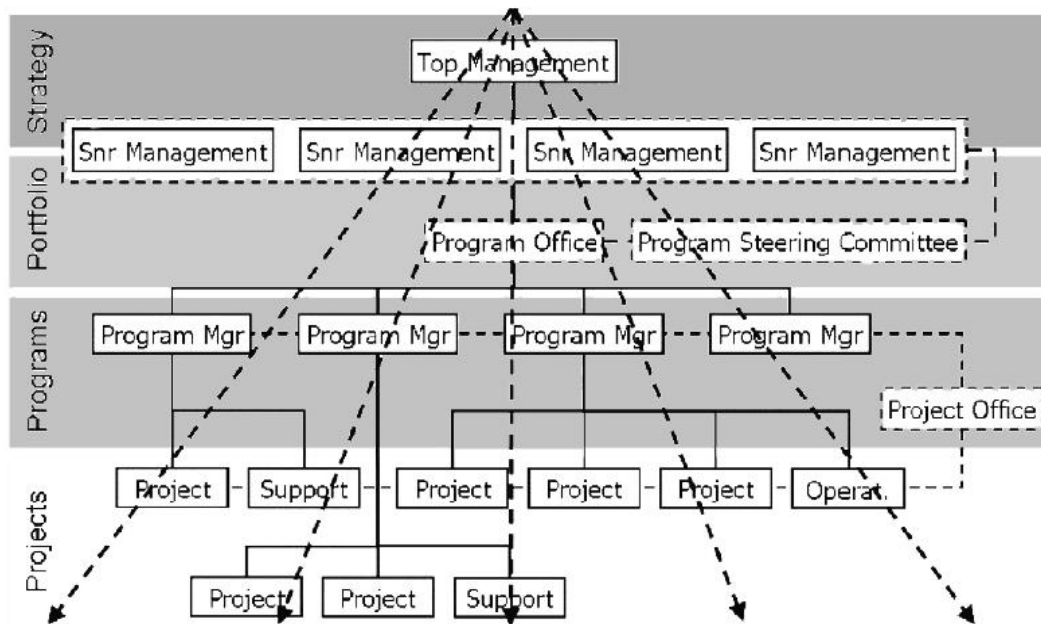


Figure 2.3 PBO model (Thiry and Deguire, 2007, p. 652)

2.3.2 Organisational project management

In order to understand the concept of organisational project management it is necessary to expand standard boundaries of traditional project management to organisational level. Thus, the concept of organisational project management can be considered as the missing link between project and senior management according to Aubry, Hobbs and Thuillier (2007). The authors defined organisational project management as follows: ‘Organisational project management is a new sphere of management where dynamic structures in firms are articulated as a means to implement corporate objectives through projects in order to maximise value’.

One of the attitudes towards the problem of organisational strategy in terms of successful project management was suggested by the Project Management Institute (PMI). This PMI standard was called the organisational project management maturity model (OPM3) (Project Management Institute, 2003, p. 3). The main target of OPM3 is to bridge the gap between two concepts of organisational strategy and project management, or in other words to assess how an organisation’s strategic goals could be achieved through delivering of the ‘right projects’. Nevertheless, the concept of organisational project management should not be mixed up with portfolio or programme management itself. The overall idea behind organisational project management is the systematic management of projects, programmes and portfolios in order to meet the strategic goals of an organisation (see Figure 2.4).



Figure 2.4 Organizational project management processes (Project Management Institute, 2003, p. 27)

The model implies ‘application of knowledge, skills, tools, and techniques to organisational and project activities to achieve the aims of an organization through projects’. OPM3 also serves for continuous improvement of processes related to three main domains – portfolio management, programme management and project management. Such improvement involves engagement with and progressing through the four basic stages of process improvement that are: standardise, measure, control and continuously improve. Three general components of OPM3 are knowledge, assessment and improvement (see Figure 2.5).



Figure 2.5 Knowledge drives assessment and improvement (Project Management Institute, 2003, p. xv)

The most important assessment unit in OPM3 is the identification of using best practices. Furthermore, in OPM3, organisational project management maturity is described via the application of best practices. According to the model ‘a best practice is an optimal way currently recognized by industry to achieve a stated goal or objective’. Particularly, best practices in the context of OPM3 include such implications as to ‘enable organizations to apply lessons learned throughout the project life cycle’, ‘develop the project management competencies of personnel’ and more. In some senses the OPM3 model can be considered as a knowledge management tool that helps an organisation to establish continuous improvement through learning.

Change as an organisational phenomena and one of the aspects of modern management can be also addressed through the perspective of organisational project management. Moreover, change and continuous adaptation to the external environment is one of the main directions of strategic management in many organisations (Thomas, 2009a). Change management takes its significant part in strategic management and helps in the process of individuals, teams, and organisations' transition from the current state to the desired one. It helps to organizations in detecting trends and tracking them with the purpose of getting benefits from environmental changes. Therefore it is important to make a stress on organisational factors that supports change. According to Thomas (2009a), the main problem applying the change is resistance which appears both at individual and organisational levels. Thomas (2009b) highlighted following factors that help to overcome resistance:

- Open, flexible plans that are fully shared and embraced by the whole organisation;
- Individual and organisational performance linked;
- Decision making and problem solving based on participation;
- Open problem solving atmosphere;
- Trust;
- Everyone involved in identifying and solving problems.

2.4 Project performance

Lavagnon (2009) generalised that discussions on a project performance topic can be divided into two categories. The first category deals with project success criteria. This category is based on a group of standards or principles that lie under the process of judgment regarding project success. To this category relates the so-called classical approach which is based on a concept of 'the iron triangle' – time, cost and quality (see Figure 2.6). The second category is called critical success factors (CSF) and it considers conditions, events and circumstances that increase project performance. Later in this chapter these categories will be discussed in more detail.

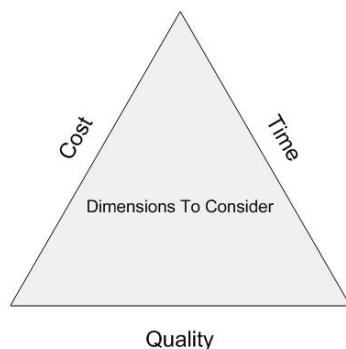


Figure 2.6 The Iron Triangle. (Atkinson, 1999, p. 338)

2.4.1 Project success criteria

Project success criteria were first mentioned in relation to the concept of ‘the iron triangle’. This triple success criterion was used by such authors as Oisen (1971, cited in Atkinson, 1999, p. 338). As follows from its name, according to this approach, judgment regarding project success is based on an assessment of three project objectives: delivery on time, within budget and corresponding to the level of quality, as stated in a project plan. However, this approach for project success measurement was criticised as being too general and was expanded by adding additional dimensions. Atkinson (1999) and Wateridge (1998) were those who argued about the necessity to add to the concept of the iron triangle such aspects as the level of stakeholders’ satisfaction with the project. Some authors such as Gardinera and Stewart (2000) even tried to abandon using of the ‘on time, to budget’ concept of project delivery and replace it with accessing of best achievable net profit value (NPV).

It was Baccarini (1999, p. 25) who proposed separating the concept of project success into product success and project management success (see Figure 2.7). According to the author, reaching the time, cost and quality objectives as well as overall project management process should be related to project management success, while product success relates to the project’s final product from a long-term prospective. The author also related product success to achievement of the project owner’s organisational goals and meeting the real project purpose which is expressed in the satisfaction of the end-user’s needs. Project management success represents the delivery of a tangible project result or output which was specified in the project plan within allocated resources or inputs. The author claimed that altogether the product and project management success compose overall project success.

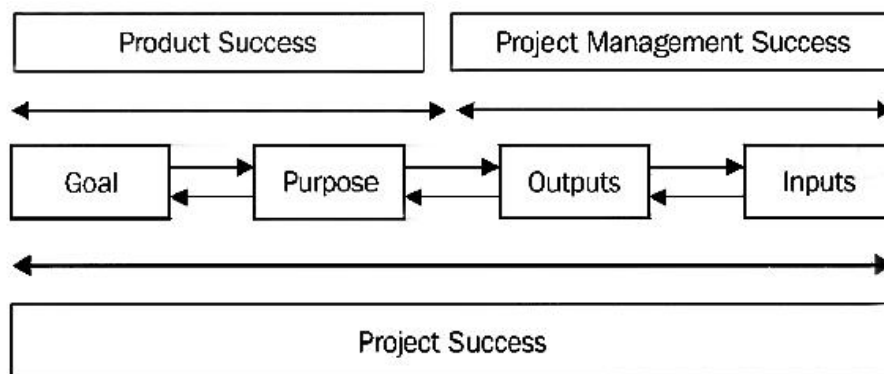


Figure 2.7 Project success (Baccarini, 1999, p. 28)

A view similar to Baccarini’s but from a different perspective was represented by Lim and Mohamed (1999). The authors discussed the so-called ‘macro and micro’ viewpoints on project success. In their research the authors determined why the same project may be recognised as ‘successful’ by one party and as ‘failure’ by another. Thus, the authors suggested distinguishing between end-users’ and stakeholders’ points of view (a macro approach) and developers’ and contractors’ points of view (a micro approach) on aspects of project success. The authors argued that because of the different perspectives on judgment regarding project success between users and

contractors, the project which has been delivered on time and within budget still can meet the low level of end-users' satisfaction.

The most complete way in comparison with previous authors for measuring project success was suggested by Shenhar, Levy and Dvir (1997). The authors introduced a four-dimension model which reflects objectives that the project manager should consider for achieving the short-term and long-term goals of the project and judging its performance on the outcomes of all four dimensions. The first dimension is a combination of two criteria – time and budget. This dimension shows whether the project was well-managed. Nevertheless it was the authors who argued that if the project was completed on time and within the specified budget it could be considered as only a short-term index of project efficiency. The second dimension considers the impact of the project on the customer and/or on the end-user. This dimension includes important aspects such as meeting performance rates, functional requirements and technical specifications. It also can be related to the degree of customer satisfaction and customer loyalty that could be considered as positive if the customer places the new project or order with the same contractor. The third dimension represents the overall impact of the project on the organisation. For commercial organisations, according to the authors, it could be higher income or improvement in any financial indexes, while for non-profit organisations the main focus should be on improvement of services or similar benefits. The fourth and final dimension, as represented by the authors, addresses the longest-term organisational objectives that, according to the authors, should include building of new skills and developing of new technologies through innovation, challenging the status quo, etc. Therefore, the authors claimed that question of project success is time dependent and each dimension can be assessed only after a specific period of time.

Concluding all the reviewed ideas on project success and concerning its applicability for the current research, the following assumptions could be made. First, in the assessing of project success the iron triangle approach still remains the most measurable aspect of all projects. Second, the quality aspect of the project should be treated more carefully, since there is always a certain level of misunderstanding which may occur in the way of defining actual client's needs, understanding of these needs by the project team, creating a project plan and delivering the final result. Third, the project should deliver certain benefits to the organisation that should overcome expenses. Fourth, every new project should increase the maturity level of the organisation through building of new skills, improvement of decision making and developing of new knowledge.

Nevertheless, even if all success criteria were met and the project can be considered as successful, there is a still one question which remains – what exactly has been done in order to reach a positive result? Assessment of this question is possible through the investigation of CSF.

2.4.2 Critical success factors

Westerveld (2003, cited in Lavagnon, 2009, p. 10) defined CSF as 'different aspects of project control'. Generally speaking, CSF is a list of areas or set of factors that a project manager should be highly aware of in order to succeed in project delivery.

Fortune and White (2006) reviewed 63 publications that focused on CSF, and outlined and generalised similarities in the lists of factors represented by different authors. Via analysing the applicability of KM practices to those factors the original list was reduced. Below you can see the list of factors that theoretically could be influenced by KM practices:

- Support from senior management;
- Competent project manager;
- Skilled and qualified staff/training provision;
- Learning from past experience;
- Understanding among departments;
- Good communication/feedback;
- Organisational adaptation/culture/structure;
- User/client involvement;
- Consultants' involvement.

The authors also highlighted that approaches chosen for project management should consider such aspects as project size, level of complexity, number of people involved and project duration. The fact that different organisational and project structures require a specific approach is also recognised by Westerveld (2003, p. 417). For example, the application of complicated approaches can give a negative result if you try to apply it in a small-scale company.

According to Pinto and Slevin (1988, cited in Lavagnon, 2009, p. 11) CSF should be related to the project life cycle which has three main phases: planning, project execution and closing. The authors outlined that consultation with the client/end-user is the most important factor during the project design phase and should be carried out until the project closing phase. Support from senior management is important during the project planning phase. Finally, during project execution, one of the key factors is troubleshooting. Later in this thesis there will be an investigation of how appropriate knowledge management can influence CSF and contribute to project success.

2.5 Knowledge management

Knowledge has become an area of rising interest in organisations and a source of competitive advantage which is acknowledged by many authors such as Eisenhardt and Santos (2002, cited in Garavan and Carbery, 2007, p. 34). It was Nonaka (1991, p. 91) who said that 'In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge'. In turn, when discussing knowledge management (KM), it is necessary to make the following assumptions regarding knowledge: 'knowledge is worth managing, organizations benefit from

managing knowledge, knowledge can be managed’ (Stewart et al., 2000). Thus, Love, Fong and Irani (2005, p. XIII) claimed that effective KM can be considered as an instrument in a project environment for reducing project time, increasing product quality and avoiding of making same mistakes.

2.5.1 Knowledge and learning

In order to start a discussion on KM, first it is necessary to understand the main definitions and aspects of KM theory. The first aspect to be highlighted is to distinguish in the literature on KM such concepts as data, information and knowledge (Corbin, Dunbar and Zhu 2007, p. 1495). Information is seen as accumulated data in some place, while knowledge resides in human brains and involves the experience of the person and his or her personal beliefs which influence the judgment process of this person. At the same time these three concepts are interrelated and depend on each other (see Figure 2.8). Gunnlaugsdottir (2003) defined ‘data’ as facts without context; when it is further organised and analysed, data becomes ‘information’ and only when information is put into a logical and understandable context can it become ‘knowledge’.

However, authors such as Braganza (2004) claimed that the data–information–knowledge hierarchy has limited practical use. Through the empirical case study, the author investigated an aspect of knowledge management from an organisational perspective. According to the study, organisations often find it difficult to distinguish boundaries among data, information and knowledge. Thus, she suggested using a top-down approach knowledge–information–data. In this upside-down hierarchy the term knowledge implies explicit knowledge that can be formulated and transferred. Information is considered as an asset that is required for employees to conduct their job responsibilities. And finally data is a derivative from information, rather than information being formed from data. Nevertheless, since the distinguishing of data, information and knowledge, as proposed by Braganza, is not yet widely acknowledged and not proved as a better approach in comparison with the classical one, in this paper I will use the standard data–information–knowledge hierarchy and its terminology for further discussions.

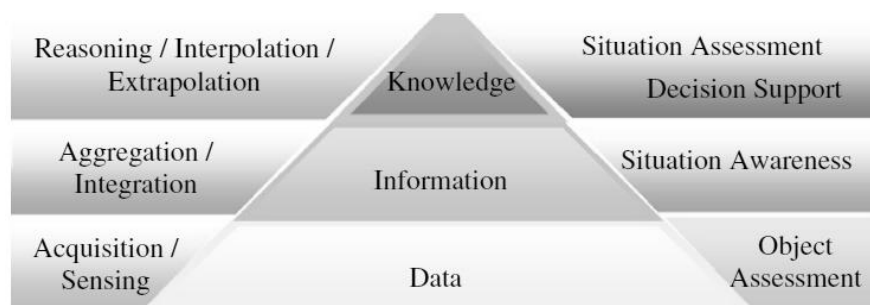


Figure 2.8 Data–information–knowledge hierarchy (Corbin, Dunbar, and Zhu 2007, p. 1495)

Another aspect related to KM is the problem of learning. According to Stacey (2001, cited in Cicmil, 2005, p. 160) knowledge and learning are context dependent, both from the individual and organisational perspectives. In contrast to differences among

definitions of knowledge, information and data, learning is very close to such concepts as knowledge creation and knowledge transfer. This dependency also can be seen in the definition of learning given by Fiol and Lyles (1985, cited in Wasif, Josephson and Styhre, 2008, p. 51): ‘learning is the development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and further actions’. Therefore, stressing the similarities between knowledge and learning it is fair to mention that the concept of organisational learning is often considered as an area of KM or vice versa (McElroy, 2000; Malone, 2002; Johannesssen, Olaisen and Olsen, 1999; Theriou and Chatzoglou, 2008; Jarrar, 2002).

2.5.1.1 Organisational learning

Organisational learning theory can be categorised into three main sub-branches (Bennett, 2001). One of those sub-learning theories considers organisational learning as a metaphor, since organisations consist of individuals, therefore they prefer to refer to individual learning in an organisational context. Particularly this concept was discussed by Wasif, Josephson and Styhre (2008). In their research, the authors distinguished different types of individual learning in a project context. The authors defined five different types of such learning. The first type of individual learning is learning through individual networks. This type of learning occurs when an employee faces a problem which it is not possible to solve on his or her own, therefore, this employee tries to find advice through personal contacts with another specialist or often through a professional network. One of the particular approaches that organisation currently try to implement in order to provide a support to their employees who face certain problems with their ongoing work is coaching. Ladyshevsky (2010, p. 293) claimed that coaching is one of the important and emerging areas of organisational development which is “designed to help employees address individual functional knowledge gaps and skills”. Coaching being claimed a tool which helps to enhance individual knowledge, nevertheless is not wide spread in KM literature yet. The second type is learning through organising and it implies participation in such work activities as meetings and in different work tasks. The third type is learning through experimenting which is related to testing and verifying different opportunities in order to define the best approach. The fourth type is learning through reading of professional literature such as journals. Finally, the fifth type is learning through attending courses and professional seminars. In their article the authors used the term ‘learning’, nevertheless they introduced the five-type model of learning which is close to the theory of knowledge creation and knowledge sharing that are discussed below.

Another perspective on organisational learning is considering organisation as an entity itself, which was discussed by Grieves (2008). The author criticised the idea of learning organisation as being too blurry and utopian. Grieves (2008, p. 465) claimed that it seemed elusive to modify organisational structure continuously for securing and providing learning organisation status. To support his idea, the author referred to the fact that there was no consensus between authors about the way to understand an organisation as a learning system. For example, Tannenbaum (1997, cited in Grieves, 2008, p. 466) highlighted the following characteristics of learning organisation: ‘learning opportunities; tolerance of mistakes; high performance expectations openness to new ideas; policies and practices supporting training; awareness of big

picture; satisfaction with development'. Sarala and Sarala (1996, cited in Grieves, 2008, p. 466) suggested a different perspective on learning organisation characteristics: 'philosophy and values; structure and processes; leading and decision making; organising the work; training and development; internal and external interactions'.

In spite of the difference in perspective of learning organisation, the most ambiguity remains in definitions and differences between concepts of organisational learning and learning organisation, as discussed by Örtenblad (2001). In the literature review made by the author he distinguished three concepts: old organisational learning; learning organisation; new organisational learning. In contrast to Grieves (2008) who referred in his paper to learning organisation in order to describe behaviour of an entire organisation, Örtenblad (2001) discovered a different definition for learning organisation. According to the literature review, the author suggested considering learning organisation as learning between individuals. This perspective implies two assumptions. First, that knowledge resides in an individual's brain and rarely can be stored in corporate memory. Second, that knowledge transfer in a learning organisation requires interaction between individuals not between individual and corporate memory. Two different perspectives on learning organisation provided by Grieves (2008) and Örtenblad (2001) create confusion and provoke me to abandon using such collocation in this thesis.

A third perspective on organisational learning was suggested by Bennett (2001) who underpinned the theory applicable to the project context. The author considered a team as a social cluster which operates in PBO and therefore referred to team learning instead and described how this new concept can be connected with a classical organisational learning approach. For this purpose the author used Dechant et al.'s model (see Figure 2.9), which identifies four learning processes:

- Framing and reframing – building of a perception about new facts, based on previous experience or transformation of a previous perception into new understanding.
- Experimenting – application of the theory or hypothesis in practice.
- Crossing boundaries – communication of team members across project boundaries.
- Integrating perspective – building of a common understanding through cooperative problem solving.

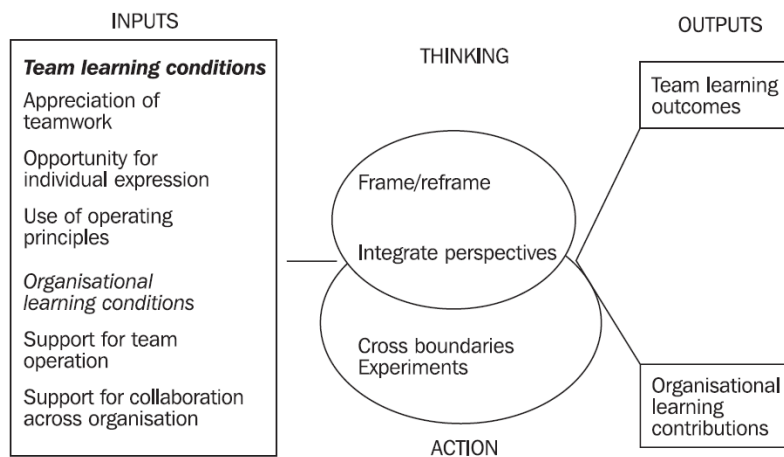


Figure 2.9 A model of team learning. (Bennett, 2001, p. 16)

Applicable to team learning, Bennett (2001, p. 16) highlighted four phases: ‘fragmented (learning by individuals); pooled (learning by pairings of some team members); synergistic learning (collective reframing); continuous learning (the use of all team learning processes)’. Further, the concepts of organisational learning will be compared with concepts of KM theory in order to build a common framework for the current research.

2.5.1.2 Communities of practice

When talking about organisational learning it is also necessary to mention a rather new approach to managing knowledge called ‘communities of practice’ (CoP). The concept of CoP emerged from organisational learning theory and considers learning as a process of social participation (Wenger, 1998). The author provided the following definition for CoP – ‘groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and experience in this area by interacting on an ongoing basis’. Örténblad (2001, p. 131) also referred to CoP as a new perspective on organisational learning. The author stressed that a new concept rejects both, considering the organisation as an individual that can learn and an individual independent learning. CoP instead considers the learning process as a social phenomenon which, in an organisational context, implies collective learning. The author also claimed that CoP’s perspective on knowledge transfer discerns it as a situational process, where information changes its meaning under different conditions and therefore is possessed only by community members and cannot be stored. Nevertheless, in his book Wenger (1998, p. 4) highlighted that a new perspective on the learning theory does not replace other theories of learning, but rather it emphasises different aspects and the nature of knowledge, knowing and knowers.

CoP is often criticised for being difficult to apply management approaches that would control it (Bishop et al. 2008). Coming back to the definition of CoP, it is fair to ask if such community can be managed at all. In the literature review made by Bishop et al. (2008) they provided several aspects of CoP managing. First, CoPs are more effective, being naturally formed and self-organised. Second, management of CoP preferably should have a supportive character rather than a controlling one. Thus, the most virtue for CoP is creating the right conditions and choosing an appropriate time and space for collaborative interaction. At the same time, under detailed consideration, the main idea of ‘knowing’ and the CoP concept coincides with the SECI model and the ba

concept that were introduced by Nonaka, Toyama and Konno (2000) and further discussed in more details. Therefore, CoP can be perceived as a particular approach for better knowledge transfer among team members.

2.5.2 Knowledge life cycle model

KM literature sometimes has a complicated mix of terms, therefore, in order to better understand such processes as knowledge creation, knowledge storage, knowledge sharing and knowledge transfer, this paper will use the concept of knowledge life cycle model developed by King, Chung and Haney (2008). The authors used the life cycle model as an entire process of knowledge conversion on the way to organisational performance. According to the model, a knowledge life cycle may start either from an inside-organisational knowledge creation process or from knowledge acquisition process, which implies that organisation may also attain knowledge from outside sources. The full life cycle of knowledge conversion on the way to organisational performance, apart from knowledge creation, contains certain stages such as knowledge refinement; knowledge storage, knowledge sharing or transfer, and knowledge utilisation (see Figure 2.10). The life cycle model itself did not appear to be widely used in practice, but it provides the framework for better understanding the concepts of KM.

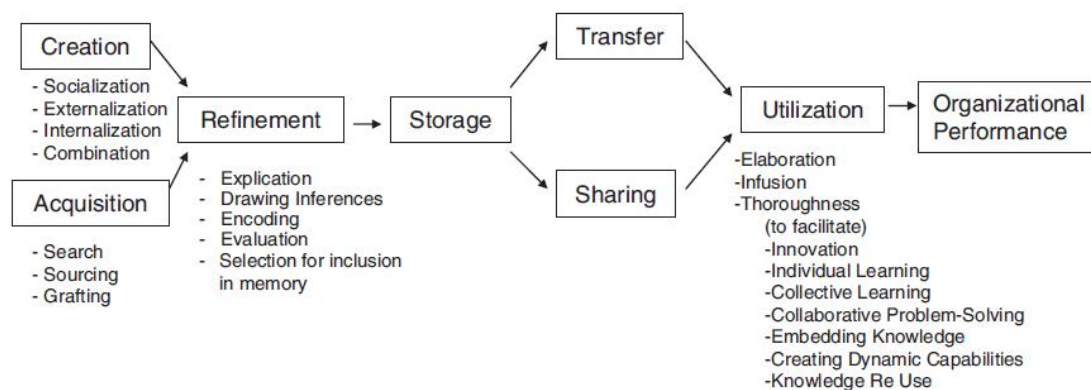


Figure 2.10 KM life cycle model (King, Chung, and Haney, 2008, p. 168)

2.5.2.1 Explicit and tacit knowledge

Considering the question of knowledge creation and transfer, first it is necessary to introduce basic types of knowledge. These types are explicit and tacit knowledge that were broadly discussed in the literature (Nonaka, Toyama and Konno, 2000; Anand, Ward and Tatikonda, 2009; Koskinen, 2000; Koskinen, Pihlanto and Vanharanta, 2003; Nonaka, 1991). Explicit knowledge is knowledge which can be expressed in words, numbers, or figures while tacit knowledge refers to people's unconscious. Explicit knowledge can be stored in media such as text-books, manuals and so forth. Tacit knowledge is considered to be beliefs, individual perception, values, viewpoints and intuitions.

According to the given definitions, explicit knowledge may seem to be more structured and logical, however, tacit knowledge should be treated with the same

respect (Nonaka, 1991). Koskinen (2000) also highlighted that, in spite of the fact that explicit knowledge can be managed more easily since it is possible to express it in a hard copy, it is still for better achievements in a project environment where strong emphasis should be made on tacit knowledge as well. Nevertheless knowledge is not static and not isolated by itself, therefore it can be transformed from one type to another. Nonaka, Toyama and Konno (2000) discussed so-called SECI model of knowledge conversion which describes four modes of such transformation (see Figure 2.11).

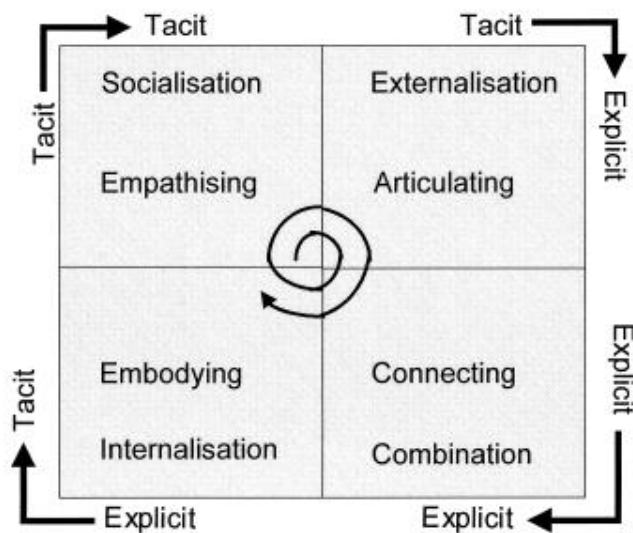


Figure 2.11 The SECI process (Nonaka, Toyama, and Konno, 2000, p. 12)

Initial letters of this model stands for:

- **Socialisation** – from tacit to tacit conversion. Socialisation in the SECI model implies the existence of a significant role of joint activities when people spend time together and share the same environment. During the socialisation process, transferring tacit knowledge becomes possible through observing the actions of your colleagues, imitating and practicing;
- **Externalisation** – from tacit to explicit conversion. During the externalisation process tacit knowledge becomes articulated and therefore transfers into explicit knowledge. Widespread techniques for this articulation are metaphors, analogies, mind-maps, etc. An example of such externalisation process, according to Nonaka, Toyama and Konno (2000), can be considered to be a process of formulating ideas for improvement of a business process via understanding of shortages of a current process;
- **Combination** – from explicit to explicit conversion. In practice, the combination process can be considered as a financial report. In such a report the new explicit knowledge is created through collection and processing of different information from multiple sources in one place. Combination allows it to make initial explicit knowledge more systematic through different types of communication such as meetings, virtual networks, paper documents, etc;

- **Internalisation** – from explicit to tacit conversion. The internalisation process can be considered as ‘learning by doing’. A person internalises obtained explicit knowledge and embodies it according to their own perception and individual understanding of a contextual singularity.

With regard to KM, the theory of tacit and explicit knowledge can be considered from the standpoint of practices that are used for maintaining and extending each type of knowledge and practices for knowledge creation through its conversion.

2.5.2.2 Knowledge creation and acquisition

According to the life cycle model, an organisation can attain knowledge either through the process of knowledge creation or through outside knowledge acquisition. An appropriate question to keep in mind while discussing knowledge creation is what is the necessity for creation of new knowledge and what techniques can be used. For many particular tasks, creation of new knowledge is not as necessary as appropriate usage of previous knowledge. Nevertheless this statement can be fair only for short-term organisational goals. An organisation that wants to be competitive in the market in the long term should adapt to its dynamic environment through development of strategies for knowledge creation (Yang, Fang and Lin, 2010, p. 231). There is especially the necessity to create new knowledge which is applicable for R&D companies (Roth, 2003). As for other industries, including construction, each new project is often faced with new conditions where a project team has to create new knowledge and adopt novel solutions (Mohrman et al., 1995, cited in Fong, 2005, p. 42).

According to the theoretical framework of knowledge creation, introduced by Nonaka, Toyama and Konno (2000), the SECI model per se can be considered as the process for knowledge creation via transforming tacit knowledge into explicit, and vice versa. In addition to the SECI model, in order to describe knowledge creation in context, the authors introduced the idea of ‘ba’. Nonaka, Toyama and Konno (2000, p. 14) described ba as follows – ‘Ba is a place where information is interpreted to become knowledge’. The authors highlighted, that this does not implies just a physical place, but rather specific conditions and time for knowledge transfer. In other words, within different ba conditions the output of the SECI process will differ and therefore the environment should be properly prepared before starting the SECI process. The third dimension of knowledge creation, according to the authors, is knowledge assets that represent knowledge storage or buffer, which interacts within the phases of the SECI process. In turn, knowledge assets are categorised into four types: experiential knowledge assets – tacit knowledge shared through common experiences (e.g. skills and know-how of individuals); conceptual knowledge assets – explicit knowledge articulated through images, symbols and language (e.g. product concepts and design); systemic knowledge assets – systemised and packaged explicit knowledge (e.g. documents, manuals and database); routine knowledge assets – tacit knowledge routinised and embedded in action and practices (e.g. know-how in daily operations). Thus, interaction between the three elements of knowledge creation forms the knowledge spiral that creates knowledge (see Figure 2.12).

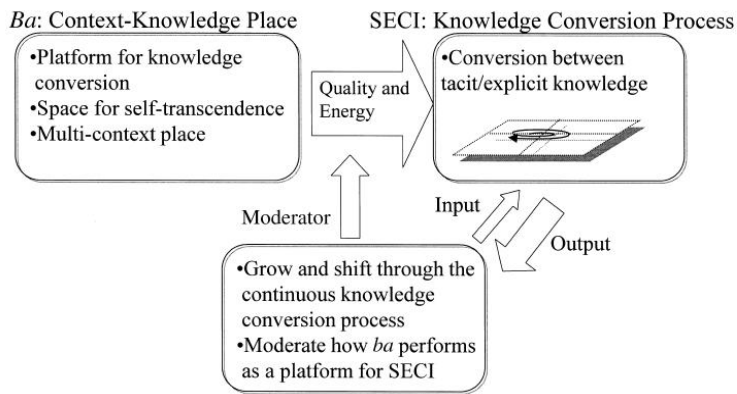


Figure 2.12 Three elements of the knowledge-creating process (Nonaka, Toyama, and Konno, 2000, p. 8)

The SECI model as a main framework for knowledge creation, aside from King, Chung and Haney (2008), was also used by Fischer (2001). The author associated knowledge creation with innovation and diffusion that in turn emerges through interaction and collective processes. Discussing the R&D activities, Fisher stressed the important role of knowledge creation in the technological change process and product innovation. Another example referring to the SECI model as a platform for knowledge creation was introduced by Balestrin, Vargas and Fayard (2008). The authors investigated through a case study what type of activities can support a knowledge creation process. Thus they have been highlighted several main activities such as social gathering, informal meetings, collective decision making, virtual communication and training. In the context of the SECI model, these activities are distributed among four dimensions of the model, as follows (see Figure 2.13). Further discussion of concrete practices for knowledge creation is represented below in the chapter ‘KM in organisational and project context’.

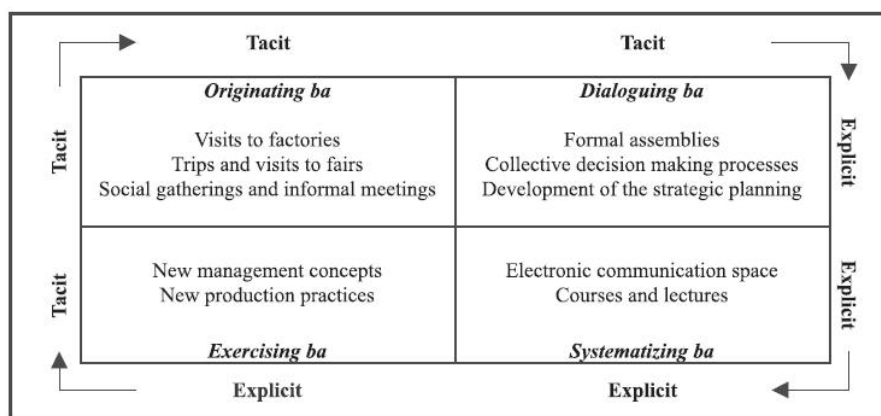


Figure 2.13 The SECI process and activities (Balestrin, Vargas, and Fayard, 2008, p. 102)

Fong (2005), in his research, highlighted some limitations of the SECI model. The author claimed that there is a fine line between the definitions of tacit and explicit knowledge which causes difficulties for the practical application of the model. Li and Gao (2003) also were critical of the SECI model. The authors highlighted that instead of using the word ‘tacit’, it is better refers to Polanyi’s work and use the term ‘implicit

knowledge'. However, none of these critics deny the applicability of the SECI model and therefore it is proved to be a useful framework for knowledge creation.

Another way for attaining knowledge which was discussed by King, Chung and Haney, (2008, p. 168) is using external sources. There are two main possibilities to draw additional knowledge to the organisation: the use of outside knowledge sources and adapting it to the organisation; and the hiring of a person who possesses the required knowledge. Thus, knowledge acquisition is the attraction of knowledge that is already formed to an explicit type.

2.5.2.3 Knowledge refinement, transfer and sharing

Literature on KM provides a number of definitions of knowledge transfer and knowledge sharing; the terminology varies from one author to another. The difference between knowledge transfer and sharing, according to King, Chung and Haney (2008), consists of a more structured way of communication in the process of knowledge transfer, rather than in knowledge sharing. Knowledge transfer involves direct interaction between a sender and the knowledge recipient, thus it makes this process more focused and purposeful. Sharing is less-focused dissemination, where it uses techniques of indirect communication such as databases and where communication is usually unilateral. In contrast to these definitions, Liyanage et al. (2009, p. 122) classified knowledge transfer and knowledge sharing as follows. Knowledge transfer is the one-way process where a possessor of knowledge transfers it to a learner, while knowledge sharing is a two-way process of exchanging different pieces of knowledge where all parties in the process of sharing learn something new. In spite of a poor coherence of definitions provided by different authors it is still possible to draw out one common point in all definitions – knowledge transfer and sharing is a process which is characterised by the mutual intention of individuals to learn something new.

Discussing knowledge transfer and sharing, as well as considering further discussed knowledge storage, it is also important to remember the differences between knowledge and information. Beveren (2002) in his article claimed that knowledge can be communicated only after it is downgraded to information. According to the author, knowledge cannot exist outside of a human brain and therefore the main focus of KM should be made on human intellectual capital. In other words, knowledge cannot be transferred to any recipient. Thus, for knowledge transfer and sharing it is necessary to meet two requirements: the recipient of knowledge should have intellectual potential for its digestion, and any particular knowledge should be selected with an appropriate technique and media for its transfer. Therefore, in order to achieve better results in the process of knowledge transfer and sharing first it is necessary to refine knowledge. Regarding the life cycle model, 'knowledge refinement serves as the processes and mechanisms that are used to select, filter, purify and optimise knowledge for inclusion in various storage media', (King, Chung and Haney, 2008, p. 168). According to Heijst, Spek and Kruizinga (1997) there can be two attitudes to knowledge refinement: active and passive. An active position implies the existence of special trained personnel or any appointed specialist who would track and detect the important knowledge, while a passive approach means that the employees recognise themselves what knowledge is efficient for them and for an organisation.

Three preconditions for successful knowledge transfer and sharing should be met: a recipient of knowledge should have mutual intention for learning; a recipient of knowledge should have intellectual abilities for learning; and an appropriate technique for knowledge transfer or knowledge sharing should be selected. If all of these requirements are met then it can give a certain assurance of successful single-loop learning (Figure 2.14).

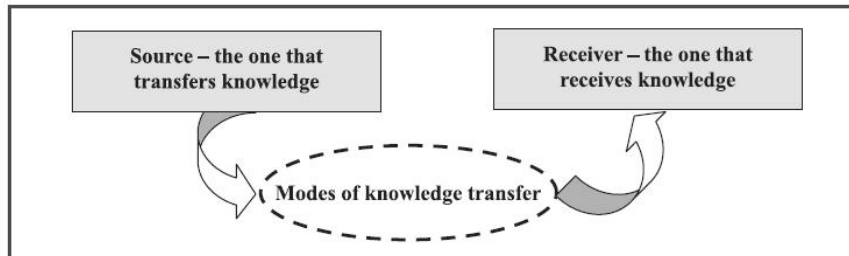


Figure 2.14 Knowledge transfer – “an act of communication” (Liyanage et al., 2009, p. 123)

2.5.2.4 Knowledge storage and utilisation

Last, but not least, to mention the problem of knowledge storage and knowledge utilisation. According to Frappaola and Wilson (2004, cited in Lahaie, 2005, p. xxxix), the entire knowledge of an organisation is usually stored in four main forms that are: employees’ brains, paper documents, electronic documents and electronic knowledge bases (see Figure 2.15). From the histogram it is clear that knowledge is mainly stored in the human brain and it becomes a part of the organisational or corporate memory only implicitly in a form of formalised reports or case studies. Thus, in the case of downsizing, an essential part of intellectual capital that an organisation possessed leaves this organisation with the employees. Lahaie (2005) described in his article the impact of such corporate memory loss in a health care industry. According to the author, one of the most important issues that many health care organisations are currently facing is related to the retirement of a number of staff from all organisational levels. As a consequence of those processes, organisations are losing experienced and knowledgeable employees and this, in turn, causes corporate memory loss. In order to overcome the consequences of a brain drain it is important to emphasise maintaining a corporate memory by using KM practices and tools. Lahaie (2005) claiming that, in spite of the fact that it is impossible to store all knowledge that a person possess, since only explicit knowledge can be recorded, still it is important to create and maintain corporate knowledge. Such procedures of knowledge maintenance, according to the author, should certainly involve formalisation of employees’ thoughts and converting implicit forms of knowledge into explicit forms with following storing it in hard or electronic copies.

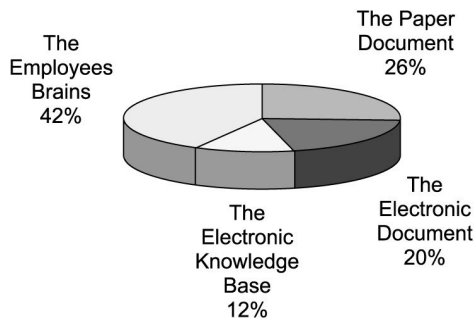


Figure 2.15 Source – harvesting corporate knowledge resources (Lahaie, 2005, p. xl)

Heijst, Spek and Kruizinga (1997) also considered in their article knowledge storage via use of the term ‘corporate memory’ and described it as ‘an explicit, disembodied, persistent representation of the knowledge and information in an organisation’. Such a perspective on the question of corporate memory gives the opportunity to focus on a physical knowledge storage and computer systems that can be used for storing this knowledge, or in other words to move away from an implicit constituent of human brains. Describing knowledge storage, the authors indirectly supported the KM life cycle model. They highlighted that, without knowledge refinement and knowledge utilisation, knowledge storage per se does not provide or secure any long-term success for an organisation. According to the authors, the most problematic part in knowledge storage is identification of information that should be stored and the building of understanding on how this information can be used in the future. For example, such information that can enhance organisational performance and is usable for storing, according to the authors, is: ‘knowledge about products, production processes, customers, marketing strategies, financial results, strategic plans and goals etc.’ (Heijst, Spek and Kruizinga, 1997, p. 44).

Thus, every stage of the knowledge life cycle is crucial since any missteps at each stage will emerge in the next one and will negatively impact on the outcome of KM initiatives in general. The last checkpoint where the knowledge manager can verify if the system works correctly is the knowledge utilisation stage. The main evidence of a well-adjusted KM system is the improvement of organisational performance which could be represented by several factors: a higher level of innovations in an organisation before and after implementation of KM practices; knowledge re-use and improvements in problem solving; and a higher level of individual and collective learning. Schematically, a loop of organisational learning can be represented as follows (see Figure 2.16).

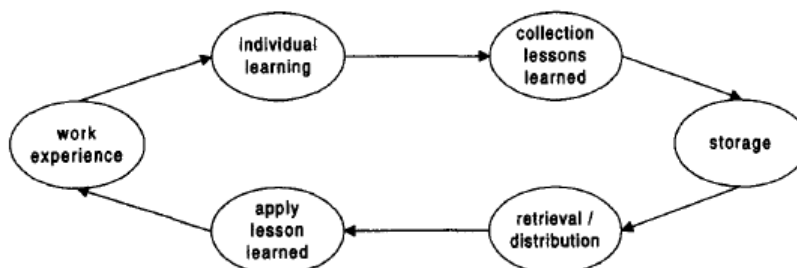


Figure 2.16 Organisational learning through maintaining a corporate memory (Heijst, Spek and Kruizinga, 1997, p. 44)

2.5.3 KM in an organisational and project context

In a business environment one of the main criteria in decision making is financial performance (Zack, McKeen and Singh, 2009). Through applying different management approaches and strategies, organisations seek to maximise profit, increase return on investment (ROI) and improve other financial indexes. The undertaking of KM initiatives is no exception and is dependent on the same rules. According to the life cycle model, the last stage of knowledge transformation is organisational performance. In other words, KM's applicability to the business environment should deliver measurable benefits to an organisation that undertakes it. In the case where there is no evidence of any improvement in processes or procedures during the period of application of KM practices, then these undertaken KM approaches should be reviewed and changed. In order to achieve better results during integration of KM practices it is crucial to understand contextual dependences of knowledge nature applicable to the organisational and project context.

2.5.3.1 Organisational culture: motivation and trust

According to Gupta and Govindarajan (2000, cited in Al-Alawi, Al-Marzooqi and Mohammed, 2007, p. 23) organisational culture (see Figure 2.17) with its procedures, rewards system, bureaucracy and career growth opportunities has a serious impact on the success of KM. One of the main obstacles for KM in an organisational context is the willingness of employees to share knowledge with their colleagues (Lam and Lambermont-Ford, 2010). An unwillingness to share knowledge usually occurs due to lack of trust between colleagues or lack of motivation when employees simply do not want to put any effort into KM practices. According to Lam and Lambermont-Ford (2010) employees' motivation is a multilevel problem that involves at any one time different aspects of the work environment.

Some employees are self-motivated, have a high performance and gladly share their knowledge; others should be additionally stimulated for it. Lam and Lambermont-Ford (2010) claimed that the main drivers to increase employees' motivation concerning KM are identical with practices that are applied in organisations to motivate employees in general. The authors also highlighted two motivator types in the motivational processes that are often take place in an organisational context. First, the motivators group is called intrinsic motivators and is related to material rewards such as money, promotion, etc. Intrinsic motivation corresponds to employees with opportunistic behaviour. The second group is called extrinsic or altruistic and is characterised by the interest of an employee to be an 'important' person within a social group (for example, 'employee of the month' reward). Nevertheless, the authors admitted that in a real situation the borders between the two behavioural types are often blurred, thus choosing a suitable motivation tactic becomes a complex task.

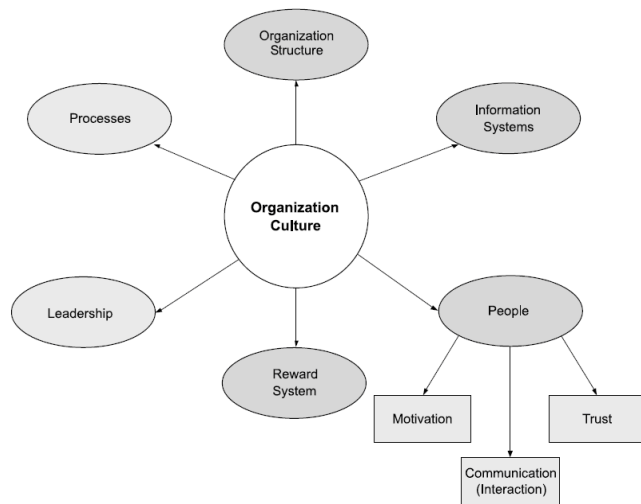


Figure 2.17 *Organisational culture framework (Al-Alawi, Al-Marzooqi and Mohammed, 2007, p. 23)*

In order to apply an appropriate motivation tactic it is important to investigate and understand in each particular case why an employee prefers to share or to keep his or her knowledge. Cabrera and Cabrera (2002, cited in Lam and Lambermont-Ford, 2010, p. 54) argued that knowledge sharing involves a social dilemma, according to which benefits from knowledge sharing are received, not only by the contributors who directly participated in the knowledge sharing, but also for the independent members of an organisation. This fact causes a problem of fair distribution of good and decreases the desire of a person to become a contributor, which is especially true for people with opportunistic behaviour.

Another aspect of organisational culture which is also enhancing the willingness of employees to share their knowledge is trust between co-workers (Lucas, 2005). In its nature, trust helps people to overcome barriers of prejudices and makes the work environment more open and friendly. According to Currall and Judge (1995, cited in Lucas, 2005, p. 89), in an organisation with a high level of trust between employees, the knowledge transfer process works more easily and often with lower cost since there is less expenses and time spent on securing knowledge privacy. In such conditions, employees know that their colleagues will not take advantage of using other's ideas for their own good without sharing the benefits of it. Lucas (2005, p. 90) argued that there are four factors for appearance of trust. First, trust emerges in the environment where there exists a certain level of uncertainty. Second, parties that participate in the process are expecting some specific outcome. Third, the trusting party is expecting the trustee to have certain behaviour. Fourth, both parties are self-motivated to meet each other's expectations.

A slightly different view on trust was suggested by Al-Alawi, Al-Marzooqi and Mohammed (2007) who believed that trust also should involve sharing of personal information and feelings. According to their research, only 29 per cent of respondents considered it appropriate to share personal information with colleagues. Thus, there is a difference between trust in a work environment and a regular friend's trust. Therefore, for investigating trust in an organisational context and obtaining more accurate results it is better to avoid knowingly asking an unpopular question about sharing of personal information with colleagues and replace it with a simple question

where employees may express if there is a certain level of trust between them and their colleagues.

Sun and Scott (2005), apart from mentioning demotivators during implementation of KM in an organisational context, considered the question of organisational bureaucracy. The authors expressed bureaucracy as a necessity to pass through a certain number of procedures or barriers on the way of achieving a final goal. According to the authors, if the number of these barriers is too high then employees show unwillingness to spend their time and put any effort into KM activities. On the other hand, a low level of bureaucracy can provoke unexpected spending of money or cause knowledge loss since there are security problems. Thus, right adjustment between motivators and bureaucratic procedures are crucial for KM's success and overall organisational performance.

Bennett (2001) also stressed that CSF influence successful learning in team conditions. From the interviews, the author found and provided following factors: feeling of security and emotional support among team members; appropriate timing for meetings and discussions; and support from middle and upper management.

2.5.3.2 KM tools: information and communication systems

As considered in previous chapters, for KM processes such as knowledge creation, knowledge storage and knowledge sharing to be implemented in practice requires selection of an appropriate communication technique. Information and communication systems are called in to help and secure successful delivery of KM initiatives in an organisation. Nevertheless, IT technologies have a contradictive impact on those processes (Lucas, 2005). On the one hand, communication tools brings new possibilities for contact with people around the globe and storing knowledge in a more convenient form, on the other hand, those tools require a certain level of training from the staff in order to use it and to move people away from face-to-face communication.

In contrast to ancient times, when most knowledge of humankind was stored in books and concentrated mainly in libraries, nowadays the picture has slightly changed. IT technologies have changed the world and have brought new possibilities to find information faster, to share it and to store it. Organisations that are implementing KM systems today demand sufficient possibilities from such systems which make developers and designers continuously improve their products. Robertson (2002, p. 296), in his article, highlighted several core requirements from a case study for a knowledge management system:

- Ability to store all types of data including any document types, voice and video files, images and web-pages;
- Personalised access to the data with security features and privacy limitations;
- Ability to comment on entries and attach notes;
- Friendly interface and fast search capabilities;
- Abilities to scale the system.

Thus, such a system can become a powerful tool for storing and sharing knowledge in the context of successful KM performing. However, any tool without right use is worthless. As it was introduced by Al-Alawi, Al-Marzooqi and Mohammed (2007), there are two factors that influence the popularity of KM tools in an organisation. First, in order to ensure effective usage of KM tools, the knowledge transfer initiatives should be supported by middle and upper management. In other words, the authors claimed that without proper motivation even a well-designed knowledge system would not be popular among employees. Second, a KM system should be designed according to specific organisational demands and its unique contextual environment. The complexity of the KM system should depend on an organisation's size and be scaled accordingly. The authors claimed that a KM system aims to solve problems of knowledge storage and sharing, not to create them. As an example of poor application of a KM system, Robertson (2002, p. 307) referred to the case study where the main problems of using KM tools were caused by the following factors.

The first factor that influenced the way of using of the KM system was the perspective of the employees on this system and their understanding of how this system should be used. Therefore, it is the manager's task to define an appropriate way of using of the KM system in terms of concrete organisational goals. Thus, a KM system can be considered either as an archive only for knowledge storing or as a collaborative tool with additional functions of knowledge transfer and sharing. The archiving function implies that the KM system is mainly used for storing final reports about completed projects. The case study showed a very small percentage of visiting and reviewing of this information by employees again, nevertheless such information could be used in the long term. The collaborative function involves dealing with the system on a daily basis, since via this system employees share documents that are vital for ongoing projects, for example, milestones reports and status reports, as well as on-line discussion of current issues. The case study showed that solving of current problems provokes employees to use a KM system more often in order to find help and answers to their questions. Thereby employees become self-motivated to share their knowledge and look for additional knowledge.

The second factor from the employees' perspective is the fact of who is supposed to use the system. In the case where entries are made and edited by administrators and managers, without involving team members, then regular team members show little attachment to and interest in the system. Instead of learning by doing, such team members should be specially trained to use the system which also decreases their interest. The most appropriate way of handling this question, according to the case study, is to provide team members with a framework that will force them to use this system on their own by adding new information and participating in conversations. This will make all project members at all levels use the KM system.

A third factor is the continual evaluation and control of the shared information by a coordinator. This fact makes team members believe that their job is overseen by a manager, which in turn pushes them to do their job better. That also makes employees feel that the information in the system is up-to-date, so they can trust it.

An additional factor that also should be considered while applying the virtual communication tools is the question of trust. Lucas (2005) argued that moving away from face-to-face communication causes the problem of trust development between parties. The parties who interact only virtually, according to the author, showed low

motivation level for knowledge transfer which usually emerges only in a critical situation when knowledge sharing is crucial for both sides.

2.5.3.3 KM success in organisational and project context

Concerning KM's success in an organisational context, there are two aspects that should be considered to appraise this success. The first aspect is the actual performing of the KM system; if it either works or not. In other words, in order to evaluate the successfulness of a KM initiative it is necessary to verify if the applied KM practices have reached their prime goals that were settled at the beginning of the implementation phase. For example, Levy (2008) attempted to identify the success of KM initiatives by referring to a case study which describes implementation of a learning model in several organisations. Before implementing the specially developed learning model, those organisations did not have any convenient way for organisational professional knowledge creation. The implementation of a systematic model for knowledge creation provided new possibilities for the company. Whereby, from the standpoint of the author, this case study was considered as a successful implementation of KM practice. This way of looking at the problem also suits non-profit organisations, since the main purpose in such organisations is to get new levels of services or better procedures without putting too much attention on the actual profit that can deliver the implementation of KM practices.

The second aspect of KM success is financial and overall organisational performing. According to Zack, McKeen and Singh (2009) successful implementation of KM practice in an organisational context is more than being only a working database or employees who are willing to share their knowledge. The authors claimed that, in order to report about the successful implementation of a KM system, it should increase the financial indicators of an organisation. In spite of the fact that there was no evidence found of a direct significant relationship between KM practices and financial performance, the authors used organisational performance to mediate these two indicators. The research showed that KM practices were directly connected and had a positive influence on organisational performance which in turn had a direct relationship with financial performance. Therefore, the authors concluded that by applying KM practice in an organisation it is still possible to estimate if this practice increased financial performance.

The question of KM success being applicable to PBO was also considered by Davenport et al. (1998, cited in Ajmal, Helo and Kekäle, 2010). The authors, along with other factors of KM success, as well as Zack, McKeen and Singh (2009), considered the financial return of a KM initiative. According to the authors, in order to report about KM success there should be evidence of positive ROI for undertaken KM activity. Other indicators of successful implementation of KM practice which were considered by the authors were knowledge content development and project survival. Knowledge content development in the context suggested by the authors implies improvement in procedures and facilities that provides better and more convenient ways for accessing and further using the knowledge. Project survival, according to the authors, is the ability of a KM initiative to secure corporate memory and prevent knowledge drain in case of downsizing.

Thereby it is possible to conclude that KM success both in an organisational and in a project context should improve aspects of knowledge treatment at the same time as

being dependent on financial indicators which should provide economical performance.

2.6 Summary and main findings of literature review

The literature review provided a base for investigation of the research questions. Through the literature review were defined project success criteria and both PM and KM CSF that may secure successful project delivery and organisational performance. A certain overlapping of responsibilities between organisational PM and KM practices was discovered. Thus, certain responsibilities of PMO such as mentoring, managing of lessons learned, developing of policies and best practices, have correlation with approaches defined in the literature for managing knowledge. A number of problems regarding successful PM were defined as well: lack of competence of a project manager; lack of skilled and qualified staff; not learning from past experience; poor communication. Those problems, according to the literature review, could be overcome by using such KM approaches as: organising of training programmes; supporting knowledge transfer and sharing procedures; using a knowledge-based decision-making system; and using communication and KM tools. Also were defined that appropriate adjustment and successful functioning of KM in turn is dependent on such aspects of organisational culture as: supportive behaviour from upper management; high level of trust among colleagues; motivation system; rewarding system; and other supportive procedures regarding knowledge transfer and sharing.

Analysis of the literature on knowledge and project management also brought on the surface a certain gap between comprehensive background of KM theory and concrete improvements in terms of project delivery. Lack of empirical evidences describing connection between using of specific KM practices and achievement of better project results induced to conduct a detailed survey regarding this problem. It is therefore of great interest to investigate whether using of the KM practices can enhance successfulness of project delivery.

3 Methodology

3.1 Research approach selection criteria

In order to organise well structured investigation of a certain research problem it should be matched with selection of a proper research approach (Creswell, 2003). According to Creswell (2003) there are three main approaches that could be used for data collection. First, quantitative approach is appropriate when the problem considers factors that influence an outcome. As it was defined by Aliaga and Gunderson (2002, cited in Muijs, 2004, p. 1), quantitative approach is “explaining phenomena by collecting numerical data that are analysed using mathematically based methods or statistics”. Second, qualitative research, according to Creswell (2003, p. 22), is “exploratory and is useful when the researcher does not know the important variables to examine”. Third, mixed methods approach is useful to cover strong aspects of both quantitative and qualitative approaches. Spratt, Walker and Robinson (2004) distinguished between mixed method studies and multi-method studies. According to the authors ‘mixed method studies attempt to bring together methods from different paradigms’, while ‘multi-method studies use different methods of data collection and analysis within a single research paradigm’.

In respect to the present research, variables to be studied are clear, thus quantitative method is selected as dominant. Nevertheless in order to develop a detailed understanding regarding the problem, as a methodology, this thesis adopted a multi-method approach.

3.2 Research design

Questionnaire was used in tandem with interviews to clarify particular parts of the survey. First a survey was developed to test the research questions. According to the recommendations of Creswell (2003, p. 30), the literature review was used to provide direction for the research questions. Thus, the reviewed literature was used during the drafting of the theoretical framework in a deductive manner to help to compile the questionnaire and to compare the findings of the survey with the theoretical assumptions.

3.2.1 Quantitative data collection

After finishing the literature review, during a brainstorm session the preliminary question-set was defined. The first version of the questionnaire was tested on a pilot basis with one project manager, whereafter it was modified and improved. The new version of the survey used a ‘closed’ question format with two different types of questions – multiple-choice single answer questions and multiple-choice multiple answers questions. Fifty-two questions were composed in total.

The questionnaire was divided into six sections. The first section had a ‘checklist’ of questions, offering a range of answers and multiple responses. The section was

handled with ethical aspects of the survey and was compiled according to Northumbria University's and Chalmers University's regulations. Particularly, addressing ethical requirements the yes or no question was included - "I understand the purpose of this research and agree to participate". The second section contained general questions regarding organisation structure, number of employees, number of ongoing projects, etc. The third section considered questions related to organisational culture and particular approaches applied in an organisation for KM. The fourth section investigated whether organisations have a PMO or similar department and what functions it performs. The fifth section considered KM practices applied during the PM process and concrete KM tools that were used during this process. A final sixth section was compiled in order to determine improvements in organisational performance and PM processes that take place in an organisation. In the sections from two to six a Likert scale was adopted. Respondents were asked to read statements that were reflected different attitudes on different issues and to select the response. All measures were based according to respondents' perception, therefore they should be considered as subjective. Although there were limitations that existed in this approach, such measures are often used in researches (Zack, McKeen and Singh, 2009).

The survey questionnaire was compiled and posted electronically on the Web with free public access to it. Invitations to participate in the survey were posted on several professional portals and 230 invitations were sent on a private basis. A total of 47 completed questionnaires were received. Nevertheless, seven out of the 47 responses were identified as inaccurate, due to several reasons and were excluded: some parts were missing; all answers were answered with the zero score, according to the Likert scale, or companies were defined as non project-based.

3.2.2 Quantitative data collection

Among others techniques for data collection in qualitative research, such as observation and document analysis, interviewing was highlighted by Burns (2000) as the most appropriate technique in case if the researcher seeks to investigate the vision of the participants regarding the problem, therefore was used for this study. There are three types of interviews: structured, semi-structured and unstructured. Structured and semi-structured interviews imply using of a pre-defined set of questions which should be addressed in the same manner to all the participants. In turn, unstructured interviews, as it claimed by Denzin and Lincoln (1998), are able to provide closer contact with the respondents and to build an open discussion. According to the nature of the study the original assumption was to observe two groups of organisations, those who applying KM on more regular basis and those who are moderate. Nevertheless since every organisation have own and unique composition of the variables, unstructured interviews seems to be more appropriate since they give more freedom to the respondent to express his or her particular case.

Thereby, after collecting the statistical data, for clarification of some particular questions and to build more detailed understanding about the nature of KM processes in organisations, two additional unstructured interviews were carried out. The criteria for selection of respondents for these interviews were based on evaluation of the previously received responses. First all the responses obtained through the survey

were sorted into two categories: poor and good applications. Responses with a dominating number of answers that were evaluated by respondents as '3' and less on the Likert scale got a 'poor application' (further mentioned as organisation 'Omega') mark and a 'good application' (further mentioned as organisation 'Alpha') mark was granted for a prevalent number of answers with grade '4' and more. Afterwards there was an additional interview request sent to one of the respondents from each group. According to Creswell (2003) for achieving better results in mixed method approach should be used open-ended interviews. Nevertheless, due to respondents' capabilities in time, were conducted forty-minute and twenty-minute interviews with a participant from each group correspondingly.

Concerning ethical issues during the interviewing process, this thesis follows Northumbria's regulations and recommendations proposed by Denzin and Lincoln (2003). Both participants proved their consent to participate in the study by filling in the special form which was sent each of them before the interview. Moreover, no explicit identities are being published within this thesis.

3.3 Data analysis

The findings obtained both from the questionnaire and from interviews were compared with the theoretical framework and analysed. Interviewees were also asked to explain some of the preliminary findings obtained through the analysis of the statistical data. For analysis of the statistical data PASW® version 17.0 software was used. In order to examine the results of the survey, linear regression analysis and Pearson's analysis of correlation coefficient were used. The purpose of the analyses was to investigate the strength of the relationship between application of KM practices and project success. For the analysis both calculated mean values of each of the six sections were submitted and all of the independent variables to define particular practices that had the most significant correlation with project success. The braking point $p < 0.15$ is used for significance testing for each type of analysis. Regression analysis, being a statistical technique, was used for the analysis of numerical data and to establish a relationship between a dependent variable (in different tables represented either as a mean value of project success or as one of the project success factors) and one or more independent variables (KM practices and concomitant factors).

4 Results

Out of 230 sent invitations, 40 appropriately filled-in questionnaires were obtained, which represents a response rate of 17.39 per cent. Based on the frequency of using projects, three types of organisations were identified, the distribution of which is represented in Table 4.1. As can be seen from the table below, among the organisations that have participated in the survey, not all are entirely project based. Nevertheless, all organisations that have been analysed through the study use projects on a regular basis, and therefore can be considered as a PBO.

Table 4.1 Organisation type.

	Frequency	Percentage	Cumulative Percentage
Entirely project based	11	27.5%	27.5%
Mainly based on projects	13	32.5%	60.0%
Partly based on projects	16	40.0%	100.0%
Total	40	100.0%	

For the convenience of the research results interpretation, this chapter is divided into sections that correspond to the questionnaire's sections. The following approach was applied to represent the data in each section. First, statistical data are represented and described, followed, where appropriate, by the comments that were obtained through the interviews. Thus, the reader will have the opportunity to observe the results of the regression analysis and correlation between areas of KM and project success criteria.

4.1 Organisational culture

According to the literature review, organisational culture has a significant impact on both successful project delivery and KM. Six aspects of organisational culture that have the most important impact on the PM and KM performance are selected for analysis in the survey. These aspects, as well as their mean values and standard deviation, are summarised in Table 4.2.

High value of standard deviation demonstrates significant difference of organisational environment of the participants in the survey. Different adjustment of cultural aspects within organisations results in a different level of organisational performance. The impact of organisational culture aspects on successful delivery of projects is demonstrated in Table 4.3. The table represents both regression results and correlation indexes between independent variables that describe aspects of organisational culture and the dependent variable – mean value of projects' success calculated for each of 40 samples.

Table 4.2 Organisational culture.

Variables	N	M	S.d.
A1) Rewards system for introducing new ideas or information sharing	40	3.38	1.055
A2) Rewards system for collaborative work and help to the colleagues	40	3.10	1.057
A3) Free access to resources needed for knowledge sharing	40	3.98	1.025
A4) Low bureaucracy level with respect to knowledge-sharing activities	40	3.68	1.803
A5) Upper management openness	40	4.70	1.244
A6) High level of loyalty to organisation among employees	40	3.50	1.895

The obtained results demonstrate significant correlation at the 0.01 level between overall project success and 4 out of 6 independent variables (A1, A3, A4 and A6). Thus the employees' loyalty to the organisation ($b=0.32$) is one of the significant predictors of project success.

Table 4.3 Overall project success via organisational culture.

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
A1) Rewards system for introducing new ideas or information sharing	.492***	.126	.721
A2) Rewards system for collaborative work and help to the colleagues	.197*	-.040	-.285
A3) Free access to resources needed for knowledge sharing	.653***	.301	1.590*
A4) Low bureaucracy level with respect to knowledge-sharing activities	.555***	.197	1.289
A5) Upper management openness	.315**	.142	1.157
A6) High level of loyalty to organisation among employees	.599***	.325	2.557**

$$\Delta R^2=0.528, F(8.265)=6.33, p<0.0001$$

The regression analysis also shows that influence of organisational culture aspects explains 52.8 per cent of the variance in overall project success.

Table 4.4 represents the results of the regression analysis and correlation between those of the project success criteria and organisational culture aspects that show the

most significant correlations with those criteria. Thereby in order to obtain specific outcomes and make an improvement in a concrete area of projects' delivery the focus should be made on certain aspects. For example, in order to reduce employees' resistance to change the upper management should adopt more open politic (b=0.37).

Table 4.4 Selective project's success criteria via organisational culture.

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
Client Satisfaction ($\Delta R^2=0.185$, $F(2.476)=6.33$, $p<0.05$)			
A6) High level of loyalty to organisation among employees	.486***	.345	2.065***
Sharing of Organisational Values and Meeting of Strategic Goals ($\Delta R^2=0.265$, $F(1.983)=6.33$, $p<0.15$)			
A4) Low bureaucracy level with respect to knowledge-sharing activities	.401**	.327	1.575*
A6) High level of loyalty to organisation among employees	.437***	.312	1.808*
Acceptance of Change ($\Delta R^2=0.419$, $F(5.690)=6.33$, $p<0.0001$)			
A3) Free access to resources needed for knowledge sharing	.523***	.370	1.760*
A5) Upper management openness	.500***	.377	2.767**
Understanding Among Departments ($\Delta R^2=0.247$, $F(3.130)=6.33$, $p<0.01$)			
A3) Free access to resources needed for knowledge sharing	.426***	.314	1.312*
A6) High level of loyalty to organisation among employees	.429***	.290	2.177*
A5) Upper management openness	.344**	.338	1.802**
Avoiding of Corporate Memory Loss ($\Delta R^2=0.354$, $F(4.566)=6.33$, $p<0.01$)			
A3) Free access to resources needed for knowledge sharing	.570***	.347	1.566*

However, in spite of the observations made by Francisco and Guadamillas (2002), in this particular study organisational culture has shown poor support for creation of innovative solutions in organisations. It also has not shown any significant impact on the iron triangle aspects of project delivery.

4.2 Organisational learning

Eight aspects, including particular practices of organisational learning, were identified through the literature review as being the most significant and important regarding enhancing organisational performance and successful project delivery. These aspects, with their mean values and standard deviations, are represented in Table 4.5. As can be seen from the table, a very small number of organisations are assessing their maturity level and applying such standards as OPM3. This fact is further discussed below.

Table 4.5 *Organisational learning.*

Variables	N	M	S.d.
B1) Benchmarking	40	3.15	1.167
B2) Identification of best practices	40	4.10	1.105
B3) Assessing organisational maturity level	40	2.65	1.350
B4) Mentorship programme for new employees	40	4.70	1.114
B5) Organising of inside or outside training	40	3.93	.917
B6) Encouraging of participation in professional networks	40	4.05	1.568
B7) Employees' intention to participate in training	40	4.50	1.396
B8) Opportunities for professional growth (learning by doing)	40	4.25	1.354

The following Table 4.6 represents the influence of eight defined aspects of organisational learning on the overall project success mean value. Obtained figures demonstrate a significant effect on project success for four variables (B2, B5, B7 and B8) on the dependent variable. At the same time, only 'learning by doing' approach ($b=0.48$) can be considered as the significant predictor of project success. Thus, the figures show that most of the organisational learning practices do not secure successful project delivery. Nevertheless, an interesting observation was made during one of the interviews regarding assessing the level of maturity in the organisation. The interviewee from Omega was asked to explain why in his organisation, which is applying the OPM3 model, he still considered that there were a lot of improvements that should be done with respect to successful project delivery, and the answer was:

Applying the OPM3 model does not secure successful project delivery as it is, but it brings to the surface problems that exist in the company. After applying OPM3 we became more critical of the things we do.

Thus, the reason, why in cases of applying such organisational learning techniques as benchmarking and assessing of organisational maturity level the impact on project success is not significant, could also be explained by a more critical attitude of respondents towards their success.

Table 4.6 Overall project success via organisational learning.

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
B1) Benchmarking	.171*	-.014	-.096
B2) Identification of best practices	.384**	.244	1.608*
B3) Assessing organisational maturity level	.389**	-.016	-.103
B4) Mentorship programme for new employees	.197*	.042	.336
B5) Organising of inside or outside training	.533***	.228	1.436*
B6) Encouraging of participation in professional networks	.392**	-.090	-.551
B7) Employees' intention to participate in training	.422***	.182	1.344*
B8) Opportunities for professional growth (learning by doing)	.672***	.487	3.116***

$\Delta R^2=0.476$, $F(5.434)=8.31$, $p<0.0001$

Table 4.7, by analogy with previous Section 4.1, represents the results of regression analysis and correlation between those of the project success criteria and organisational learning aspects that showed the most significant correlations.

Table 4.7 Selective projects' success criteria via organisational learning.

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
Client Satisfaction ($\Delta R^2=0.155$, $F(1.787)= 8.31$, $p<0.15$)			
B6) Encouraging of participation in professional networks	.492***	.368	1.779*
Learning From Experience ($\Delta R^2=0.255$, $F(2.669)= 8.31$, $p<0.05$)			
B5) Organising of inside or outside training	.486***	.324	1.713*
High Level of Innovative Solutions ($\Delta R^2=0.246$, $F(2.589)= 8.31$, $p<0.05$)			
B5) Organising of inside or outside training	.522***	.407	2.140**
Acceptance of Change ($\Delta R^2=0.311$, $F(3.202)= 8.31$, $p<0.01$)			
B8) Opportunities for professional growth (learning by doing)	.563***	.653	3.639***

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
Understanding Among Departments ($\Delta R^2=0.227$, $F(2.433)= 8.31$, $p<0.05$)			
B4) Mentorship programme for new employees	.328**	.336	2.190**
B8) Opportunities for professional growth (learning by doing)	.493***	.501	2.639***

By running a regression which considers as dependent variable particular success criteria, such as client satisfaction level and understanding among departments, it became possible to define that independent variables B4 and B6 are also quite important for project success.

4.3 Project management office

The literature review shows that a PMO is not considered as one of the KM tools, nevertheless, some of the functions that it performs relate to the managing of knowledge. Six functions of a PMO are chosen for the analysis and are represented in Table 4.8. It also should be mentioned that only 17 out of the 40 organisations who participated in the survey use a PMO as such. Therefore statistical data for analysis of this part is limited to only 17 samples.

Table 4.8 PMO.

Variables	N	M	S.d.
C1) Project Portfolio Management	17	4.47	.874
C2) Management for project policies, procedures, templates	17	4.24	.831
C3) Development of project management methodology, best practices and standards	17	4.29	.920
C4) Analysing of previous projects, creation of feedback	17	4.29	1.047
C5) A mentoring platform for project managers	17	3.18	1.074
C6) A platform for introducing new ideas	17	3.41	.795

Table 4.9 demonstrates that project's success is not dependent on the functions that a PMO performs. Project success, in this table, considered as a mean value calculated for each of the seventeen available samples of organisations that have a PMO.

Table 4.9 Overall project success via PMO.

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
C1) Project Portfolio Management	-.192	-.096	-.269
C2) Management for project policies, procedures, templates	.023	.176	.534
C3) Development of project management methodology, best practices and standards	.063	.019	.057
C4) Analysing of previous projects, creation of feedback	.164	-.176	-.477
C5) A mentoring platform for project managers	.335*	-.244	-.709
C6) A platform for introducing new ideas	.639***	.866	2.282**

$\Delta R^2=0.146$, $F(1.456)= 6.10$, $p<0.30$

The figures show that variable C6 have a significant correlation with project success. Nevertheless the performed regression analysis shows that entire impact, of predicted formula which considers PMO functions, on project success ($p<0.30$) is exceed the braking point $p<0.15$ which is used for significance testing. However, by using t-test for comparing two groups of organisations that have and do not have a PMO, an interesting observation could be done. The results of the performed t-test are presented in Table 4.10.

Table 4.10 Organisations with PMO and without (t-test for Equality of Means).

Project success variables	<i>t</i>	<i>df</i>	Mean Difference
Overall Project Success	1.793*	38	.47110
Quality	1.943**	38	.660
Sharing of Organisational Values and Meeting of Strategic Goals	1.853*	38	1.077
High Level of Innovative Solutions	2.759***	38	1.453

Thus, from the table it is possible to observe that organisations that have a PMO show better results in respect to successful project delivery. Particularly those who have a higher rate of overall project successfulness; specifically, those organisations have a higher rate of innovative solutions and better quality of their products which also meet the strategic goals of such organisations.

4.4 KM practices

In addition to approaches of organisational learning and six practices applied for managing knowledge in a PMO, six more practices are defined in respect to managing knowledge within the PM process. These KM practices are summarised below in Table 4.11.

Table 4.11 *KM practices.*

Variables	N	M	S.d.
D1) Decision-making depends on feedback review	40	3.55	1.131
D2) Accessing the project manager work with facilitator	40	4.08	1.141
D3) Common activities among different project managers	40	3.45	1.280
D4) Common activities among different project teams	40	3.35	1.350
D5) Brainstorming sessions	40	3.63	1.148
D6) After-work activities	40	3.28	.987

Table 4.12 demonstrates results of regression analysis and correlation performed to facilitate the influence of KM practices on overall project success. According to the figures predictor variables which consider KM practices account for approximately 50% of the total variance in project success with the high level of significance ($p < 0.0001$). Particularly the figures show that applying a complex of KM practices, the significant importance in terms of project success are variables D1, D4 and D5 that also show high value of beta.

Table 4.12 *Overall project success via KM practices.*

Independent variable	<i>r</i>	<i>B</i>	<i>t</i>
D1) Decision-making depends on feedback review	.621***	.330	2.141**
D2) Accessing the project manager work with facilitator	.290*	-.008	-.044
D3) Common activities among different project managers	.218*	-.230	-1.056
D4) Common activities among different project teams	.495***	.439	1.724*
D5) Brainstorming sessions	.580***	.341	2.171**
D6) After-work activities	.274*	.019	.133

$\Delta R^2 = 0.495$, $F(7.375) = 6.33$, $p < 0.0001$

The results show that application of KM practices can improve seven out of ten project success criteria that have been defined. Table 4.13 represents these particular project success criteria and KM practices that are suitable for making improvement in each particular case.

Table 4.13 Selective project success criteria via KM practices.

Independent variable	<i>r</i>	<i>B</i>	<i>t</i>
Quality ($\Delta R^2=0.325$, $F(4.126)= 6.33$, $p<0.01$)			
D1) Decision-making depends on feedback review	.571***	.515	2.892***
D4) Common activities among different project teams	.517***	.327	1.111*
Client Satisfaction ($\Delta R^2=0.204$, $F(2.662)= 6.33$, $p<0.05$)			
D5) Brainstorming sessions	.549***	.472	2.389**
Sharing of Organisational Values and Meeting of Strategic Goals ($\Delta R^2=0.139$, $F(2.052)= 6.33$, $p<0.15$)			
D4) Common activities among different project teams	.395**	.619	1.864*
Learning From Experience ($\Delta R^2=0.334$, $F(4.262)= 6.33$, $p<0.01$)			
D1) Decision-making depends on feedback review	.626***	.513	2.897***
High Level of Innovative Solutions ($\Delta R^2=0.157$, $F(4.021)= 6.33$, $p<0.01$)			
D4) Common activities among different project teams	.506***	.816	2.759***
Understanding Among Departments ($\Delta R^2=0.317$, $F(2.210)= 6.33$, $p<0.15$)			
D5) Brainstorming sessions	.387**	.375	1.848**
Acceptance of Change ($\Delta R^2=0.586$, $F(10.196)= 6.33$, $p<0.0001$)			
D5) Brainstorming sessions	.718***	.552	3.874***

During discussion with the interviewee from Alpha few interesting thoughts regarding the problem of change and approaches that can help to reduce the resistance to change among employees emerged. Particularly the problem of education and professional trainings was debated. According to interviewee's opinion employees who participated in professional trainings are less resistant to change because after trainings they attain new skills. Nevertheless, according to the interviewee's opinion,

they may be afraid to fail in application of new methods therefore they still can be resistant to change.

4.5 KM tools

Implementation of KM practices in an organisation in correspondence with the literature review is often followed by integration of different KM tools that basically represent communication and information systems used for KM purposes. Two systems and three approaches are defined as being the most well recognised in KM literature and are represented in Table 4.14.

Table 4.14 KM tools.

Variables	N	M	S.d.
E1) Storing audio/video record of meetings	40	.15	.362
E2) Storing reports of meetings	40	.33	.474
E3) Storing e-copies of paper documents	40	.78	.423
E4) Using internal WEB-server/forum	40	3.23	1.459
E5) Using knowledge-based decision-making system	40	3.20	1.436

The results of regression analysis and correlation between overall project success and use of KM tools represented in Table 4.15 demonstrate its positive influence. Nevertheless, only factor E4, using internal electronic space, could be considered significant since only this factor also shows a high value of beta.

Table 4.15 Overall project success via KM tools.

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
E1) Storing audio/video record of meetings	.335**	.003	.017
E2) Storing reports of meetings	.451***	.303	2.126**
E3) Storing e-copies of paper documents	.489***	.238	1.678*
E4) Using internal WEB-server/forum	.576***	.351	1.839*
E5) Using knowledge-based decision-making system	.335**	.055	.312

$$\Delta R^2=0.397, F(6.138)= 5.34, p<0.0001$$

The results of regression analysis and correlation between individual project success factors and use of KM tools are shown in the following figures that are represented in Table 4.16.

Table 4.15 Selective Project's Success Criteria via KM tools.

Independent variable	<i>r</i>	<i>b</i>	<i>t</i>
Time ($\Delta R^2=0.048$, $F(1.392)= 5.34$, $p<0.15$)			
E5) Using knowledge-based decision-making system	.247*	.341	1.540*
Quality ($\Delta R^2=0.238$, $F(3.438)= 5.34$, $p<0.01$)			
E4) Using internal WEB-server/forum	.554***	.497	2.315**
Acceptance of Change ($\Delta R^2=0.243$, $F(3.507)= 5.34$, $p<0.01$)			
E3) Storing e-copies of paper documents	.504***	.456	2.874*
Avoiding of Corporate Memory Loss ($\Delta R^2=0.335$, $F(4.932)= 5.34$, $p<0.01$)			
E4) Using internal WEB-server/forum	.598***	.457	2.280**

The results also show that even in the case of an organisation which tries to rely on previous experience regarding its decision-making process, it is not always the case that such organisations use a knowledge-based decision-making system. Regarding this observation, the project manager from Omega was asked to comment on two facts: why he believed that revision of previous experience was still important, and what practices they used for it. His answers were:

Basically I know what I did before and remember a lot of things, so partly I just rely on my memory and common sense. Nevertheless, sometimes, especially after so many projects, memory gives you the wrong numbers, that is why I prefer to re-check them. It is true that we do not use any decision-making system as it is, but after finishing every project we try to discuss it in the PMO and define the weak and strong parts it. Thus, we create feedback that is further available for consideration.

Another interesting opinion regarding corporate memory was received from the interviewee from Alpha:

Data base can provide a supportive function in case of downsizing for colleagues who are aware of the topic. But data can't work. You should upload the data to someone's brain.

5 Discussion

The theory clearly shows that with KM practices it is possible to help to enhance organisational performance. Nevertheless, there is a significant gap for practitioners who decide to apply those theories. Particularly the theory does not answer the main question – which of the particular KM practices corresponds with improvement in a certain area of project performance, i.e. which of the variety of KM practices is applicable for achievement of each particular project success factor. For example, if a project manager believes that a certain improvement should be done regarding enhancing quality of projects, there should be a specific list of KM practices that can provide the intended effect. Based on the theoretical framework and obtained results, the following discussion helps to build understanding regarding this problem.

5.1 The iron triangle

Time, cost and quality as the three pillars which project management leans on still remain the most important aspects for assessing project success (Atkinson, 1999). Among others, often subjective measures of project success using the iron triangle are the most simple and direct way to assess project in terms of success. But what can help to improve these factors? The results of the research support the statement made by Love, Fong and Irani (2005, p. XIII) that KM can support and help to enhance delivery of projects in terms of time and quality. Moreover, the research answers the question as to what particular KM practices could be applied for that. According to the obtained results, one practice can be used for supporting the time parameter of project delivery and three for enhancing the quality aspect.

5.1.1 Time

There is no need to say that, during the years since PM emerged, the question of time and time planning as a main tool for its control were investigated and analysed from all possible perspectives. In spite of the fact that developers continually offer new and better software for time planning, the main principles and techniques remain the same. Therefore no breakthrough is foreseen in this area. That is why it is important to continue addressing these questions: how time for project delivery could be reduced, and what techniques can help to kept within the time limits.

The reviewed literature on KM, apart from abstract statements, does not provide a concrete answer to whether any correlation exists between project time delivery and a specific KM practice. Through the research were analysed 31 independent variables and only one demonstrated significant correlation and beta value with project time improvement. Thus, according to the performed analysis, the practice that can help to improve project time delivery is the use of a knowledge-based decision-making system (see Table 4.16). Interpreting this observation it is logical to conclude that a well-adjusted KM system is capable indeed of reducing time on searching discrete pieces of evidence which could be necessary for decision-making that in turn can reduce final project delivery time.

5.1.2 Cost

The research results provide no empirical evidence of the fact that any KM practices directly correspond with project cost. Nevertheless, due to nature of the iron triangle, the cost parameter is related with two others and therefore indirectly could be changed via variation of time and quality.

5.1.3 Quality

Compared to time and cost, quality is the least understood concept (Maylor, 2005, p. 61). As in the cases of time and cost, the reviewed literature does not provide any description of how project quality could be enhanced by the application of KM practices. Therefore, there were no anticipatory expectations that any concrete practice will emerge. Nevertheless, the research results show that project quality is dependent of three factors.

First, project quality can be enhanced if the process of decision-making on different levels involves revision of previous projects and consideration of feedback. Second, existence of an internal web-server/forum where employees can address their problems and discuss it with colleagues also demonstrates a positive impact on project quality. This could be explained in the way that such an approach helps employees to solve their task more effectively and to find solutions of problems through a certain type discussion. Third, common activities among different project teams also help to improve project quality. This factor is also in line with the previous observation since it is also a certain way in which employees can discuss difficulties that they face in projects and build a common solution.

5.2 Client satisfaction

Client satisfaction as a criterion for assessing project success initially emerged from the quality aspect and demonstrates the relationship between expectations and perceptions of clients (Shenhar, Levy and Dvir, 1997). As is sometimes said, 'you can not read another man's soul', still, according to the research results there are three factors of KM which can help to gain client satisfaction. First, organisations that can build a high level of loyalty among their employees demonstrate a higher level of client satisfaction as well. This could be interpreted in terms of employees' responsibility. Nevertheless, employees' loyalty is an environmental factor that is not so much used as a tool as considered as an additional factor that may increase effectiveness of the two other KM practices. Thereby the level of client satisfaction is correlated with the fact of participation of employees in professional networks and performing of brainstorm sessions. According to the literature on KM, professional certification and participation in professional networks is a powerful tool that at the same time secures high qualification level of employees and provides them with access to the knowledge pool with up-to-date information. Thus, a higher level of client satisfaction in such organisations could be explained by providing them with better and more modern services. Brainstorming activities are the last, but not least, aspect that may explain a high level of client satisfaction. According to the SECI

model, brainstorming is a tool that helps to formulate knowledge and transfer it from a tacit to an explicit form. Therefore, in terms of a project, such sessions can help to bring to the surface certain problems and, if the problem is formulated, it can be solved.

5.3 Sharing of organisational values and meeting of strategic goals

According to the literature review, one of the main problems in a PBO environment is to implement corporate objectives through projects. The literature also claims that application of a project maturity model such as OPM3 is able to bridge the gap between organisational strategy and project management. However, according to collected statistical data there is no evidence that application of those models has a significant impact on this success criterion. Nevertheless, citing the interview results in Section 4.2, this fact can be explained by a higher level of criticism towards the actions of the respondents who apply OPM3 or similar maturity models. Apart from those predicted, the three practices show positive influence on the factors of strategic goals meeting and organisational values sharing.

First, a low bureaucracy level in respect to knowledge-sharing activities according to the research might help. In case employees feel a necessity to communicate with their colleagues, low-level bureaucratic barriers – for example, for organising real or on-line meetings – creates an atmosphere which will promote the spreading of organisational ideas. On the other hand, judging this evidence objectively, it would be fair to presume that on a bigger number of samples this factor can become less significant and other factors may emerge. Second, employees' loyalty appears to be important when considering organisational values. Apparently this fact is self-explanatory, but additionally it can be explained by the desire of employees to be integrated into the organisation as much as it possible. Third, common activities among different project teams also support the delivery of organisational strategic goals and help the employees to be aware of the organisational values. By the analogy with the snowball effect, the process of spreading information in the organisation can be described as something that starts from a small initial state and then builds upon itself, becoming larger. Since in the case of a PBO the organisational structure is not grouped by functional departments, the standard up-to-down hierarchical distribution of information is not always efficient. Thus, communication across project groups becomes a significant and powerful tool for sharing knowledge and information.

5.4 Learning from experience

It is quite difficult to answer the question of why people are repeating the same mistakes. In an organisational context such behaviour can cause serious problems in terms of successful project delivery. The research results show that through analysis of previous projects and building the decision-making process based upon reviewing the obtained feedback, organisations can reduce a bad practice of repeating the same mistakes in different projects. Even if it sounds as simple as ABC, nevertheless,

according to the results, not all organisations pay high attention to this practice. As was highlighted during the interview (see Section 4.5), we might not always be sure about information that is stored in our memory and that is why it is better to re-check it with hard copy. Another practice that can enhance the process of learning from experience is organising of inside or outside training. It is not always the case that a person who is repeating the mistake does not realise that he or she is doing something wrong; sometimes it could be explained by the fact that this person just does not know how to do this thing in a right way. In this interpretation, training provides the basis for improvement; through education, employees can learn how to start doing things in a better way.

5.5 High level of innovative solutions

According to Shenhar, Levy and Dvir (1997), the sustainable development of an organisation from a long-term perspective implies creation of innovative solutions. At the same time as stressing the innovativeness, such a decision should be in line with organisational strategy and values. From the KM perspective, innovation is related to creation of new knowledge that has not existed or has not been used before. As for the practices that can help to enhance creation of innovative solutions, the research shows following results.

First, innovativeness shows correlation and appears to be dependent on organising professional training in the organisations, both inside and outside. With respect to innovativeness, such training often provides employees with modern and up-to-date information which hereafter could be refined and catalysed in the creation of new and unique ideas already inside the organisation. This fact is in line with the theory of knowledge life cycle model, according to which new knowledge can be drawn to the organisation through the knowledge acquisition process. This process implies the use of outside sources which, in this particular case, could be interpreted as using outsourced training. Another way to create new knowledge is the SECI process of knowledge externalisation and particularly one of its practices – common activities among different project teams. Thus, empirical evidence obtained through the study supports the theory. However, it is also fair to mention that, in spite of the fact that the SECI model also considers the socialisation process and such practices as informal gatherings, they have not shown any significant connection with innovativeness level in this research.

5.6 Understanding among departments

Not being exactly the criterion of project success, the existence of appropriate communication and understanding among departments in an organisational context is still important for successful project delivery. Fortune and White (2006) defined it as one of the crucial CSF that may secure successfulness of the project process. As could be expected, the environmental factors show the significant impact on level of understanding among departments (see Table 4.4).

First among the environmental factors is the openness of upper management, which implies low administrative barriers for contact and communication across all levels of the organisational hierarchy. The second environmental factor is a high level of employees' loyalty, which was discussed before. The third and final of the environmental factors, that shows causation with 'understanding among departments' success criterion, is free access to resources needed for knowledge sharing. All three factors together provide the picture of team spirit and informal communication. Nevertheless, it is necessary to mention that such an environment is mainly demonstrated by rather small organisations with no more than 200 employees. Thus, in the case of larger companies, such environmental implications might be not achievable. However, there is a tool that can be used both in bigger and smaller organisations. The results also show that the existence of a mentorship programme for new employees helps to build understanding between departments. During the survey no clarification was obtained regarding how exactly the mentorship programme was adjusted in each particular organisation, but the process of induction of new employees into the organisation shows its importance.

5.7 Acceptance of change

According to (Maylor, 2005, p. 382) 'many organisations cannot change until they are on the very edge of extinction'. Nevertheless, in a project context, during the execution process organisations have to carry out a variety of changes before the project will be closed. In order to secure the successful implementation of change, the resistance level should be decreased (Thomas, 2009a). The research shows that there are a certain number of KM practices that help to increase the level of acceptance of change among employees. Findings support the theoretical assumptions, specifically confirmation found for the three facts.

The first fact that is confirmed by the data is that upper management openness decreases the level of resistance to change. It is fair to admit that in cases where the employees can to some extent discuss change with upper management, they most probably will feel involvement in the change and, as a consequence, will be more acceptable to it. Second, brainstorming sessions as a technique for open problem solving where everyone involved in the process, also show causation of higher level of acceptance of change. The third practice which is correlated with acceptance of change is 'learning by doing' approach. Thus, organisations that provide opportunities for employees to build their skills and attain experience through participation in novel projects or, in other words, put employees every time into the different environment, also have a higher level of acceptance of change among their employees.

5.8 Avoiding corporate memory loss

The problem of corporate memory loss implies that organisations during turbulence and downsizing lose an essential part of their intellectual capital which is represented in knowledge possessed by employees. Considering such KM practices as knowledge sharing, transfer and storing, the most logical assumption that follows from the nature

of application of KM tools in the context of those practices is that such KM systems can help to avoid corporate memory loss. However, the research results show that correlation between using those practices and securing corporate memory is not as strong as could be expected.

First of all, it is necessary to mention that the facts of storing video and audio materials of meetings, e-copies of paper documents, or the use of a knowledge-based decision-making system, according to the results do not avoid corporate memory loss. Causation of securing of corporate memory according to the research is connected only with the use of an internal web-server/forum and ease of access to the resources needed for knowledge sharing. Thus, Figure 2.15 which represents the percentage of corporate memory distribution among different resources could be interpreted in the way that it is next to impossible to store more than 12 per cent of knowledge in a database, but it is easy to lose even that 12 per cent. It was also highlighted during one of the interviews that information and even knowledge stored in data base worth nothing in case if in the organisation there is no qualified enough staff that can interpret and understand this knowledge. Thus knowledge proved to be a people's oriented phenomenon.

5.9 Limitations

This study has a certain number limitations that could be addressed in future researches. First, the study has only examined 31 factors of KM while the literature provides an enormous and continually emerging number of KM practices for further investigation. It is fair to admit that there can be other factors that influence project success. For example, one of the emerging practices of KM that has been identified, but due to lack of referencing has not yet been investigated, is coaching. Future research can investigate practices that have not been covered in this research. Second, the study only examined whether organisations use various KM practices or not, without detailed investigation of whether those practices are applied with appropriate adjustment justified by the theory. It was taken for granted that organisations apply KM practices in accordance with theoretical recommendations, nevertheless, it might be not always be the case. Hence, future research by considering fewer factors can more deeply address the KM practices' quality implication issues. Finally, only 40 filled-in questionnaires were returned and only two follow-up interviews were conducted. Thus, on a larger number of samples, the research results might differ.

5.10 Contributions and implications

While many studies take the fact that KM can enhance organisational and project performance for granted (e.g. Thus, Love, Fong and Irani, 2005) and mainly investigate how KM practices can be improved, only a few studies have addressed the problem that KM practices really have a measurable impact on particular performance indexes. This issue was also highlighted by Kalling (2003), who encouraged further research that considered KM initiatives to place more stress on specific intermediate performance outcomes. Thus, this thesis is bridging the gap and builds understanding about which KM practices have connection with organisational performance and

particularly with successful project delivery. The nature of the conducted study allows the claim that the results could be used by practitioners as a guideline for integration of those KM practices that correspond with their particular tasks. The study also might help researchers to conduct more detailed and focused investigation, based on obtained results.

6 Conclusion

Over the last decade KM theory was rapidly developed and found a wide spread in many researches, books and articles. A lot of related theories emerged and KM practices were developed. At the same time in contemporary literature on KM there have, however, been only a few attempts to evaluate the extent of its usefulness in practice. Therefore, in some sense, the time has come when it is necessary to draw a line under the previous generation of researches that demonstrate a lack of clarification about which KM practices contribute the most. It is time to settle the understanding of what kind of KM approaches are appropriate in terms of specific organisational and project requirements.

The purpose in conducting this research was to address those issues and bridge the gap between application of particular KM practices and its contribution to the project success. Through the literature review have been identified best practices and approaches used in KM, as well as criteria of project success and CSF of successful project delivery. The variance of 40 samples were investigated and proved correlation and causation between some KM practices and criteria of project success. Particularly there were highlighted and investigated five areas of KM including organisational culture aspects, organisational learning approaches, PMO functions related with managing of knowledge, KM practices and KM tools.

The research results in general supported the theoretical findings highlighted in the theoretical framework. Among others factors, the results supported the importance of the SECI process in knowledge creation described by Nonaka, Toyama and Konno (2000). Through organisation of outsourced training and common activities between project teams, organisations appear to be able to bring in new knowledge from outside or to create it inside of the organisation. Moreover, those two ways of knowledge creation showed the most significant and positive correlation with level of innovativeness in the organisations. Another finding, which was supported by the results, is related with the theory of organisational change. It was proved in practice that an open problem-solving atmosphere, which could be created by application of brainstorm sessions and openness of upper management, is a positive influence in acceptance of change among employees. The research also has justified the statement made by Love, Fong and Irani (2005) that KM can reduce project time, increase product quality and avoid making the same mistakes. According to the results this can be achieved, particularly through revision of knowledge base with previous projects, using of knowledge-based decision-making system, organising of training programmes and collaborative activities among project teams.

Comparing theory with the research results, however, a few unexpected findings surfaced. First, in spite of the fact that the SECI model of knowledge creation also considers socialisation, with its significant role of informal gatherings, such activities do not help to achieve better project results, according to the obtained data. Second, an interesting observation was made regarding application of different maturity models in organisations, such as OPM3. Thus application of the OPM3 model has not showed significant impact on project success criteria. However, it could be explained by the fact that due to higher maturity, those organisations are more critical towards their own achievements. Third, functions that a PMO performs with respect to managing knowledge, per se, do not increase the successfulness of project delivery.

Although organisations that have a PMO are more successful in terms of: delivering strategic goals through the projects, the quality of those projects, and having a higher level of innovative solutions. Finally, a paradox of knowledge was revealed in respect to knowledge storage systems. Even if knowledge was successfully stored it does not secure that it will be applicable for further use, due to difficulties with understanding or misinterpretation by the recipient.

The main limitations of the study relate to the complexity of KM theory. Thus, during the study only 31 factors of KM were investigated, while the literature provides a significantly larger number of different approaches and practices for managing knowledge. Since 31 is still a large number for investigation of those factors, it was not too detailed or deep. It also was difficult to motivate people to participate in the survey, therefore the statistical data was limited with 40 samples. These limitations and newly raised questions should be addressed in further researches.

6.1 Further research

First of all, in order to build more detailed understanding and justify recent findings, additional research should be run on a larger number of samples. It could give possibilities to find additional correlations between the appropriate selection of KM practices, proved by project success, and specific organisational size, organisational structure, etc. Secondly, further research should investigate practices that have not been covered in this study. Particularly coaching seems to be an interesting area for investigation. Finally, more deep and detailed investigation of those practices that showed the most significant correlation with project success would be appropriate.

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9 Appendix A (Interviews)

Interview 1

Respondent 1:

Vladimir Sobchikov

Project Manager Alpha

With the interviewee were discussed following issues:

- **Corporate memory** (See the main text, Section 4.5).
- **Education and professional certification.** According to the interviewee there is a difference in the organisation in salary between certified specialist, who usually gain a higher salary, and non-certified specialist. In the interviewee's opinion such difference is justified since more educated specialists are more productive and often find non-standard and better solutions to the problem.
- **Resistance to change** (See the main text, Section 4.4).
- **Resources spent on education, and training programs.** The interviewee highlighted few concepts that authorities apply to enhance knowledge transfer and knowledge acquisition. Particularly were described and discussed inside and outside trainings. The organisation provides inside trainings which are aimed to transfer relevant knowledge among specialist from different departments for better performance and understanding. Along with inside trainings the organisation delegates employees on open seminars and trainings to outsourced organisations. The interviewee also mentioned that the organisation provides employees with free press such as professional journals which also helps to follow latest news in the industry and be informed about new solutions.

Interview 2

Respondent 2:

Dmitry Dolmatov

Project Manager Omega

With the interviewee were discussed following issues:

- **Informal activities.** According to the interviewee in his organisation authorities encourage employees to participate in activities apart from work process. Particularly were given examples and described following activities: a dancing club, a pool, a fitness club. The company also organise dancing competitions. According to interviewee's opinion such approach helps to build friendly atmosphere among colleagues, nevertheless sometimes shifts the focus of staff from work towards those competitions.
- **Socialisation.** As one of the examples, how organisation also tries to enhance communication among employees and to build friendly environment, the apartment house was literally built to accommodate the most talented employees.
- **Rewards system.** According to interviewee following practices are applied for rewarding employees: flats in the mentioned house, employee of the month, promotion, checks and money certificates, free tickets to concerts and cinema.
- **Organisational maturity assessment** (See the main text, Section 4.2).
- **Corporate memory** (See the main text, Section 4.5).

10 Appendix B (Questionnaire)

Ethical Part	
About The Questionnaire: This questionnaire as part of the dissertation research conducted in order to increase understanding in the area of successful knowledge management, and to define best practices that organisations use in knowledge management and how it influence projects. This questionnaire is a tool for collecting data for a university study and will not be used for any other reason. Please be aware that your answers will be confidential and only are used for conducting this study. All personal information obtained through this research will remain confidential unless you agree this information to be openly used.	
Contact Information: Researcher: Alexander Alekseev E-mail: alekseev@student.chalmers.se Tel: +46 765 839 170 Programme of study: MSc International Project Management University: Joint Master Program: Chalmers University and Northumbria University of Newcastle	
1	Name:
2	Organisation:
3	I understand the purpose of this research and agree to participate: Yes/No
4	I want to keep my anonymity: Yes/No
5	I want the name of the organisation to be confidential: Yes/No
6	In case you want to get results of this survey, please type your e-mail:
General Part	
1	What is your responsibility in the organisation? Knowledge Manager/ Project Manager/ Project Team Member
2	What best describes the structure of your organisation? Entirely project based/ Mainly based on projects/ Partly based on projects (e.g. project managers have limited authority)/ Organisation is not grouped by projects (e.g. grouped by functional departments)
3	How many employees do you have in the organisation? Less than 20/ Between 20 and 50/ Between 50 and 250/ More than 250
4	What is the average duration of employment in your organisation? Up to 1 year/ 1 to 3 years/ 3 to 8 years/ More than 8 years
5	How many projects do you run at the same time (on average)? 1-10/ 10-50/ 50-100/ >100

Organisational Culture	
What practises are used in your organisation in order to support knowledge transfer and sharing?	
1	Rewards system for introducing new ideas or information sharing <i>(e.g. money, employee of the month honour)</i>
2	Rewards system for collaborative work and help to the colleagues <i>(e.g. money, employee of the month honour)</i>
3	Free access to resources needed for knowledge sharing <i>(i.e. in case of necessity to share knowledge the organisation provides employees with resources and free time during work day or pays for overwork)</i>
4	Low bureaucracy level with respect to knowledge-sharing activities <i>(All procedures that support knowledge sharing are open, clear, and have a low bureaucracy level)</i>
5	Upper management openness <i>(e.g. any employee can directly talk to top management on a daily manner)</i>
6	High level of loyalty to organisation among employees
Organisational Learning	
What practises are used in your organisation for process improvement and employees' training?	
1	Benchmarking <i>(A benchmarking is the process of comparing one's business processes and performance metrics to industry bests and/or best practices from other industries. Dimensions typically measured are quality, time, and cost. Improvements from learning mean doing things better, faster, and cheaper)</i>
2	Identification of best practices <i>(The best practice is a technique, method, process, activity, incentive, or reward that is believed to be more effective at delivering a particular outcome than any other technique, method, process, etc. when applied to a particular condition or circumstance)</i>
3	Assessing organisational maturity level <i>(For example with the help of P3M3 or OPM3*. *The Organizational Project Management Maturity Model or OPM3 is a globally recognized best-practice standard for assessing and developing capabilities in Portfolio Management, Program Management, and Project Management)</i>

4	Mentorship programme for new employees
5	Organising of inside or outside training
6	Encouraging of participation in professional networks <i>(e.g. by paying for education or by increasing a salary of certified specialists)</i>
7	Employees' intention to participate in training <i>(Are employees glad to participate in professional trainings?)</i>
8	Opportunities for professional growth (learning by doing) <i>(The organisation provide the opportunity for employees to build their skills and attain experience through participation in novel projects)</i>
<p>Project Management Office (PMO)</p> <p>The PMO in a business or professional enterprise is the department or group that defines and maintains the standards of process, generally related to project management, within the organization. The PMO strives to standardize and introduce economies of repetition in the execution of projects. The PMO is the source of documentation, guidance and metrics on the practice of project management and execution.</p>	
0	We have a PMO or similar department in the organisation: Yes/No (In case if you answered "no" on this question please go to the next section)
1	Project Portfolio Management <i>(A projects portfolio is aggregated information regarding different projects gathered in one source in order to assist in the delivering of organisational strategic objectives. Portfolio management technique implies identifying, prioritising, balancing, controlling and other methods applied to multiple projects in a way of achieving concrete business strategies)</i>
2	Management for project policies, procedures, templates
3	Development of project management methodology, best practices and standards
4	Analysing of previous projects, creation of feedback
5	A mentoring platform for project managers
6	A platform for introducing new ideas
<p>Knowledge Management Practices in Project Management Process</p> <p>What KM practices you use during project management process?</p>	
1	Decision-making depends on feedback review

2	Accessing the project manager work with facilitator
3	Common activities among different project managers
4	Common activities among different project teams
5	Brainstorming sessions
6	After-work activities
<p>Knowledge Management Tools</p> <p>IT based Communication Tools (ITCT): Intranet; Data Base; Trouble Shooting / Problem Tracking System (TS/PTS))</p> <p>What of the following knowledge management tools you use in your organisation?</p>	
1	Storing audio/video record of meetings
2	Storing reports of meetings
3	Storing e-copies of paper documents
4	Using internal WEB-server/forum where all employees can discuss different issues with their colleagues, share their knowledge, and help to each other.
5	Using knowledge-based decision-making system, based on previous feedbacks from different projects.
<p>Projects Delivery and Organisational Process</p> <p>What positive tendencies you may highlight in terms of improvement of a project management process in your organisation?</p>	
1	We have a positive tendency of improvement of a project delivery process in terms of: Time
2	We have a positive tendency of improvement of a project delivery process in terms of: Cost
3	We have a positive tendency of improvement of a project delivery process in terms of: Quality
4	Our clients are very satisfied with the procedures we have and the deliverables we provide.
5	Every project we undertake is inline with organisational strategy.
6	We are learning from experience: not making same mistakes again and avoiding "re-invention of the wheel" in our organisation.
7	There is a high level of innovative solutions in our organisation.
8	We have a high level of understanding among different departments in our organisation.
9	Implementation of changes in our organisations does not face any resistance from the employees.
10	In case of downsizing most of an employee knowledge keeps in the organisation in a certain form (organisation don't loose the knowledge that an employee possess).