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**COURSE: Knowledge Management System
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Faculty: Hari Ram Vishwakarma SLOT: F2

**Project title: Creating Knowledge Management System for project-
based organizations- Automobile Ordering System**

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Abstract

The current study is driven by the growing importance of learning capabilities within organizations. Nowadays an ability to constantly develop and improve based on mistakes and broadly apply successful experience is becoming a strategic competitive advantage in highly competitive business environment. This is even more relevant for project-based organizations, where natural specifics of project activities impose higher requirements in regards to their ability to learn quickly.

At the same time, despite the existing number of recommendations there are only rare cases of successful systemic application of knowledge management activities in project based organizations. Thus, additional exploration of the topic is required through identification of critical factors that influence implementation process.

From this standpoint an exploratory research has been conducted, including an exhaustive literature review and a qualitative case study in a single company, complemented with additional interviews in ten other organizations. The combination of scrupulously summarized theoretical insights from the existing extensive range of academic research and the data obtained empirically resulted in a comprehensive theoretical framework. This framework depicts all the recommended elements that need to be incorporated into a project-based knowledge management system, as well as a list of critical factors, which should be considered while rolling out a system in practice.

The current study revealed some new factors, which critically influence the success of project-based knowledge management systems implementation. These new findings are also included into the final framework and supposed to help to eliminate the existing confusion regarding the topic. Therefore, the produced comprehensive framework is highly recommended for practitioners as a starting point for planning their knowledge management system implementations projects. It also suggests further exploratory opportunities.

Key words: Knowledge management, Lessons Learned, Project-based organizations, Knowledge management system. ent

1.1. Background of the research problem

It is broadly accepted that for businesses knowledge is a vital source of competitive advantage in dynamic contexts (Connell et al., 2001, p.48). Organizations can and need to capitalize on learning from experience: the usage of knowledge from previous activities helps to avoid waste of time and reduce costs. Thus, it is becoming an increasing concern for management to understand how knowledge flows may be managed and how knowledge or expertise may be leveraged (Connell et al., 2001, p.53). These efforts to enable knowledge identification, sharing, application and creation within the organizations are considered a Knowledge Management (KM) (Pemsel et al., 2014, p.1413).

The KM theory has already passed through several stages with the focus of the studies moving from one dimension to another and with organizations choosing various KM strategies (Nicolas, 2004, p.23). In spite of numerous attempts of companies to embed knowledge management systems (KMS) into their operational processes, in reality the success is rare and not that prominent as expected: the failure rate of KM initiatives is estimated from 50 to 70% (Akhavan et al., 2005, p.1).

Back in 1999 Hansen et al. (1999, p.106) argued that knowledge management as a conscious practice was still immature and executives lacked successful models to use as guides. After almost two decades the issue appears to be the same: KMSs still may miss some essential elements or incorporate redundant ones, or not everything that is required is done in the right way when the KM is being implemented.

From project management (PM) point of view, the role of KM is also widely recognized. It is believed that projects provide excellent preconditions for creating new knowledge: they are highly focused, fast and autonomous (Sydow et al., 2004, p.1481). Project-based organizations (PBOs) are considered to be effective at integrating different types of knowledge and skill and coping with the project risks and uncertainties, however, they can hinder knowledge retention and sharing as well as impede promoting organization-wide learning (Hobday, 2000, p.871; Sydow et al., 2004, p.1475; Peltokorpi & Tsuyuki, 2006, p.36).

1.2. Research gap

The area of KM in project-based organizations can be considered quite mature with many academics addressing and exploring its various aspects. However, two research problems can be identified in the existing research:

- *Excessive diversity of approaches with little specification on PBOs.* In spite of the multiplicity, suggested frameworks and approaches rarely fulfil KM needs of organizations fully and comprehensively (Rubenstein-Montano et al., 2001, p.5). Moreover, these approaches to KMS do not usually consider distinguishing features of PBOs, such as their temporary nature and fragmented structures with differing values and knowledge. Thus, organizations of such type require a framework for systemic knowledge accumulation that would take all this specifics into the consideration (Todorović et al., 2015, p.773).
- *Insufficient understanding of success factors and obstacles that appear while implementing project-based KMs in practice.* There is a gap between the theory and the practice of implementing KMS: practitioners rarely understand all the implications of the process (Nicolas, 2004, p.20). On the one hand, there is little evidence about relevant success factors (Terzieva, 2014, p. 1095). On the other hand, reasons why KMS are not successful are under-researched (Atkinson et al., 2006; Keegan & Turner, 2001; Kerzner, 2009; Klakegg et al., 2010; Milton, 2010; Schindler & Eppler, 2003; Williams, 2008; Wysocki, 2004, 2009, cited in Duffield & Whitty, 2015, p.311). In general, there is a lack of practical advice regarding successful and effective implementation of KMS (Duffield & Whitty, 2015, p.312).

1.3. Research question and research objectives

Hence, the research question can be formulated the following way:

How could knowledge management systems be implemented in project-based organizations in a successful way?

In order to answer this question, the researchers need to reach the following objectives: 1. to investigate frameworks and approaches to KM in project-based organizations suggested in academic literature; 2. to identify major elements of a successful KM system in PBOs; 3. to elaborate a comprehensive theoretical framework for implementing KMS in PBOs; 4. to identify major obstacles for successful implementation of KMS in practice; 5. to complement the framework with a sufficient list of critical factors that organizations and individuals should consider while trying to implement project based KMS.

1.4. Intended contribution

It is expected that achieving the above-mentioned objectives and answering the research question will bring both theoretical and practical contribution. On the one hand, the researchers aim to eliminate confusion between numerous existing approaches and elaborate a comprehensive model that could facilitate the success of implementing KMS in project-based organizations and decrease chances of its failure. It is expected that this new model will inspire further research in the area of knowledge management in the era of projectification.

On the other hand, the framework will be useful for practitioners as a reference point for creating and implementing new KMS in project-based organizations and evaluating the existing ones. In addition, the study will give an overview of how project-based KMSs in practice within different geographical and industrial contexts.

1.5. Introduction of the case

The choice of the unit of analysis, i.e. what the case study is focusing on, such as an individual, a group, an organization, a city, and so forth (Berg, 2001, p.231) is determined by the research question and by the researchers' intention to analyse the real-life event. For the current study, the unit of analysis is the knowledge management system that exists in the Company Z, in particular, in its Professional Services Division. The Company Z is a mature project-based organization, which undergoes reorganization processes and as a part of it develops further its KMS. This case is considered representative; therefore, it can be used to represent a typical project-based organization with characteristic impediments inherent in its KMS (Yin, 2009, p.48).

1.6. Relevant concepts

The key theoretical concepts are used in the current document as follows:

Knowledge - *“a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information”* (Davenport & Prusak, 2000, p.5).

Explicit knowledge - formal and systematic, expressed using a system of language, symbols, rules, objects, or equations, which make it possible to share and communicate to others in the form of quantifiable data, written procedures, universal principles, mathematical models, etcetera (Nonaka, 1991, p.98; Nemati et al., 2002, p.145).

Tacit knowledge - highly personal; it is deeply rooted in action and an individual's commitment to a specific context, and consists of includes beliefs, perspectives, and mental models, subjective expertise, insights and intuitions, and partly technical skills, so-called “know-how” (Nonaka, 1991, p.98; Nemati et al., 2002, p.145).

Knowledge management - a systematic process for creating, acquiring, disseminating, leveraging and using knowledge to retain competitive advantage and to achieve organizational objectives (Nicolas, 2004, p. 20).

Knowledge management system (KMS) - application of IT systems and all other organizational resources to manage knowledge strategically in a more effective and systematic way (Sankaran & Kouzmin, 2005, p. 287).

Project-based organizations (PBOs) – both pure project-based firms where the project is the primary unit for production organization, innovation and competition AND those organizations that may deploy both project-based divisions as well as functional divisions (Hobday, 2000, p. 874; Turner & Keegan, 2000, p.132).

1.7. Outline of the Master's Thesis

This Master's Thesis consists of seven chapters.

Chapter 1 introduces the research topic and highlights its importance. It starts with a summary of the current state of the academic research on the topic and identification of the gap in the existing literature. Then, the research question, its objectives and unit of analysis are presented. Finally, the structure of the thesis is outlined.

Theoretical research methodology is covered in Chapter 2. There, the underlying assumptions of the research are explained using the research onion layers: research

philosophy, research approach, research strategy, and research design. These layers are aligned with each other and with personal views and attitudes of the researchers.

In Chapter 3 “Literature Review” the theoretical basis for the research is set, which aims to deepen the understanding of its main concepts: knowledge management and project based organizations. For this purpose, knowledge is conceptualized and its growing importance for organizations is explained with an emphasis on project-based firms. Following this, different approaches to implementation of KMS are presented with description of specifics of this process in project-based organizations, including review

of most common obstacles in practice. Based on this review, the researchers identify the gap and present a framework that will guide the research.

Chapter 4 “Empirical Methodology” justifies the selection of the case as well as the choice of data collection techniques. The researchers describe data analysis strategy and their approach to data reduction and display. The Chapter also touches upon reliability, validity and ethical considerations within the research.

Chapter 5 “Findings” starts with presenting the Company Z chosen for the case study. Then a detailed evaluation of the gathered data is offered in an attempt to identify patterns within the results obtained. First, the findings regarding KMS in the Company Z are discussed through comparison and aggregation of the information collected during all the interviews. After that, the data about complementary organizations are analysed, and the findings are merged with the results for the Company Z.

Chapter 6 “Discussion of the findings” compares the gathered empirical data with the initial theoretical framework elaborated on the grounds of the literature review and suggested in Chapter 3. Based on this comparison, the revised version of the framework is presented, on the one hand, as an attempt to fill the gap identified in the existing academic research, and, on the other hand, as a way to seal off a breach between numerous theoretical approaches to implementing KMS in PBOs and its unsuccessful realization in practice.

The last Chapter 7 “Conclusions” gives an overview of the study and provides an answer to the research question, proving that the research objectives set in the first chapter are accomplished. The chapter also covers theoretical and practical implications of the research as well as its limitations and suggestions for further research.

2. THEORETICAL RESEARCH METHODOLOGY

This chapter describes and justifies the theoretical methodology used by the researchers in the current study. The methodological framework follows the research ‘onion’ approach suggested by Saunders et al. (2009, p.108) moving from the research philosophy to strategy and design, as well as aligning all these layers with each other and with the nature and objectives of the research.

2.1. Research philosophy

Considering the theoretical research stances of the study, the departing point is to define the research philosophy, as it contains important assumptions about the way in which the researchers view the world and further it will underpin a research strategy and the methods chosen (Saunders et al., 2009, p.108). These choices determine the way the research is done, i.e. whether the data are collected to test existing theories or to build new one (Bryman & Bell, 2015, p. 20).

2.1.1. Ontology

Ontology is a philosophical stance, which is concerned of what is the social nature of the world, the reality in which the researchers exist (Bryman & Bell, 2015, p. 32; Ritchie

et al., 2014, p. 4). The focal point is to understand if social entities should be seen as objective entities in a reality external to social actors, or if social phenomena are created by perceptions and actions of social actors (Saunders et al., 2009, p.110; Bryman & Bell, 2015, p.32). These two different positions are the most frequently referred to as objectivism and subjectivism or constructionism (Saunders et al., 2009, p.110; Collis & Hussey, 2013, p.47; Bryman & Bell, 2015, p. 32). In this case, an objectivist view states that social phenomenon existence is independent of social actors concerned about it (Saunders et al., 2009, p. 110). In contrast, a constructionist's ontological position incorporates a viewpoint that social phenomena and their meanings are continually being accomplished by social actors (Bryman & Bell, 2015, p. 33).

Since the focus of the current study is on knowledge management systems, as on social phenomena, which are based on humans' interaction and are dependent on changing environment of an organization, it is possible to conclude that the study adopts a subjectivists viewpoint as it is defined in the paragraph above. Moreover, in order to reach the research objectives, it is required to get specific individuals' interpretations and to analyse them in order to define trends and summaries. Therefore, while analysing data the researchers are dependent on the social actors (interviewees) and on themselves as those who interpret results. This consideration is another factor in favour of the ontological position defined above.

2.1.2. Epistemology

After defining the position of how to see the reality, the next question is how to study this reality. This is called an epistemological consideration, and the issue here is to define if the social world should be studied applying the same principles and procedures as the natural sciences (Bryman & Bell, 2015, p. 26). This choice within the epistemological consideration is driven by the decision of what constitutes acceptable knowledge in the field of study (Saunders et al., 2009, p.112). There are four epistemological positions discussed in academic sources: positivism, realism, interpretivism and pragmatism (Saunders et al., 2009, p.109). Positivism and interpretivism can be placed on different poles. While positivists consider as acceptable knowledge only phenomena that can be objectively observed and measured; interpretivists believe that validity of knowledge depends on the researchers' individual beliefs and requires the social researches to grasp the subjective meaning of social actions (Collis & Hussey, 2013, p.47; Bryman & Bell, 2015, p. 29). Saunders et al (2009, p. 116) argue that an interpretivist approach is the best suitable for the business and management research, where it is required to enter the social world of the research subjects and understand their world from their point of view. Another epistemological position is realism, which similarly to positivism relates to scientific enquiry (Saunders et al., 2009, p.114). The essence of this viewpoint is that the reality is independent of the human mind and is separate from the description of it (Bryman & Bell, 2015, p. 29). Then, in cases when the choice of the epistemological position is not clear, pragmatism may be applied, resulting in variations in epistemology, ontology and axiology as long as they help to answer a particular research question (Saunders et al., 2009, p. 109).

For the current research, following the justification of the ontological position and the definitions provided above, the researchers adopt an interpretivist epistemological position. This statement is based on the fact that for the current study qualitative data is collected through interviews and the researchers are about to make conclusions dealing with subjective meanings of a particular social act captured from different social actors (Collis & Hussey, 2013, p.47; Bryman & Bell, 2015, p. 29). In this way, interpretivism is used to seek the meaning of the phenomena through the analysis with the purpose of creating the pattern, which may be repeated in other similar situations (Collis & Hussey, 2013, p.47), and this coincides with the aim of the current study. Further it is supported by the researchers' focus on the views and opinions of research participants during data collection and analysis. Therefore, interpretivist stance is a preference as participants' worldviews regarding the topic of interest are studied and analysed to identify ground concepts and connections between them (Bryman & Bell, 2015, p. 30).

2.1.3. Axiology

Before moving to the discussion of particular methods and approaches, it is topical to define the role of the researchers' values in the research process as one of the foundation stones for its credibility. This philosophical stance about the role of value in studies is called 'axiology' (Saunders et al., 2009, p.116). For the axiological perspective the position of the researchers is defined in line with the chosen ontological and epistemological stances. Following the presented above considerations regarding the adopted interpretivists positioning and dependence of the results of the research on the subjective perceptions of both research participants and researchers themselves, it is obvious to acknowledge that the research design may be impacted by the researchers' preconceptions. Biedenbach and Jacobsson (2016, p. 150) state that any research is driven by the 'personal' values of researchers that, consciously or unconsciously guide the research process. They argue that an explicit treatment of this type of values is almost non-existent, and the target of being non-biased is practically unreachable.

At the same time, even given the stated above, but knowing that all stages in the research process are demonstrating researchers' values, it is important to be aware of this influence and to try to find the way to avoid biases.

Therefore, the researchers understand that their background and personal world and professional views have impacted their attitude to the current study. Both researchers have academic and practical experience in the area of project management. One of the researchers has relevant professional certification (Project Management Professional by Project Management Institute, USA). Moreover, both researchers have an experience managing people and teams in organizations of different size. The subject areas of implemented projects vary from the reformation of public health care and business change management projects to technical software development. Based on these the researchers consider themselves as familiar with the nature of knowledge sharing and lessons learned distribution in practice.

Thus, they try to exploit this influence by critically assessing planning and design of the study in the most holistic way possible. The authors focus on exploitation of own biases

since under interpretivists position the research is value-bound anyway (Saunders et al., 2009, p.119). Therefore, the researchers acknowledge the impossibility to reach the highest level of objectiveness, but they still try to present credible results, which bring new perspective within the topic studied. One of the factors, which can contribute to increasing the credibility of the study, is that researchers are from different countries (Russia and Ukraine) with professional and personal backgrounds in completely different areas, what allow having a broader and more comprehensive vision of the research topic.

For the study itself, the significant number of academic sources was analysed in order to embrace most part of available diversity of views and beliefs regarding the topic discussed. For the practical part, even though the companies selected were predefined by the contacts available, the sample created still reflects the satisfying diversity in terms of geographical location and areas. Then, the interviews were designed in a way to include all the aspects regarding the targeted topic which the researchers could define from the academic sources and cases reviewed. All this, from the researchers' point of view, helps to achieve the required level of objectiveness in the current study to make the final outcome as credible and applicable in practice as possible. The practical value of the expected outcome is mutually shared by the researchers, and in this case is considered as a favourable factor for the research and its outcomes.

2.2. Research approach

Continuing the journey within the layers of the theoretical research methodology, the next step is to define the way how to connect the research with theory in the current study. The most popular ways of establishing truth as a result of research in order to draw conclusions are induction and deduction (Ghauri & Gronhaug, 2010, p.15). It is acknowledged that a deductive approach is focused at the revision of a theoretical framework from existing views by testing related hypothesis. An inductive research suggests development of theories from an observation of a particular phenomenon, which results in generalisation of findings (Collis & Hussey, 2013, p.7; Bryman & Bell, 2015, p. 23; Saunders et al., 2012, p.124-125). Moreover, according to Ghauri and Gronhaug (2010, p.15) "induction is based on empirical evidence, while deduction is based on logic". The common position is that deduction is more connected to a positivist approach while induction is closer related to interpretivist view (Saunders et al., 2009, p.124).

Despite this clear theoretical separation, the reality is different and rarely only one of the approaches is clearly followed. Ghauri and Gronhaug (2010, p.16) state that most researchers and scientists believe that they have been using both approaches in their research. Partly caused by this heterogeneity, abductive mode of reasoning is gaining popularity among business researches and in other social scientific disciplines (Bryman & Bell, 2015, p. 27). The purpose of this way of reasoning is similar to inductive and deductive approaches, that is to make logical inferences and build theories, at the same time, abduction is considered a way to overcome the limitations associated with the other two positions (Bryman & Bell, 2015, p. 27, Dubois & Gadde, 2002, p.559). This is achieved by scientists through an iterative back-and-forth application of both empirical data and the literature sources (Dunne & Dougherty, 2016, p. 149). By its nature, abductive reasoning is a form of reasoning that starts with a puzzle or surprise from

empirical evidence which cannot be explained by the existing theory, and then generates and evaluates hypotheses in order to make sense of puzzling facts (Bryman & Bell, 2015, p. 27; Dunne & Dougherty, 2016, p. 131). Therefore, in abduction, the study begins with the rule and the observation, after that the explanation is inferred if it accounts for the observation in light of the rule, making the observation less puzzling, turning surprising facts into the matter of course (Mantere & Ketokivi, 2013, p. 71-72).

The nature of the gap within the subject area identified by the researchers earlier allows concluding that the applied relationships between the theory and the research have distinctive features of abductive research. In particular, the surprising fact is that despite the existence of numerous studies and recommendations regarding KM, majority of companies still fail to implement these practices successfully. Moreover, in an attempt to generate recommendations and suggestions about the ways to eliminate potential obstacles and exploit success factors, many academics deliver results that are differently oriented and sometimes seem confusing. Hence, application of the abductive way of reasoning is to help the researchers to select the most relevant explanation from competing explanations or interpretations of date (Mantere & Ketokivi, 2013, p. 81). In particular, the researchers try to select the most relevant and effective ways to increase chances for successful implementation of KM in project-based organizations, obtaining findings through iterative application of literature and empirical data gained from interviews. Such iterative process aims to cross-check the findings from the sources of different nature and to use them to explain the initial surprising fact defined as the gap.

2.3. Research strategy

Current research is mostly practice-oriented, since its objective is to contribute to the knowledge of specific practitioners responsible for a specific practice (Dul & Hak, 2008, p.30). In the present case, such practitioners are organizations that operate in a project-based environment, as they need knowledge to solve or clarify a “problem” of their knowledge management systems being unsuccessful.

According to the classification presented by Ghauri and Gronhaug (2010, p.56) and Saunders et al. (2009, p.139-140) the current research is considered exploratory. The researchers aim to draw an accurate picture of the situation (i.e. knowledge management system in a project-based organization, its impediments and critical factors), however, their main task is to clarify understanding of the problem and find new insights into it (Saunders et al., 2009, p.140), in particular: through identifying barriers that lead to the

failure of KMSs to suggest more specific ways to overcome existing problems and create successful systems. Following the typology of Weathington et al. (2012, p.43) the current study can be also considered confirmatory, since the authors aim to check the validity of existing theories (confirm or refute it) based on the obtained data, and their findings can influence a theory as well as serve as a guide for additional research.

Research can be conducted using either quantitative, qualitative or mixed methods, which all play a valuable role in both theoretic and scholarly investigations (Walle, 2015, p.22). Quantitative and qualitative approaches allow reaching different

objectives: while the former addresses better questions of prevalence, generalizability, and calibration, the latter is mostly used for description, interpretation, and explanation (Lee, 1999, cited in Bluhm et al., 2011, p.1870). In qualitative research data collection and analysis focus on non-numerical data, i.e. texts or visual images, without involving quantification techniques (Cassell et al., 2006, p.162), while quantitative methods tend to rely upon mathematical and statistical analysis (Walle, 2015, p.24). For the current study the authors chose the path of qualitative research due to their desire to address the complexity of the phenomena, to focus on its rich description rather than on its quantification and to suggest some new perspective to existing research (Weathington et al., 2012, p.398).

This choice was in large part determined by the main defining characteristics of interpretive qualitative research: (i) its occurrence in the natural setting of the organization; (ii) origination of qualitative data from the participant's perceptions of his or her experiences; (iii) its reflexivity in regards to the changes of design of the data gathering and analysis during the research process; (iv) not standardized methods of qualitative data collection and analysis; (v) a generally accepted researcher bias; and (vi) the reduction of data to produce meaning from the data (Lee, 1999, 27-28; Bluhm et al., 2011, p.1871).

In addition, qualitative research does not require high degree of manipulation with the phenomena being investigated, neither does it require strict control and systematization of the data gathering process, thus this approach seems to be more appropriate for the current situation in contrast to scientific/quantitative research (Walle, 2015, p.1).

The authors acknowledge that given the possible ambiguity of the object of study (i.e. knowledge management systems), qualitative approach may provide less rigour in comparison to traditional quantitative research, but in this case they aim to achieve more realism and relevance in regards to successful implementation of KMSs in project-based organizations (Gummesson, 2006, p.173).

2.4. Research design

Each research project has unique characteristics and poses specific challenges; therefore, researchers need to create a specific research design, i.e. a plan for collecting the data using empirical techniques that would allow them to answer research questions (Weathington et al., 2012, p.74). There are three main requirements to a good research design: (a) efficiency in terms of producing the best-quality data by using the least amount of time, effort, and money; (b) elimination of factors that bias the results; and (c) usefulness of generated data to clearly address the research question and account for alternative explanations (Weathington et al., 2012, p.216).

Research can be accomplished in a number of different ways: experiment, survey, case study, action research, ethnography, grounded theory, archival research, etc. (Saunders et al., 2009, p.141). The choice of research design depends on the type of research question, the control of the researcher on behavioural events, the focus on a current or a historical phenomenon and the type of information needed (Ghauri &

Gronhaug, 2010, p.110).

In order to investigate how KMS could be successfully implemented in project-based organizations, the researchers opted for case study design, which can be defined as “analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more method” (Thomas, 2011, p.513). It is an in-depth look at a particular event or series of events, usually presented in a narrative form that tells a story in an informative and, typically, in a didactic manner (Walle, 2015, p.30).

As an inquiry, case study research can focus on any of the following purposes (or their combination): describing, understanding, predicting, and/or controlling the individual (i.e., process, animal, person, household, organization, group, industry, culture, or nationality) (Woodside, 2010, p.1). Since the current research aims to answer how and why questions, its main objective can be determined as description and explanation. However, this study does not attempt to forecast short- and/or long-term events or behaviours in this or similar case, neither does it tries to influence KMS being studied, therefore, the current research does not pursue the objectives of prediction and control (Woodside, 2010, p.11).

Thus, the application of other designs for this study was ruled out based on two strategic decisions made by the researchers: the degree of manipulation and the degree of control. On the one hand, inability to manipulate the situation (i.e. knowledge management process and its participants) in this study makes it impossible to use experiment. On the other hand, the survey does not meet the researchers’ objective to qualitatively analyse the obtained data, even though such design also studies instances in their real life context (Dul & Hak, 2008, p.5).

This logic is in line with Yin (2009, p.8-9) who suggests to justify research design based on three conditions: the type of research posed, the extent of control an investigator has over actual behavioural events and the degree of focus on contemporary as opposed to historical events. Following this approach, case study method is seen as the most appropriate one compared to experiments, surveys, histories or archival analyses.

It can be specified that the current study follows the single-case holistic design (Yin, 2009, p.46), investigating the case of knowledge management system within the context of one company Z (its selection is described further in this document).

In addition, the researchers plan to use the distinctive feature of case study research, which is a virtual absence of specific requirements guiding case research (Meyer, 2001, p.329), in order to tailor the design and data collection procedures to their research questions. However, such lack of explicit steps and standard procedures to create and test theory in case study research is often criticized (Woodside, 2010, p.20; Taylor et al.,

2011, p.303). In order to avoid developing a poor case, the authors refer to the principles suggested by Woodside (2010, p.398) to support the usefulness for theory creation, doing valid research, and implementing successful practice (i.e., workable

implemented strategies), in particular: following systems thinking, looking for multiple party participation, consideration of the context, etc.

Another criticism of case study research concerns inadequate replications to support either generalization or practical relevance to aiding decision-making in other contexts (Woodside, 2010, p.20). However, Lukka and Kazanen (1995, p.77) argue that properly conducted case study can become a basis for generalization to a reasonable extent, in particular, for obtaining results that can be hold true for other cases. In order to address this challenge and support such analytic generalization (as opposed to statistical generalization) (Taylor et al., 2011, p.303), the researchers decided to gather data in additional contexts (organizations), aiming this way to crosscheck the findings from the case study in Company Z and compare them with each other to draw conclusions. The theoretical framework developed in the previous chapter serves as the vehicle for such generalizing: it states the conditions under which a knowledge management system is likely to be successfully implemented in project-based organizations (a literal replication) (Yin, 2009, p.54).

In spite of the above-mentioned criticism of case study design, the authors see it the most suitable for replying the existing research question, as it is believed to allow deep understanding of the actors, interactions, and behaviours occurring for knowledge management process in project-based organizations. According to Woodside (2010, p.6), deep understanding in case study research includes both knowledge of “sense making” processes created by individuals, and systems thinking, policy mapping, and systems dynamics modelling.

From the time point of view, this research is cross-sectional and studies the phenomena of KMS in project-based organizations at a particular time (Saunders et al., 2009, p.155). Conduction of longitudinal case study is not possible due to time constraints and the design of the research.

3. LITERATURE REVIEW

This chapter establishes the theoretical basis for the research and aims to deepen the understanding of the notions touched upon in the research question: knowledge management and project-based organizations. For this purpose, the existing literature on KMS in PBOs is reviewed. It starts with conceptualization of knowledge in general and explanation of the reasons for its growing importance for organizations, especially in project-based ones. Secondly, different approaches to implementation of KMS are presented with description of specifics of this process in project-based organizations. The following section reviews obstacles that organizations, including PBOs, face when implementing KMS in practice. Lastly, based on the literature review the authors identify the gap and present a framework that will guide the research and help to enrich the answers to the research question.

3.1. Approach to Literature Search and Selection

The literature review is driven by the research question (Jesson et al., 2011, p.18). The selection of the sources for this review followed the recommendation of a structured approach, suggested by Webster & Watson (2002, p.xvi). In particular, it is based on the leading journals (e.g. Journal of Knowledge Management, International Journal of Project Management, etc.) and uses backward and forward citations of the articles, thus aiming to cover different research methodologies, different sets of journals, different geographic regions (Webster & Watson, 2002, p.xv) as well as various time periods of these publications (Torraco, 2005, p.360).

The key words that were identified for literature search included “knowledge”, “knowledge management”, “lessons learnt”, as well as “knowledge management system”, “learning (inquiring) organisation”, “project-based organization”, etc.

Mostly articles in refereed academic journals were chosen, as they are (i) evaluated by academic peers prior to publication; (ii) usually written by recognized experts in the field; and (iii) demonstrate attention to detail, verification of information as well as an extensive bibliography (Saunders et al., 2009, p.70). To sum up, the following parameters were used for the search:

- Language of publication: English;
- Subject areas: Business Administration, Management;
- Literature type: refereed journals, books, conference proceedings, and dissertations.

Specific exclusive criteria were not applied due to the complexity of intersection of the knowledge areas considered. The search of the articles was performed in the Internet using access to the online libraries of Umeå University and Heriot-Watt University, as well as Google Scholars.

3.2. Knowledge and Knowledge Management

3.2.1. Role of knowledge in organizations

Everyday life of any individual or organization consists of numerous decisions and choices for which obtaining relevant knowledge and creating new one is essential. Knowledge is quite a broad phenomenon and its understanding is dependent on the area where it is applied and objectives of articulation. As a reference point, it is possible to find the origins the word “knowledge” in Latin where “know” derives from “noscere” and “ledge” may have originally meant “process” or “action”, therefore knowledge can be seen as the “capacity for effective action” (Senge et al., 1999, p. 4).

In this paper the authors articulate knowledge as “a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information” as it was defined by Davenport and Prusak (2000, p.5). According to this view, knowledge originates in and is applied in the minds of knowers, while in organisations it is embedded both in documents or repositories and in organizational routines, processes, practices, and norms.

The literature distinguishes different types of knowledge: procedural and declarative, esoteric and exoteric, shallow and deep (Courtney, 2001, p.23) with explicit vs. tacit typology being the most commonly used. Explicit knowledge is formal and systematic, expressed using a system of language, symbols, rules, objects, or equations, which make it possible to share and communicate to others in the form of quantifiable data, written procedures, universal principles, mathematical models, etc. (Nonaka, 1991, p.98; Nemati et al., 2002, p.145). Tacit knowledge, on the contrary, is hard to formalize and communicate to others, since it is highly personal, includes beliefs, perspectives, and mental models (Nonaka, 1991, p.98; Nemati et al., 2002, p.145). Being deeply rooted in action and an individual’s commitment to a specific context, it consists of subjective expertise, insights and intuitions, and partly technical skills, so-called “know how”.

For organizations knowledge is a critical resource: they use different types of already existing knowledge in all their activities, while drawing upon their own factual knowledge and constantly creating new one (Nonaka, 1994, p. 31). Thus, organizations are considered a dynamic and evolving system of knowledge production, learning and application.

Within such knowledge-based view of an organization, knowledge and the ability to integrate accumulated knowledge in the context of required tasks is seen as an essential competitive advantage (Kogut & Zander, 1992; Grant 1996; Spender 1996; Conner & Prahalad, 1996, cited in Linder & Wald, 2011, p. 877). However, managing knowledge in the desired way is a challenge for an organization due to the complex nature of knowledge and diversity of its forms.

Skyrme and Amidon (1997, p. 27) identified that systematic management of knowledge led to measurable business benefits, such as creation of innovative products and services, better customer services, faster time-to-market, improved efficiency, lower costs, etc. Also, in a modern volatile context, organizations have to link the strategic

considerations with knowledge creation (Nonaka, 1988, 1994, cited in Nicolas, 2004, p.21). This explains why one of new approaches to the organization strategy is called the learning approach (Mintzberg et al., 1998, cited in Nicolas, 2004, p.21).

Management of management is strongly associated with the process of the lessons learning. In organizations this process is seen as a way to react to deviations from the plan, to reflect on what has happened and to implement actions not to repeat mistakes or to exploit positive experience in the future (Milton, 2010, p. 2). Thus, the knowledge is lessons, which come from experience (positive and negative). And, the lesson is considered learned when something changes as a result of it (Milton, 2010, p. 15). However, real-life examples demonstrate that it is rarely a case: often one individual organization unit repeats work that has been already done by other individuals or in other parts of the organization. This may cause not only loss of time and other resources, but may have other serious negative consequences (Terzieva, 2014, p. 1087). That is why the concept of lessons learned will be further elaborated later in this paper as it serves as a crucial evaluation factor for value of management of knowledge for an organization.

It is also critical to understand the flow of the learning process. Milton (2010, p. 23) suggests a simple learning loop that encapsulates three major steps in learning a lesson: identification, action and institutionalization. The first step described is a process of reviewing, analysing and generalizing. Then, a lesson needs to be accompanied by an action if it is to be considered as learned. If the lesson learned requires change, then an action will be needed, to make the change happen and to fix or implement something. All this process must be guided and controlled in order to be aligned and not to dissolve among other activities.

To sum up the stated above, knowledge created and accumulated in an organization is its strategic asset on global and operational levels. In order to satisfy needs in information and to increase efficiency and effectiveness, organizations nowadays tend to put more efforts in implementing different methods and practices of KM.

3.2.2. Knowledge Management in organizations and its importance

The activities aimed to deal with knowledge, described in the section above, in a systemized form constitute a global process, which is called knowledge management (KM). KM is generally viewed as a systematic process for creating, acquiring, disseminating, leveraging and using knowledge to retain competitive advantage and to achieve organizational objectives (Nicolas, 2004, p. 20). But, at the same time different authors have given different definitions to KM, and yet none of these definitions is completely accurate, nor are they completely inaccurate. The correct definition of KM changes from one organization to another and KM programs are typically tied to organizational objectives and are intended to achieve specific outcomes; these can

include improved performance, competitive advantage innovation, lessons learnt transfer (for example between projects) and the general development of collaborative practices (Terzieva, 2014, p. 1087).

There are no doubts that the KM contributes significantly to the organizational success (Duffield & Whitty, 2015, p.311) as an aim of KM is to ensure that the right knowledge is available in the right forms to the right entities at the right times for the right costs

14

(Holsapple, 2008, p.837). Considering “what everyone in the organisation knows and how they use their knowledge” is seen as a prerequisite for obtaining sustainable competitive advantages by a company (Mas-Machuca & Martinez Costa, 2012, p. 1297). Moreover, proficiency in KM is increasingly important to the competitiveness of decision makers as the world rapidly moves into the global knowledge society (Holsapple, 2001, p.1).

In order to achieve these targets and utilize the knowledge available, organizations have to put KM efforts and activities into the frame of system and processes to be capable to collect, retain and disseminate different types of knowledge produced within an organization’s existence. For that many organizations apply for information and communication technologies, which are used to support KM processes and which in the literature are called knowledge management systems (Aidemark, 2007, p. 5; Thierauf, 1999, p. 5; Alavi & Leidner, 2001, p. 107). Even though in this case the main purpose of knowledge management systems is stated as to leverage organizational knowledge management behaviors (Wang & Wang, 2016, p. 830), it is mostly about information technologies (IT) only.

In order to avoid ambiguity and not to confuse the reader, in this paper the authors stay with a broader definition of knowledge management system (KMS), which involves the application of not only IT systems but also other organizational resources to manage knowledge strategically in a more effective and systematic way (Sankaran & Kouzmin, 2005, p. 287).

According to Landaeta (2008, p.30), a KMS enables managing knowledge and includes as inputs “both the elements that provide direction and define the system, as well as the elements that make possible the operation and control of the knowledge system (e.g., hard and soft support from senior management, the vision and goals of the knowledge systems)”. Performance indicators that measure impact of the KM processes are considered as its outputs (Landaeta, 2008, p.31).

3.2.3. What does "successful KM" mean?

The global value of learning as a result of KM efforts in an organization comes in avoiding repeating bad experiences or reproducing success, and as a result it is expected to get continuous improvement in performance (Milton, 2010, p. 9). Jennex and Olfman (2006, cited in Mas-Machuca & Martinez Costa, 2012, p. 1297) similarly see KM success as “reusing knowledge to improve organizational effectiveness by providing the appropriate knowledge to those who need it when they need it”.

Ciabuschi et al. (2011, p.131) conceptualize success of KM process or KMS itself through two evaluation criteria: transfer efficiency (i.e. the speed and cost of the transfer), and transfer effectiveness (i.e. the extent to which knowledge is satisfactory adopted, used and implemented and used in the receiving subsidiary).

In their research of successful KM projects, Davenport et al. (1998, p.48-49) selected the following characteristics associated with success of KM initiatives:

- Growth in the resources attached to the initiative, including people, money etc.;
- Growth in the volume of knowledge content and usage;

- This initiative is organizational and not individual;

15

- Some evidence of financial return either for the knowledge management activity itself or for an organization in general.

Hence, lack of few or all the above characteristics in KM initiatives would mean their failure. However, it is important to remember that success of KM initiatives is not only contingent on the presence of success factors but also on the absence of failure factors (Chua & Lam, 2005, p.16). Thus, much attention should be paid to monitoring, identification and mitigation of such factors that impede success of KM.

In general, different authors have quite unambiguous understanding of what is the success of KM in an organization. There is a common belief that a proper KM process helps to filter relevant information and to use it in order to increase organizational effectiveness. KM can be considered nowadays as an emerging tool to get competitive advantage (Kogut & Zander, 1992; Grant, 1996; Spender, 1996; Conner & Prahalad, 1996 cited by Linder & Wald, 2011, p. 877). And, if organizational KM can deliver this expected result, this is the best acknowledgement of its success.

From the practical point of view, this success can be expressed in a direct tangible results and Milton (2010, p. 110; p. 137) provides examples how British Petroleum and Ford managed to cut operational and infrastructure expenditures due to timely common sharing and usage of some improvements done by particular project teams.

Examples like this prove the relevance of KM efforts for organizational strategic development and success.

3.3. KM in PM process: its growing significance and specifics

Previously project management (PM) was regarded as a specialized management process more relevant for such project-based industries like construction, defence, management consulting, film-making, and software engineering (Ajmal & Koskinen, 2008, p.8; Lindner & Wald, 2011, p.877). However, currently the need to address complex business changes and react fast to innovative and interdisciplinary questions pushes more and more companies to organize their work by projects (Disterer, 2002, p.519). So, now PM is seen as an inclusive concept that can be integrated into a general organizational effort to provide better quality to customers through effective intra organizational integration and the optimal utilization of scarce resources (Ajmal & Koskinen, 2008, p.9). The number of tasks and the amount of work within such

companies is expected to continue growing fast because key characteristics of project based organizations support their success factors: high flexibility, interdisciplinary work, promoting innovation (Disterer, 2002, p.514). In accordance with the results of Economist Intelligence Unit's research (2009, p.2), 90% of global senior executives and PM experts say that Project Management is a key to the delivery of successful results and gaining a competitive advantage.

Projects are accepted to be knowledge intensive organizational forms (Lindner & Wald, 2011, p.887). Duffield and Whitty (2015, p.316) summarized that for organizations projects are not just a pragmatic means of controlling work and the workforce but an activity to gain and capture knowledge, innovate and explore new markets and compete against others. Hence, projects are a mechanism by which organisations can adapt to better fit their environments (Duffield & Whitty, 2015, p.316), since knowledge transfer across projects allows effectively dealing with issues, problems, crisis and disasters

16

caused by the uncertainty in projects-based organizations (PBOs) (Landaeta, 2008, p.37). For the purpose of the current study, the researchers use the term PBOs not only for pure project-based firms where the project is the primary unit for production organization, innovation and competition but also for those organizations that may deploy both project-based divisions as well as functional divisions (Hobday, 2000, p. 874; Turner & Keegan, 2000, p.132).

The unique and temporary nature of projects and programs gives an opportunity to acquire new knowledge for individuals and organizations; from the other side, it creates even more challenges from the perspective of catching, saving and using knowledge (Terzieva, 2014, p.1088). That is why, project management activities offer inputs for the efficient KM as they combine processes that repeat in time and enhance specialization and knowledge consolidation, and refer to unique initiatives, that introduce new knowledge and experience (Terzieva, 2014, p.1095).

In PBOs learning helps project managers deliver not one but a succession of successful projects and to develop the right sorts of capabilities, such as PM process, the product development process and the KM process (Owen et al., 2004, p.23). While intra-project learning is occurring through project discussions and documented in status reports and memos, inter-project happens in more formal situations (Owen et al., 2004, p.23).

Increasing technical complexity and interdependency of projects across functional boundaries leads to higher dependency of project's success (i.e. achieving schedule, budget and quality objectives as well as customer satisfaction) on the organizational capability to generate and share knowledge (Ayas & Zeniuk, 2001, p.64), and to capture, disseminate and apply lessons learned (Duffiel & Whitty, 2015, p.311). Hence, there is a strong need in solid management of knowledge in and between temporary organizations (Lindner & Wald, 2011, p.887).

KM and respective lessons learnt systems are considered the way to strengthen PM competence retention (along with provision of developmental perspectives for project managers through human resource management) (Ekrot et al., 2016, p.147). The

importance of collecting and documenting lessons learned is also recognized in Project Management Body of Knowledge, which defines them as “the knowledge gained during a project which shows how project events were addressed or should be addressed in the future with the purpose of improving future performance” (PMI, 2013, p.543).

At the beginning of a new project it is highly important to understand which most valuable source of previous experiences and competences are required for this team (Formentini & Romano, 2011, p.547). Sokhanvar et al. (2014, p.1827) in their research framework suggest that in PBOs eight types of knowledge are crucial during the four phases of project life cycle (from initiation, planning to execution and monitoring to the closing). These types include PM knowledge, knowledge about procedures, technical knowledge, knowledge about clients, costing knowledge, legal and statutory knowledge, knowledge about suppliers, and knowledge about who knows what. Their importance varies depending on the phase of the project and from the level of maturity of PBOs (Sokhanvar et al., 2014, p.1827).

Landaeta (2008, p.34) suggests that three different types of knowledge are necessary to successfully complete projects and achieve their objectives: (1) technical knowledge

17

that enables to execute the project tasks; (2) the knowledge to solve project tasks' issues, problems and crisis; and (3) the knowledge that enables the continuous improvement of project tasks (e.g. Six Sigma, KM). According to Gasik (2011, p.30) the full project knowledge micro-cycle requires the different types of knowledge to flow between several levels: from global to organizational to project and individual.

It is noteworthy that knowledge in projects can be managed by focusing on knowledge embedded in plans and on knowledge embodied in people (Gemino et al, 2015, p.299). However, short-term orientation of temporary organizations, unique and temporary nature of projects, frequent disbanding of teams leads to some issues specific for KM in PBOs (Sokhanvar et al., 2014, p.1826), which will be discussed in more detail later. Most frequently researchers talk about drain of project knowledge (Sokhanvar et al., 2014, p.1826) and fragmenting the project knowledge (Lindner & Wald, 2011, p.877). Schindler & Eppler (2003, p.219) introduced a concept of “project amnesia” as “not retaining project insights” and not integrating it systematically into the organizational knowledge base. And in such temporary organisations, besides IT-support and formal elements of the organization that is cultural factors that can compensate for the lack of organisational routines and organisational memory and strongly influence KM success (Lindner & Wald, 2011, p.877).

To support this idea, Tukul et al. (2008, p.180) indicate that less formalized structure of project-driven organizations encourages the learning itself. However, the authors claim that the length of time between the execution of successive projects impacts the quality and relevance of the transferred knowledge: when the time is short, close-out reports can be maximally used, while with long lapses between projects the changes in project environment the accumulated knowledge gets less relevant (Tukul et al., 2008, p.181).

Given all the diversity and specifics of KM in project environment, in this research lessons learned in projects are considered as described by Jugdev (2012, p.20):

“Lessons learned occur in formal, informal, self-directed, collective and social ways.

Lessons learned are more than administrative, documented outputs (codified knowledge) pertaining mainly to the closeout phase.

Lessons learned involve more than transferring knowledge from one person to study.

Lessons learned are more than information used to collect, distributed and archive project documents (e.g., templates, files, guidelines, records, policies, procedures, repositories).

Lessons learned are ways of mobilizing (constructing and sharing) valuable project knowledge.

The processes of learning and sharing are organic and fluid and not mechanistic and rigid.

We learn within and between our projects. Learning is also very participative and it involves teaching, learning and sharing in formal and less formal way”.

3.4. Approaches to implementing KM

3.4.1. General overview

Views regarding the KM have been evolving in time, following the overall change in the organizational management. Nicolas (2004, p. 23) provides an interesting interpretation of the development of KM theory over the last ten years, which has passed through several phases. The first phase was philosophical, during which academics focused on the entity of “knowledge” and gave this concept a strategic dimension. The second phase was technological one, when the IT dimension took the lead in the management of knowledge. The third one was the networked phase where academics stressed the need to link individuals with trust and dialogue. The latest is the strategic learning phase. This phase aligns the learning priorities with business strategies and expressed that KM should have an impact on decision making.

General approaches to learning are evolving in time as well following the growth of an individual or organization. Mumford (1995, p.28-35) and Terzieva (2014, p. 1089) distinguish four major approaches: intuitive approach, incidental approach, retrospective approach and prospective approach. According to the intuitive approach learning from experience is not a conscious process but something natural. This approach is considered as a basic way for learning for humans but not for organizations as they are not alive organisms (Milton, 2010, p.2). Such knowledge coming from experience is tacit and this creates limits for sharing it with others. The incidental approach is learning in situations out of the normality, which happens incidentally. The retrospective approach instead, is the one where individuals learn from experience.

Very often this approach is provoked by mistakes, just as it is with the incidental approach, but people who use the retrospective approach are ready to learn from both positive and negative experiences and make conclusions that later can serve as lessons for them or for others. Milton (2010, p. 2) stresses attention on necessity to learn not only from mistakes, but also from success which is sometimes more difficult to duplicate. The focus of this retrospective approach is on writing down lessons and disseminating them. The fourth approach is the prospective one, which concentrates on looking forward and planning to learn in future.

The evolution of KM theories and learning approaches has its impact on KM strategies adopted by organizations. These KM strategies help to structure the organizational knowledge base and to accumulate strategic knowledge. Building their KM strategies organizations tend to go through similar stages of their strategic vision on how to create the organizational knowledge base and to accumulate strategic knowledge. Nicolas (2004, p. 23) and Earl (2001, p. 216) point out that there are three knowledge management strategies, in particular:

1. Technological KM strategies. This strategy (also named codification strategy (Hansen et al., 1999, p. 1) or technocratic school (Earl, 2001)) is designed to structure organizational knowledge in a better way. The supports of this KM strategy are technology, systems and databases. It focuses on information or explicit knowledge. Individuals have to express explicitly their knowledge in order to transfer it via the database.
2. Personalization KM strategies. Also named the spatial school (Earl, 2001, p. 225), it is designed for the emergence of knowledge. With this strategy, knowledge is

19

closely tied to the person who developed it (Hansen et al., 1999, p. 2). Firms focus on dialogue and face-to-face technique for knowledge sharing. The purpose of this KM strategy is to facilitate learning through shared experience.

3. Socialization KM strategies. This strategy combines both technological and personalization KM strategies. Knowledge communities, that is to say, groups of people inhabiting the same knowledge space and interacting with each other through relationships, represent socialization. Socialization KM strategy is designed to exchange and pool knowledge.

Following this overview of KM evolution, it can be seen that scholars acknowledge the growing importance of social and cultural factors, as well as attention that need to be paid to strategic alignment of KM activities with overall organizational needs.

And it is important to acknowledge this change and shift in the focus since from the point of view of the implementation of KM still there is a common belief that IT is a critical element to achieve this task (Duffield & Whitty, 2015, p.315). And, the literature provides numerous technological solutions of storing, recording and accessing lessons learned. Barnes (2011, p.8) identified a wide variety of technologies that can support and enable knowledge management activities, including business intelligence, client relationship management system, learning management system, search technology, portal technologies, workflow technologies, e-discovery technology, blog software,

social networking software, instant messaging technology, collaboration technologies and many others. In addition to technology another support system for organisational learning is infrastructure, where having the right facilities, equipment and materials in place supports effective lessons learned practices (Thomas, 2012, cited in Duffield & Whitty, 2015, p.315).

But, at the same time some authors consider the role of IT in KM a debatable topic in practice, as implementation of KM is not simply a technological process, it requires balancing many other elements (Mao et al., 2016, p. 1062). Williams (2007, cited in Duffield & Whitty, 2015, p.315) reports that there is an over-reliance on IT systems and that IT is only a part of the KM process. Often organisations implement an IT system solution without considering the organisation's learning needs, and implementations that focus on technology typically fail (Barnes, 2011, p.9). Also, the study conducted by Ciabuschi et al. (2011, p.147) proved a positive effect of IT on knowledge transfer success, i.e. its efficiency and effectiveness, however, they encourage firms to use benefits of different IT solutions, with caution of not over-relying on IT based KMS. To support this, the study by Chaabouni and Ben Yen (2014, p. 314) confirm the necessity to balance as it shows that the successful use of ERP systems is attributable to a suitable application of the KM practices. The efficient usage of the system in the case study was only possible when the system, decision process and the KM were balanced through favourable social context.

The empirical study by Nicolas (2004, p.24) confirms the gradual shift of the focus within KM: the proportion of the companies that pursue technological KM strategy decreased from 92% in 1998 to 53% in 2002, while prevalence of socialization strategy increased from 12% to 55% during the same period of time.

To sum up, KM approach selected by an organization is seen as a way to respond to organizational learning needs, behaviours and actions that are embedded in and

distributed across organisational artefacts, IT systems and processes, and cultural practices and rituals (Duffield & Whitty, 2015, p.314). And, the way selected determines the particular combination of all the elements together, and the final outcome is a creation of specific organisational KMS.

3.4.2. Implementation of project-based KM

As it was already discussed, modern organizations have to react fast and be flexible to innovative and interdisciplinary questions. Therefore, organizing by projects is on a strong increase, because projects are accepted to be learning intensive organizational forms. But the boundaries between projects and the permanent organization are strong barriers for knowledge and experiences gained in projects (Disterer, 2002, p. 512). This temporary nature of projects is considered by most scholars as the biggest challenge for project-based knowledge sharing and is discussed in various forms later in this paper.

Focus on different stages of project-based KM process

Based on the review of recent literature and actual discussions, Disterer (2002, p. 513) argue that most researchers see project closing as the most important phase to identify and capture new knowledge and to prepare the knowledge for transfer to other projects. One of the most popular forms to capture the result of such reflection is so called “lessons learned”, a special documentation that describes in full and in detail the process of identification and the solution of specific and minutely explained problems, which can be used as examples for following projects (Disterer, 2002, p. 512). Another documentation tool highlighted by Disterer (2002, p. 513) for project knowledge is represented by project profiles, which cover project characteristics and summaries. Employees are granted access to the profiles and can browse through them or search for a particular one. In addition, many researchers also suggest firms to define some organizational responsibilities for transferring knowledge and experiences from projects. This is supported by an example that SAP recently introduced full time positions called “project experience managers” in order to anchor knowledge and experiences from projects to the organization (Blessing & Görk, 2000, cited in Disterer, 2002, p. 513).

Earlier studies had a slightly different focus, for instance Ayas (1997, p. 64) suggested that in order to enhance corporate learning with project management, a number of learning tools should be proposed as an integral part of the integrative approach. Therefore, the focus was mostly on learning tools, including project audits and ‘lessons learned’ database, as major supportive mechanisms, which are necessary and useful for developing skills and capabilities to confront new and different issues in future projects.

The leading role of tools as major facilitators in project-based KM stays topical also in some later studies. Terzieva (2014, p.1090) lists possible methods and practices for knowledge transfer used in project management activities, including networks, interactive PM trainings, storytelling, coaching and mentoring programs, etc. - for tacit knowledge, and PM software tools, networks, intranets, portals, FAQs and many others – for explicit knowledge. Based on the findings of the quantitative study in different organizations Terzieva (2014, p.1094) argues that explicit knowledge management methods are more common, with shared folders, drives, status reports, intranets, portals and shared networks as well as PM documentation templates being the most popular

21

tools. Application of tacit knowledge management tools, on the contrary, was not that common and mostly performed through after action reviews, project status reviews, project post-mortems, and sometimes via networks and coaching and mentoring programs.

Apart from being concentrated on tools, many authors focus only on knowledge capturing. For example, Chirumalla (2016, p.4989) suggests that the need to capture lessons learned is a continuous and major target when dealing with lessons learned.

Ideas with similar primary focus on capturing were developed by Ekrot et al. (2016, p.155) who suggest to measure a formal lessons learnt system in project-oriented organisations through two main processes:

1. **Capturing:** lessons learned are recorded and documented in the course of the project; classified and processed systematically; discussed in project meetings at certain milestones; and the project team is allowed sufficient time for this process;
2. **Sharing:** lessons learned are distributed after project completion across divisions; the most important of them are regularly transferred to standards and/or routines; and at the beginning of a project, lessons learned from past projects are provided to the project team.

And even though the sharing process is acknowledged, knowledge application still stays ignored. Duffield and Whitty (2015, p.314) see such focus on explicit knowledge capturing as a problem from a more global perspective. According to their study, KM process includes three essential steps: identification (capturing knowledge), dissemination (transferring knowledge) and application (using knowledge in order to change the way the organization does something). And this is knowledge application where the lesson learned application process typically breaks down and fails (Duhon & Elias, 2008; Keegan & Turner, 2001; Williams, 2007, cited in Duffield & Whitty, 2015, p.314). Thus, this step requires the most significant effort, commitment, and understanding of people behaviour for both the organisation and individuals, while the findings of other authors cited before indicate the opposite: more efforts are put into lessons identification, given all the diversity of tools available for that, while knowledge application stays deprived of required attention.

From their side, Formentini and Romano (2011, p.548) see the roots of the problem with KM application in a lack of clear guidelines and suggest a systematic methodology based on value-added technique to solve this issue. Though this approach allows standardized storage and reuse of all the information, it still does not address (and control) how this information is being re-used.

In this connection, it is important to look at a model for KM processes in project environment developed by Sokhanvar et al. (2014) on the basis of Owen and Burstein's model (2005, cited in Sokhanvar et al., 2014, p.1826-1827). According to the researchers, KM in project-based organizations comprises four interconnected processes and associated sub-processes:

- creating: socialization, externalization, combination, internalization;
- capturing: identification, storing, classification, selection;
- transfer: adapting, applying, integrating;
- reusing: distribution and forwarding, sharing.

22

However, the survey conducted by Sokhanvar et al. (2014) indicated that in practice development of KMS was seen primarily as a way to support knowledge capturing and creation, while knowledge transferring and reusing had lower priority. These findings also confirm prevailing focus of practitioners on knowledge identification rather on its application.

At the same time, following the global personalization and socialization trends in KM in general some authors concentrate their attention on social interaction in KM process rather than on mechanistically processes. Newell et al. (2006, p.182-183) suggests putting more effort into developing personal networks rather than project documents and codified lessons learned.

Gemino et al. (2015, p. 299) distinguish two approaches to KM in projects — one focused on aligning project documents (“the Plan-based approach”) and another focused on developing shared understanding between different teams within a project (“the People-based approach”). Based on the results of their study the authors argue that the people-based approach is more strongly influential on a project's success in securing business benefits. Although the plan-based approach is less influential, it does positively influence business benefit attainment and also supports the people-based approach. Therefore, connecting these results to the KM process, the authors assume that attaining shared understanding within the project team is critical while aligning key documents is also important and complements the people-based approach for a project's KM strategy (Gemino et al., 2015, p. 299).

This point of view is supported by Hartmann and Dorée (2015, p. 350) who suggest that learning between projects should consider individual, social and organisational contexts through which projects are formed and which are constantly produced by project activities. The authors argue that projects are connected through their organisational setting, tools and norms, and the experiences of project team members. Therefore, learning between projects is a social accomplishment that takes place within projects and through goal-oriented activities that enact knowledge embedded in the interlinking project context.

The importance of social context in KM process is also emphasized by Sense (2004, p. 132). Based on his case study in Australia, the author defined the following elements that significantly support intra-project learning practice: learning relationships between participants in a project team; understanding of different cognitive styles in operation within a project team and how they impact situated learning; KM approaches engaged within a project team; the mandate for learning and the on-going support provided by both the project and the organizational environments; and, the pyramid of authority that participants in a project team individually and collectively possess. These findings also spotlight the increasing role of social and communicational context for organizational learning purposes.

Taking into account complexity and flexibility of project-based organizations, it is necessary to consider the importance of managerial and coordinating role for combining in practice all the building blocks of project-based KM. This idea is supported by Keegan and Turner (2001, p. 78) who identified centralization as one of three key

factors influencing learning from and through projects, thus highlighting the importance of governing the KM process based on fixed and clear vision.

In order to increase knowledge sharing between projects in an organisation, Roth (2003, p.42-43) suggests introducing a knowledge facilitator initiative, which would act:

- as a catalyst for action,

- as a coordinator of knowledge creation,
- as a guide towards company's knowledge vision,
- as a creator of "caring climate",
- as an enabler of a sharing culture; thus, being "a combination of a personal role and an actionable process that provide dynamic tools for managing knowledge".

In their turn, Reich et al. (2014, p. 665) developed a model of project-based KM consisting of three dimensions: knowledge stock, enabling environment and knowledge practices; and they stressed the role of a project manager in each of these elements. The researchers see a project manager as the one who can alter the knowledge stock by changing the quantity and/or expertise of the people selected to be part of the project and who can develop a knowledge-enabling environment by providing technology support and/or facilitating the social environment for sharing knowledge, thus contributing to knowledge management within a project.

Alternatively, to ensure cross-project knowledge transfer, Newell et al. (2006, p.167) suggest to introduce a role of intermediaries to oversee several projects and identify how knowledge acquired on one project might be useful to another team. The topic of coordination is also considered by Owen et al. (2004, p.27) in scope of a model for knowledge reuse in a PM environment where the knowledge is absorbed at a tactical (or project) level and then flows to a strategic, thus linking two models: Observe, Orient, Decide, Act (OODA) loop and the Plan, Do, Study, Act (PDSA) cycle.

Another point of view on the importance of coordination and control for KM purposes in project-based organizations is presented by Pemsel and Wiewiora (2013, p. 42). The authors stressed the potential of project management offices (PMOs) to act as knowledge brokers between projects, and between project and top management. However, their study found that PMOs don't fully satisfy knowledge sharing needs of project managers (PMs) even though their facilitating and coordinating role is indisputable. This finding confirms the similar results produced by Desouza and Evaristo (2006, p. 414) who found that PMOs as part of the permanent organization were set up for facilitating and coordinating the activities of the temporary organization.

Following that, it is recommended to develop PMOs as centres of excellence that can optimize, help coordinate and enhance the effectiveness of a range of knowledge networks operating within an inter-organisational or intra-organisational project team, turning personal knowledge into corporate and organizational knowledge (Walker & Christenson, 2005, p.275).

Some of the studies regarding project-based KM reviewed for the purpose of the current research provide more comprehensive overview of knowledge management systems, thus, they are described in more detail further.

To start with, an interesting statement was made by Sense (2004, p.132-140) who argues that offering a model or framework for learning in PM environment can be oversimplification for such complex and dynamic situation. Instead, in order to aid and promote a systematic focus on learning within project management process, he suggests a “learning architecture”, which includes five interdependent elements: · the learning relationships between participants in the project team; · the understanding of different cognitive styles in operation within the project team and how they impact situated learning;

- the knowledge management approaches engaged within a project team; · the mandate for learning and the on-going support provided by both the project and the organizational environments;
- the pyramid of authority that participants in the project team individually and collectively possess.

These statements are shared by Ayas and Zeniuk (2001, p.64-65) who argue that to be successful, project-based learning needs to develop systemic and collective ‘reflective practices’, that include:

- creating a sense of purpose and clarity of both long- and short-term objectives;
- offering psychological safety in project environment;
- building a learning infrastructure while balancing between emerging and formal structures;
- creating cross-project communities of practices;
- leaders who set the tone for learning;
- considering problems and mistakes as opportunities for learning.

In both cases the authors discuss the combination of elements to be included into the KMS and acknowledge importance of all of them from the perspective of their contribution to the final outcome. And, an alignment of these elements stays a topical issue when implementing KMS. To follow this, Todorović et al. (2015, p. 777, p. 782) propose a way to analyse the acquisition and transfer of knowledge in project-based organizations through project success analysis. The main proposition of that paper is that analysing project success can help to align different elements of the KM process and to overcome one of the key problems in knowledge management in PBOs – the lack of proper documentation on the results of previous projects.

The authors of this paper consider a model of project KM presented by Gasik (2011, p. 23) one of the fullest and most consistent. On the one hand, the researcher takes into consideration different types of project knowledge, which quite often are neglected by other scholars: micro-knowledge, needed for performing a single task (or its part), and macro-knowledge (i.e. all the knowledge possessed by people from a given organizational level). On the other hand, which is even more important, Gasik’s model covers all the stages (knowledge creation and acquisition, its identification and

documentation, transfer, sharing and application), while project knowledge is managed at four distinct levels: individual, project, organization, and global.

A new vision in the academic studies with regards to project-based KM was reflected in a model elaborated by Lindner and Wald (2011, p. 882) who built KM system on three major blocks that are equally important: culture and leadership, organization and processes and IT systems. Moreover, the authors acknowledge the importance of both tacit and explicit knowledge and see the conversion of the former into the latter as a crucial and difficult step in the organizational knowledge process (Lindner & Wald, 2011, p. 877).

Similarly, a conceptual framework suggested by Akhavan et al. (2014, p.110) also combines the majority of the findings highlighted in the literature review above and divides success factors for project-based KMS into three levels:

- Level one: the culture of an organization, organizational structure and organizational strategy;
- Level two: support of head managers and project managers, project goals, education and technology;
- Level three: the factors of motivation, experimentation, evaluation, network expertise, developing R&D and systematic documentation.

The practical value of Akhavan et al.'s framework lies in the thirteen steps recommended for successful application of KM in PBOs (Akhavan et al., 2014, p. 116117). These steps concern alignment of organizational strategy, creation of supporting organizational culture and facilitating organizational structure, development of relevant software infrastructure, software and hardware systems, provision of respective trainings, raising awareness about KM, increasing level of transfer and application of knowledge through motivation of employees, promotion of R&D activities and networks and monitoring and evaluation.

In conclusion, the current review of various reflections on project-based KM demonstrates the relative homogeneity in views regarding the importance of KMS elements. The Table 1 summarizes the reviewed studies and groups them around particular areas within the topic of KM in PBOs. The academics are quite concurrent about their suggestions as well, only in some rare cases having opposite points of view.

Table 1. Summary of the reviewed approaches to KM in PBOs

| | | <u>Primary focus Authors</u> |
|---|---|--|
| | | Disterer (2002) |
| | Knowledge capturing Ekrot et al. (2016) | <u>Chirumalla (2016)</u> |
| KM stages | | <u>Terzieva (2014)</u> |
| Knowledge transfer | Disterer (2002) | Knowledge application Formentini and Romano (2011) |
| | <u>Duffield and Whitty (2015)</u> | |
| | <u>All the stages above Sokhanvar et al. (2014)</u> | |
| | <u>Tools Terzieva (2014)</u> | |
| Sense (2004) | | |
| KM elements | | <u>(2015)</u> Roth (2003) |
| Social interaction | | Owen et al. (2004) |
| | | Desouza and Evaristo |
| | Coordination & Control | (2006) Reich et al. (2012) |
| | Newell et al. (2006) | <u>Pemsel and Wiewiora</u> |
| | Gemino et al. (2015) | <u>(2013)</u> |
| | <u>Hartmann and Dorée</u> | |
| | <u>All the elements above Lindner and Wald (2011)</u> | Ayas and Zeniuk (2001) |
| Most | i.e. considering all the | Gasik (2011) |
| comprehensive | stages and elements | Lindner and Wald (2011) |
| approaches | Sense (2004) | Akhavan et al. (2014) |
| The review allows understanding what should be included and considered when building a KMS in project-based organizations and serves as a basis for a comprehensive framework that will be presented further in this chapter. | | |

3.4.3. Summary of facilitating factors for project-based KMS

Based on the previous review, it is possible to sum up success factors, which can facilitate the KMS implementation in PBOs according to different academics' opinion. In their research Mas-Machuca and Martinez Costa (2012, p. 1305) classified three groups of critical facilitating factors for project-based KMS:

- strategic factors: top management support, organizational structure, incentives to encourage knowledge sharing; alignment of KM strategy with corporate strategy;
- cultural factors: corporate culture which is based on the values of trust, transparency, honesty, collaboration, professionalism, flexibility and commitment);

- technological factors: measurement, business process, technological infrastructure.

Technological factors

First of all, the role of technological factors should not be over-estimated. According to Maqsood and Finegan (2009, p.306), technology is only 10% of the knowledge management solution with the remaining 90% related to human capital. There is a move

27

away from KM being IT or process or people focussed to a more aligned and balanced people, process and technology approach (O'Dell & Hubert, 2011, p.54). However, it is important to note that in a temporary project environment there must be IT systems effectively supporting communication, storage and retrieval of knowledge (Linder & Wald, 2011, p.887). The literature provides numerous technological solutions for storing, recording and accessing lessons learned. The key is to identify what works for an organisation and constantly monitor, update, and keep it current and relevant (Williams, 2007, cited in Duffield & Whitty, 2015, p.315).

Cultural factors

Social and cultural factors are topical to provide solutions to organisational learning (Duffield & Whitty, 2015, p. 313). Socialization process is a key driver of knowledge creation with KM technology or respective organizational structures being an enabler and facilitator of the means of getting people together in order to create and share knowledge (Walker & Christenson, 2005, p.278). Similarly, Lucier (2003, p. 33) argues that an ability to encourage team members to document their mistakes with no fear of further action equals to an ability to establish a useful knowledge system.

As Fernie et al. (2003, p. 177) point out, knowledge sharing is best performed through the communication of individuals, and two clearly identifiable social-based processes that appear successful are networking and mentoring. Also, the authors emphasize that people factors influence the success of the lessons learned process and that a learning organisation culture is critical to successful dissemination of lessons learned (Fernie et al., 2003, p. 177; Sense, 2007, p. 33).

Strategic factors

Schindler and Eppler (2003, p. 228) state that management of project insights requires significant improvements with regard to the format, process and use of lessons learned. Various formats, process steps, and usage scenarios exist that can enable project-centred learning in a company. Without management's leadership, however, these methods remain ineffective. Prerequisites for systematic project learning include discipline, motivation, debriefing skills and know-how about adequate documentation formats. The knowledge needs to be reflected in an organisation's policies, processes and procedures (Duffield & Whitty, 2015, p. 313).

Thus, project-based KMS should be developed based on continuous project learning with introducing new project roles and tasks and institutionalising the lessons learned process (Schindler & Eppler, 2003, p. 227).

All the findings discussed above serve as a significant foundation stone for the theoretical framework presented later in this document.

3.5. Problems related to implementing KMS in practice

3.5.1. General barriers for implementing KM

Despite the natural human inclination to learn, there are many potential pitfalls in the path to developing a successful learning organisation (Milton, 2011, p. 8).

28

Organisations may believe that they are a learning organisation, but inspection shows that they do not learn even though organisations' leadership believes they do (that was the case in the study of Rhodes and Dawson, 2013, p.160).

In spite of the popularity of the lessons learned process, it fails to deliver the intended results as lessons are identified but are rarely followed through and integrated into the organisation (O'Dell & Hubert, 2011, p. 69). One of the fundamental problems is that organisations are unable to apply or implement the lesson learned (knowledge) they have (Duffield & Whitty, 2015, p.312). This has been proved in a number of researches. For instance, in one of the case studies conducted by Milton (2010, p.7) out of 70 organisations that attempted lessons learned processes, 60% were dissatisfied with their results. In another study performed by Williams (2007, cited in Duffield & Whitty, 2015, p.312), 62% of 522 project practitioners responded that they had a process for learning lessons, but out of those only 11.7% followed the process.

Malhotra (2004, cited in Israilidis et al., 2015, p.36) names two broad reasons of KMS failure: on the one hand, most attention is paid to KMS inputs (i.e. data, IT, best practices, etc.), which alone may be inadequate for effective business performance; while, on the other hand, little attention is paid to the efficacy of inputs and their strategic deployment once 'expected' performance outcomes.

For many years academics have been attempting to identify the obstacles that prevent organisations from successful implementation of KM. So, Skyrme and Amidon (1997, p.29) discovered that when trying to reach potential benefits from KM, companies face a number of recurring challenges with justifying the investment, creating a knowledge sharing culture, defining the scope of knowledge initiative, gaining the support from top management, nurturing networks, choosing appropriate technology, and balancing systematization, creativity and innovation in KM.

The interesting view of the issue was presented by Fahey and Prusak (1998, p.265) who saw KM impediments not as challenges but as fundamental 'knowledge management errors' and even 'deadliest sins' of KM. This way the authors tried to put more responsibility on managers who can and should take actions in order to avoid such errors and make their organizations more knowledge-driven enterprise. According to

the authors, the most critical error is not developing a working definition of knowledge, and it contributes directly to other ten fundamental errors, among which: viewing knowledge as existing predominantly outside the heads of individuals; paying little heed to the role and importance of tacit knowledge; disentangling knowledge from its uses; focusing on the past and the present and not the future; substituting technological contact for human interface; etc. (Fahey & Prusak, 1998, p.265-274).

Alternatively, Israilidis et al. (2015, p.27) introduced the concept of 'KM anti-patterns' as dysfunctional situations, ineffective patterns or counter-productive practices which could result due to poor KM practices or KM failures. The researchers aim to help practitioners in fast and effective problem identification and resolution, as well as cutting KM costs generated as a result of such anti-patterns. The novelty and value of this research is seen in its practical approach to analysing reasons of KM anti-patterns, checking the symptoms and giving vivid description of possible negative consequences for organization and recommendations about mitigating actions.

29

A slightly different focus into the problem of obstacles to successful KM was brought by Chua and Lam (2005, p.12-13) in their research on KM failure factors. Apart from addressing technological, cultural and content barriers, the authors consider any KM initiative as a project and identify related project management issues, in particular, insufficient involvement of KM users as well as of staff with the required technical and business expertise, lack of a proper rollout strategy, poor planning of project costs and absence of systematic tracking and measuring the success of KM projects.

Given the numerous researches on the topic, there also have been quite many attempts to summarize their findings. For example, based on the critical review of the literature, Kalkan (2008, p.390) distinguished six main KM challenges faced by global business: (i) developing a working definition of knowledge; (ii) dealing with tacit knowledge and utilization of IT; (iii) adaptation to cultural complexity; (iv) attention to human resources; (v) developing new organizational structures; and (vi) coping with increased competition.

Later, Riege (2005, p.23-29) classified more specific barriers to knowledge sharing that were identified by scholars by that time into three main domains:

- individual hurdles (general lack of time, low awareness about the value of knowledge for others, dominance of explicit knowledge over tacit one, etc.); · organizational (lack of leadership and managerial direction in KM, lack of transparent rewards and recognition systems, existing corporate culture, shortage of existing infrastructure, etc.); and
- technology-related (lack of integration of IT systems and processes, reluctance to use IT systems due to lack of experience working with them, etc.).

Similarly, Benmoussa (2009, p.322-327) developed a detailed list of common barriers in KM implementation in three main areas of planning, enabling and motivating, and divided them into: organizational (which also included IT-related issues) and personal (individual perceived lack of benefits, incentives and/or time to share knowledge).

Review of the latest research regarding obstacles that organisations face in implementing KMS with focus on various areas, countries and contexts (Leistner, 2010; Filieri, 2010; Oliva, 2014; Shokri-Ghasabeh & Chileshe, 2014; Kumar et al., 2014; Miklosik & Zak, 2015; Feijoo et al., 2015) indicate that most of these works follow previously presented categorization of barriers into individual, organizational and technological groups. And as the studies discussed above, the researchers tend to emphasize such obstacles as time constraints, cultural and motivational issues, balance of tacit and explicit knowledge as well as need for leadership in KM, in that way demonstrating unanimity of views.

3.5.2. Impediments to successful knowledge management in PBOs

In PBOs like in organizations of other types, knowledge transfer often fails in spite of all the KM efforts and strong potential benefits that efficient KM can bring. The knowledge captured from one project is typically not used as a 'tool of knowing' by others (Newell et al., 2006, p.167).

Difficulties that appear in PBOs during the KM process are often similar to those barriers described above that an organization of any other type faces. However, they

are

30

intensified due to fundamental aspects of projects: their temporary nature, uniqueness with non-routine features, and trans-disciplinary character (Williams, 2008, p.249). Normally after the end of a project there is no institution where existing knowledge can be accessed or even place where the documentation of a specific project is stored, neither there are other meeting points (groups, departments, etc.); this makes it difficult to find out who exactly worked on a recently finished project and who was responsible for what (Disterer, 2002, p.512).

This is supported by Lindner and Wald (2011, p.878) who identified the following specific challenges for project knowledge management in PBOs:

1. Hindered emergence and development of organizational routines, organizational memory and, therefore, impeded organizational learning as a result of the uniqueness and temporariness of projects;
2. Fragmentation and disintegration of individual and organizational knowledge by reason of discontinuous working constellations/contents and discontinuous team compositions lead to;
3. Difficulties with the transfer of knowledge from one project to the other or from one project to the permanent part of the organization due to the lack of learning mechanism, especially in geographically dispersed projects and intercultural project teams;
4. The conflict between short-term orientation of projects with focus on immediate deliverables and long-term perspective of KM, which may lead to an insufficient transfer of knowledge between projects.

Academic literature offers a variety of researches on obstacles for successful KM in PM activities, and much work is focused on three groups of such impediments: time, culture and organization.

Time

The time-critical nature of most projects usually reflected in high time pressures and deferrals is named among the main reasons for not eliciting and documenting lessons learnt in project-based firms (Keegan & Turner, 2001, p.77; Schindler & Eppler, 2003, p.221; Fuller, 2011, p.1; Williams et al., 2012, p.42; Akhavan et al., 2014, p.106). Timing of the end-of-project reviews is not very effective as well: either it is too late (when the team is disbanded and/or less motivated to think about lessons learned) or too early (before the team can really determine those lessons) (Newell et al., 2006, p.181).

And it is argued that time constraints will remain typical characteristics of knowledge transfer in PBOs in spite of all managerial attempts to increase the time available and provide adequate tools for collecting and disseminating lessons learned (Hartmann & Dorée, 2015, p.348).

Culture

A large number of studies put culture as the most significant challenge for KM in project-based organizations (McCann & Buckner, 2004; Mason & Pauleen, 2003; De Long & Fahey, 2000; Carrillo et al., 2004, cited in Rhodes & Dawson, 2013, p.156). Insufficient willingness of the persons involved to learn from mistakes, reluctance to share problem experiences, group thinking, blame culture or/and unwillingness to criticize processes or people in the organization, political pressure, power effects, lack

31

of active KM members in project teams are common obstacles, and they all reside within the minds of individuals (Williams et al., 2012, p.47; Schindler & Eppler, 2003, p.221; Akhavan et al., 2014, p.106). Learning is mostly recognized only when there is a problem in the project, and is ignored when it goes well (Newell et al., 2006, p.181). Accordingly, Ajmal and Koskinen (2008, p.13) emphasize the importance of fostering an organizational culture that facilitates and encourages the creation, sharing, and utilization of knowledge.

Organization

Many obstacles identified by the researchers are related to existing (or missing) KM procedures, processes and tools in organizations. In particular, projects are often rolled out haphazardly without a standard working process for execution and without an enforced KM procedure in project manuals; besides, experience recording is not integrated into project process and there is no KM measurement and evaluation in different projects (Schindler & Eppler, 2003, p.221; Akhavan et al., 2014, p.106). In addition, ICT-systems that are essential for successful capturing and transferring knowledge across projects (Lindner & Wald, 2011, p.887) are often not very useful: databases and review progress are focused on product rather than process knowledge and describe what was done instead of explaining how and why it was done (Newell et al., 2006, p.181).

All these peculiar challenges of KM process in multi-project environment require a specific set of tools and formal procedures implementing knowledge transfer practices (Formentini & Romano, 2011, p.546).

3.6. Research gap

3.6.1. Excessive diversity

The plethora and diversity of academic studies and elaborated frameworks on KM, many of which are similar to each other, make it difficult to select one, which would fit better to the specifics and objectives of a particular organization. Rubenstein-Montano et al. (2001, p.5) highlight the fact that even though there is a variety of approaches to KM implemented in organisations, they rarely fulfil the KM needs of these organisations fully and comprehensively. The authors recommend developing a hybrid KM framework that would be both prescriptive and descriptive and would present KM consistently with system thinking approach, i.e. it should consider purpose/objective, knowledge, technology, learning, and people/culture of the organization (Rubenstein Montano et al., 2001, p.13). Supporting the argument above, Roth (2003, p. 32-33) encourages focusing not only on collecting and storing knowledge but also on reusing it, since the latter is considered the ultimate goal of KM.

In addition, multi-project organisations need a specific set of tools and formal procedures for implementing knowledge transfer practices (Formentini & Romano, 2011, p.546). However, in spite of much research about knowledge transfer, the implementation of knowledge transfer across projects in project-based organizations was not investigated enough (Landaeta, 2008, p.30), and there is a lack of a method for systematic knowledge accumulation, which prevents organizations from proper knowledge transfer (Todorović et al., 2015, p.773).

32

At the same time, most frameworks and research do not specify, which data exactly PBOs and project teams need and use in their KMS. Moreover, they emphasize knowledge sharing and transfer at the beginning and/or the end of a project, this way often neglecting frequent needs of project team members to urgently get so-called “micro-knowledge, needed for performing a single task (or its part)” (Gasik, 2011, p. 23) at any stage of project life-cycle. In the literature reviewed the authors could found only one explicit recommendation regarding this issue: Hau et al. (2013, p.364) encourage organizations to activate the question and answer function of the KM system at the individual level. Thus, it seems interesting for the authors to know how PBOs in general and project teams deal with this issue in practice.

3.6.2. Lack of understanding real practical obstacles for implementing project-based KMSs

Practical aspect of present theories is another important issue. Nicolas (2004, p. 20) calls the existing gap between “the reality” and “the theory” one of the dilemmas against KM, since academics deliver advanced and complex researches on the benefits of KM while practitioners use different KM practices without understanding all their implications. This is supported by Duffield and Whitty (2015, p.312) who argue that in spite of many opinions and ideas, there is little practical advice regarding workable processes that effectively enable the organisation to learn from past project experiences.

At the same time, scholars cannot provide enough evidence what are the implementation success factors helping to avoid the failures on the way of developing KM systems (Terzieva, 2014, p. 1095). Hence, many authors suggest to continue researching the reasons why the dissemination and application of lessons learned fail to deliver the intended results (Atkinson et al., 2006; Keegan & Turner, 2001; Kerzner, 2009; Klakegg et al., 2010; Milton, 2010; Schindler & Eppler, 2003; Williams, 2008; Wysocki, 2004, 2009, cited in Duffield & Whitty, 2015, p.311).

To the best of the authors' knowledge, the same challenge exists in regards to obstacles for KM: many authors present extensive lists and typologies of potential barriers, but there is a lack of explicit practical recommendations and steps on how to overcome these barriers for successful implementation of KM, suggestions in the literature are of more strategic, higher level. For instance, the framework created by Miklosik and Zak (2015, p.518-520) presents a recommended cycle of regularly performed activities for removing barriers in KM implementation, however, suggested countermeasures are typical ones and not practical enough in order to address each of the identified constraints.

3.7. Suggested framework

In this Chapter, the authors have looked through different reflections on general Knowledge Management and its specifics in project-based organizations, including success factors and potential obstacles. The Table 2 below presents a compilation of views and beliefs that prevail in the reviewed literature and, therefore, were selected by the researchers to be included into the summarizing theoretical framework.

Table 2. Summary of theories and views applied in the suggested framework

| Summary categories Major findings from the literature review | |
|---|---|
| Role of KM, contribution to success, competitive advantage, strategic alignment | Importance of IT tools Culture |
| Meaning of successful KM Strategies to implement KM | Responsible roles and control |
| Stages of KM (identification, dissemination, sharing) | Processes KM is a source of sustainable competitive advantage (Nicolas, 2004, p.20); it aims to ensure that the right knowledge is available in the right forms to the right entities at the right times for the right costs (Holsapple, 2008, p.837). |

KM is successful if it's efficient (in terms of speed and cost of knowledge transfer) and effective (i.e. knowledge is satisfactory adopted, used and implemented) (Ciabuschi et al., 2011, p.131).

KM should follow socialization strategy, thus combining knowledge communities with technology, systems and databases in order to exchange and pool knowledge (Nicolas, 2004, p.23; Duffield & Whitty, 2015, p.314).

In their study, Duffield & Whitty (2015, p.314) say that the established literature on project-based lessons learned processes comes to essentially three KM process steps: identification (capture), dissemination (transferring) and application (implementation). And, knowledge application still stays ignored – more efforts are put into lessons identification, given all the diversity of tools available for that, while knowledge application stays deprived of required attention (Duhon & Elias, 2008; Keegan & Turner, 2001; Williams, 2007, cited in Duffield & Whitty, 2015, p.314).

Leading role of IT tools as major facilitators in project-based KM stays topical also in some studies (Ayas, 1997, p. 64; Terzieva, 2014, p.1090), as IT has a positive effect on knowledge transfer success, however, organizations should use IT solutions cautiously trying not to over-rely KMS on them (Ciabuschi et al., 2011, p.147).

In their research Mas-Machuca and Martinez Costa (2012, p. 1305) classified three groups of critical facilitating factors for KMS, and one of them is cultural factor, which is defined as a corporate culture, which is based on the values of trust, transparency, honesty, collaboration, professionalism, flexibility and commitment.

It is critical to consider the importance of the managerial and coordinating role for combining on practice all the building blocks of the project-based KM, especially given the complexity and flexible nature of the project environment and nature (Keegan & Turner, 2001, p. 78; Newell et al., 2006, p.167; Owen et al., 2004, p.27; Pemsel & Wiewiora, 2013, p. 42). It is critical to define some organizational responsibilities for transferring knowledge and experiences from projects (Blessing & Görk, 2000, cited in Disterer, 2002, p. 513).

Many obstacles identified by the researchers are related to existing (or missing) KM procedures and processes tools in organizations. Multi-project environment requires a set of tools and formal procedures implementing knowledge transfer practices (Schindler & Eppler, 2003, p. 228; Akhavan et al., 2014, p.106; Formentini & Romano, 2011, p.546).

34

Summary categories Major findings from the literature review

| | |
|--|--|
| Role of facilitating factors for project-based KMS (motivation, training, quality check, promotion, awareness <u>of the process, time issues</u>) | <u>2003, p.227</u> . Alignment of organizational strategy; supporting organizational culture; open and flat organizational structure; IT corresponding to knowledge needs; adequate KM training for employees; awareness about importance of KM; proper documentation procedures; support of staff's motivation; <u>networking within KM (Akhavan et al., 2014, p.116)</u> . Barriers to successful KM fall into three main categories: individual, organizational and technological (Riege, 2005, p.23). In project-based organizations, the most factors common obstacles are related to time technological constraints, organizational issues, and cultural |
| Recommended steps to implement successful KMS (+ required sub elements of KMS as control, trainings) - summary | |
| Acknowledged barriers and impediments (summary) | |
| There are three groups of critical facilitating factors for KMS: strategic, cultural and | |
| (Mas-Machuca & Martinez | Costa, 2012, p. |

1305; Akhavan et al., 2014, aspects (Williams et al., 2012, p.42; Schindler p.116). For PBOs, PM methodology and & Eppler, 2003, p.221; etc.) learning are essential (Schindler & Eppler,

As it was stated before, the elements presented in the table above serve as a foundation for a new theoretical framework developed by the researchers and visualized in Figure 1 below. This framework is aimed to help answering the research question through suggesting a solution for elaborating a comprehensive project-based KM, thus, avoiding further confusion between diverse and inhomogeneous views, which was highlighted in the previous discussion of gaps in the academic literature.

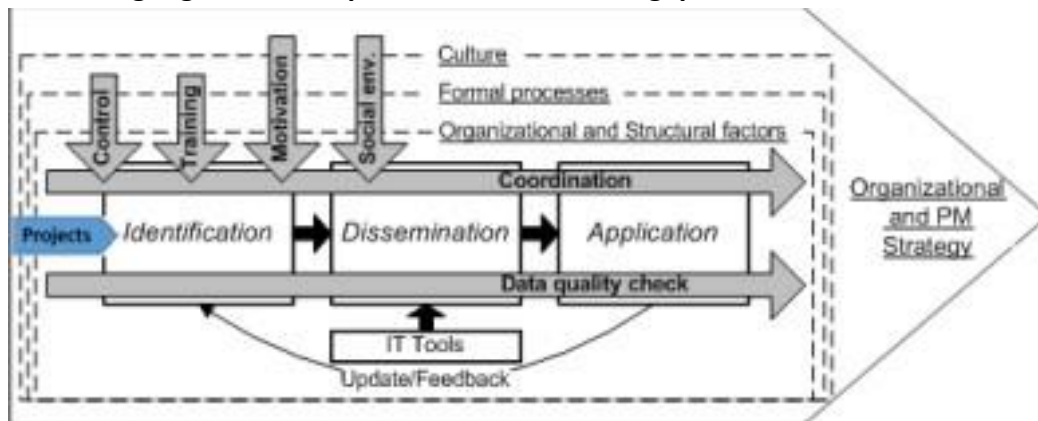


Figure 1. Suggested unified framework for KM in project-based organizations

The framework above presents major stages of the KM process: identification, dissemination, and application. These stages are sequential and imply the loop connection, meaning that the results of knowledge circulation and following changes must be used for the process improvement and update. Also, the stages described are institutionalized and guided by the natural organizational boundaries, such as: culture, formal process, organizational and structural factors. All of them are aligned and directed by general organizational strategy. The KM stages are coordinated, and the data control checks are applied on all the levels. Throughout the organizational layers the overall control of the process is being performed. The KM process is encouraged by the motivation policy on different levels together with creation of a social environment, which facilitates initial informal exchange of the information (necessarily followed by

35

formal procedures). On the diagram, the arrows of Culture, Training, Motivation and Social environment start from the relevant organizational boundaries, which supposedly influence them the most. From the side of tools application, IT systems are critically required on the stage of data dissemination (including its accumulation in a centralized database).

This framework guides the researchers through the case study, during which its main propositions need to be verified. Based on better understanding of the relevance of KM elements as well as new insights regarding obstacles and success factors the guiding framework is to be changed or complemented. As a final outcome, the revised framework will be enriched with a set of focal points with regard to facilitating the implementation process, thus combining theoretical and empirical findings.

4. EMPIRICAL METHODOLOGY

This chapter continues to uncover the deeper layers of the research ‘onion’ approach suggested by Saunders et al. (2009, p.108) and outlines the techniques for data collection and analyses used by the authors in the current study. The authors make sure that these layers are also consistent with each other and with the nature and objectives of the research. The chapter also covers the quality criteria of the study (i.e. reliability and validity) and ethical considerations.

4.1. Selection of the case

In qualitative studies only some sampling issues are important, especially which and how many units of observations (and analysis) should be included in order to gain insights instead of arriving at statistically valid conclusions as it is done in quantitative research (Ghauri & Gronhaug, 2010, p.148). That is why non-probability sampling is more appropriate for the current study as it allows selecting most informative cases based on the researcher's subjective judgement (Saunders et al., 2009, p.233). In particular, purposive strategy of typical case sampling is used: the researchers selected the Company Z as they see it as a representative case, which can help to create an illustrative profile of a project-based organization that faces particular obstacles and risks that hinder successful knowledge sharing and learning from the past experience (Saunders et al., 2009, p.240; Yin, 2009, p.48). Therefore, the case is expected to provide the researchers with the understanding of underpinning reasons for KMS failures. In addition, the Company Z is of special interest for the present research due to its maturity and to the fact that currently the management recognizes the importance of KMS and makes attempts to improve it in order to stay competitive in the market. Thus, recommendations provided by the researchers as the result of the study may be useful and timely for the Company's management.

The desire of the researchers to compare the findings obtained in the Company Z with few other project-based organizations adds variability to the study in terms of contexts, geographical location of the organizations, industries, etc. In selecting these additional organizations, the researchers also followed theoretical (Ghauri & Gronhaug, 2010, p.149) or heterogeneous sampling (Saunders et al., 2009, p.239). The main criterion for selecting the organizations was their project-based nature in accordance with the definition of PBOs given at the beginning of the paper. The researchers did not narrow down the search in terms of the size of companies and their location. However, the choice of these comparative organizations was determined (and limited) to much extent by the researchers' access to the required data, i.e. their contacts to their employees related to project management activities. Table 3 below presents some details about these organizations.

Table 3. Project-based organizations studied additionally

| # | Code | Country | Industry | Number of employees |
|----|-----------|-------------|---|---------------------|
| 1 | Company A | Italy | IT Consulting | 100 - 500 |
| 2 | Company B | Global | IT Services | >300K |
| 3 | Company C | Global | Software development and implementation, IT Consulting | 5 000 - 10 000 |
| 4 | Company D | Global | IT Services and consulting | 15 000 – 20 000 |
| 5 | Company E | UK | Finance, but for the purpose of this research - focus on Change Department | 5 000 - 10 000 |
| 6 | Company F | Global | Finance, but for the purpose of this research - focus on IT Project | |
| 7 | Company G | Sweden | Finance, but for the purpose of this research - focus on IT Project Management | |
| 8 | Company H | New Zealand | Project Management | |
| 9 | Company I | Canada | Construction projects, but for the purpose of this research - 10 000 - 20 000 | 100 - 500 |
| 10 | Company J | Canada | Energy delivery, but for the purpose of this research - focus on IT Project Management | 10 000 - 15 000 |
| | | | State health authority, but for the purpose of this research - focus on IT Project Management | 15 000 - 20 000 |
| | | | 000 | |

4.2. Data Collection Techniques

The data within the current study was collected both from primary and secondary sources - using interviews and internal documentation respectively. Such approach allows, on the one hand, obtaining the data that is more consistent with the research question and objectives, and on the other hand, reaching construct validity of the study.

4.2.1. Interviews

Interviews can be considered the most widely employed method in qualitative research (Bryman & Bell, 2015, p.479). It is a process when people are asked to provide specific information in a mindful and self-conscious manner, and even though it is typically slower and costlier than surveys, and it lacks the synergism of focus groups, it allows collecting a variety of qualitative, quantitative, and objective information (Walle, 2015, p.50, 69). The richness of information gathered determined the choice of interview technique for data collection in the current research (Walle, 2015, p.69).

Out of different formats for interviews (i.e. unstructured, semi-structured, and structured), the authors opted for semi-structured interviews, as they provide informants with the freedom to respond to questions while giving the interviewer control over the flow of the interview in order to steer the conversation in a particular direction and gather certain information (Walle, 2015, p.72). This type of interview seems to be preferable as the current research requires obtaining certain facts and/or subtle and sophisticated responses (Walle, 2015, p.73; Saunders et al., 2009, p.324).

38

The selected type of technique may also be referred as a long interview, i.e. an intensive questioning of informants selected for their special knowledge, experiences and insights (or ignorance) of the topic under study (Woodside, 2010, p.263).

For the current study, the authors prepared an interview guide based on the research problem, its objective, the background information and knowledge about potential respondents (Ghauri & Gronhaug, 2010, p.127). The guide includes a quite structured list of questions to be asked, and they are ordered in a coherent way to help the interview to run smoothly (Walle, 2015, p.70). In particular, it starts with an introductory part where the researchers (i.e. interviewers) explain the essence and purpose of the research, inform respondents about the voluntary nature of the conversation and confidentiality of the obtained information. It is followed by warm-up questions about a respondent and his/her experience at the organization. The main body of the guide is split into several sections, which address the following areas: importance of KM in general; need for KM in respondent's work; the state and characteristics of the existing KMS in an organization; gaps and motivation for better KM. The interview finishes with a suggestion to a respondent to express his/her opinion on the topic and ask questions. The full version of the Interview guide is presented in Appendix 1. All the questions are open-ended without providing any answers or alternatives (Ghauri & Gronhaug, 2010, p.122), which gives a respondent an opportunity to reply as he or she wishes (Saunders et al., 2009, p.337).

Telephone communication (as well as Skype or other types of conference calls) was selected for conducting interviews in this research. In spite of some known drawbacks of this type of interviews, including the sense of impersonality and the lack of visual contact, it was the best option available, given the geographical spread of the studied organizations and respondents as well as time limitations of the researchers (Adams et al., 2007, p.149).

Overall 19 interviews were conducted during the data collection stage of the research: nine – in the Company Z, and one interview in each of ten additional companies. As it was mentioned above, the respondents were chosen based on their experience of working with and in projects. In the Company Z the researchers tried to interview employees of various levels and roles who are involved in project implementation and, consequently, in knowledge sharing process. In the rest of the organizations respondents were mostly members of project teams. The Table 4 below contains some details about the respondents and interviews.

Table 4. Primary data collection through interviews

| Code | Organization | Position in the organization | Date | Duration |
|-------------|---------------------|--|-------------|-----------------|
| Z01 | Company Z | Vice-president of Professional Services Division | 11.11.2016 | 42 minutes |
| Z02 | Company Z | Engagement Director | 23.11.2016 | 47 minutes |
| Z03 | Company Z | Senior Project Manager | 29.11.2016 | 30 minutes |
| Z04 | Company Z | Director, Technical Consulting | 9.11.2016 | 59 minutes |
| Z05 | Company Z | Director, Business Consulting | 30.11.2016 | 22 minutes |
| Z06 | Company Z | Business Consultant | 4.11.2016 | 33 minutes |
| Z07 | Company Z | Senior Technical Consultant | 11.11.2016 | 42 minutes |
| Z08 | Company Z | Senior Business Consultant | 11.11.2016 | 35 minutes |

39

| Code | Organization | Position in the organization | Date | Duration |
|-------------|---------------------|-------------------------------------|-------------|-----------------|
| Z09 | Company Z | Senior Project Manager | 13.10.2016 | 25 minutes |
| A01 | Company A | Head of PMO | 28.10.2016 | 46 minutes |
| B01 | Company B | Head of Global Delivery Services | 20.10.2016 | 56 minutes |
| C01 | Company C | Project Manager | 29.11.2016 | 28 minutes |
| D01 | Company D | Program Manager | 18.11.2016 | 76 minutes |
| E01 | Company E | Business management representative | 15.11.2016 | 41 minute |
| F01 | Company F | Head of Change department | 14.10.2016 | 30 minutes |
| G01 | Company G | Internal Auditor | 30.11.2016 | 36 minutes |
| H01 | Company H | PMO Coordinator | 08.12.2016 | 39 minutes |
| I01 | Company I | Business Analyst | 21.10.2016 | 25 minutes |
| J01 | Company J | Technical Consultant | 18.11.2016 | 47 minutes |

4.2.2. Documents

Secondary data in the form of documentary written materials was used in the current research in order to enrich information gathered through semi-structured interviews (Saunders et al., 2009, p.259). The documentation studied included materials provided by the Company Z, in particular: description of KM tools and processes, information letters, the results of internal engagement survey as well as resource plans. Such organizational documents were used to build up a description of the organization (Bryman & Bell, 2015, p.561). It's important to notice that since these documents have not been created for the purpose of this study, they do not affect the validity of the data, however they require special attention from ethical point of view (Bryman & Bell, 2015, p.555).

4.3. Data analysis strategy

Data analysis method is dictated by the research strategy chosen, i.e. qualitative research. It is believed that in qualitative research, the emphasis is on telling a story or piecing together a puzzle that can help explain a particular phenomenon and its relationship to other factors in the people and environment(s) involved (Weathington et al., 2012, p.405). In the current research the qualitative data derives from the interviews, thus, it constitutes large volume of unstructured textual material, however,

there are few well-established and widely accepted rules for analysis of qualitative data (Bryman & Bell, 2015, p.579). Saunders et al. (2009, p. 502) distinguish several inductively based procedures for analysing qualitative data: data display and analysis, template analysis, analytic induction, grounded theory and discourse analysis. For this research, the authors apply two techniques: template analysis and data display.

The general flow of the data analysis, followed by the researchers in the current study, is presented on the Figure 2. It reflects major steps of manipulations with data, leading from a bulk of raw interview results to the desired research outcomes. The content of every step is explained in detail in the following sections of this Chapter.

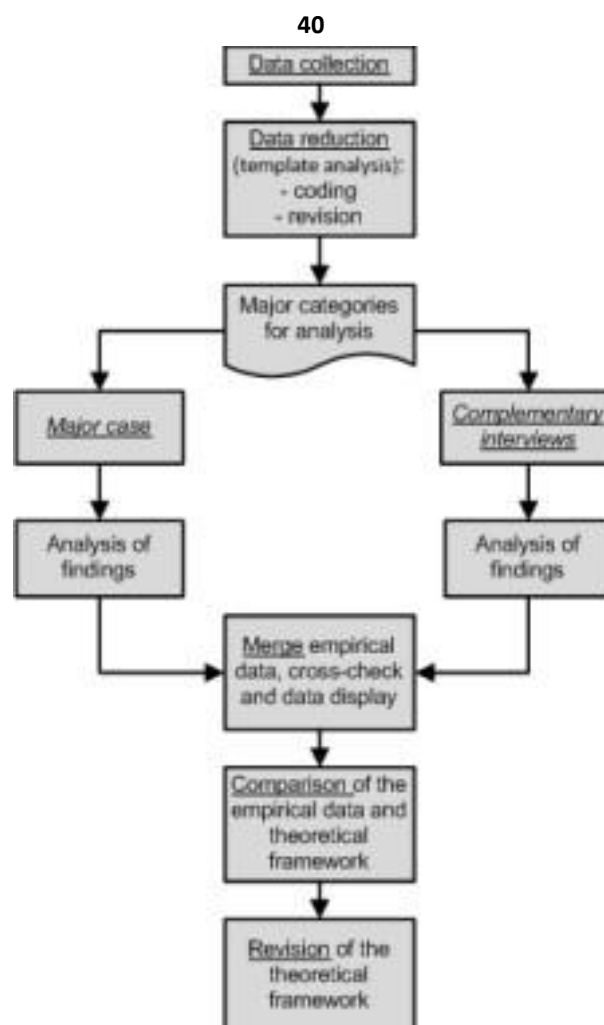


Figure 2. The flow of data analysis in the current research

4.4. Data preparation and analysis process

Since analysing data gathered through semi-structured interviews can be problematic due to a large quantity of flexible data (Waring & Wainwright, 2008, p. 85), the researchers faced the necessity to prepare this data before moving to classification and comparison, which are essential parts of any type of data analysis (Ghauri & Gronhaug, 2010, p.151).

The primary idea behind the empirical data preparation for the purpose of the current research is its reduction, as the amount and the structure of data gained from the interviews does not fit purely the purposes of analysis and comparison. Data reduction means “selecting, focusing, simplifying, abstracting and transforming” moving from independent to correlated dimensions of data (Miles & Huberman, 1994, p. 10; Ghauri & Gronhaug, 2010, p.189). Out of several inductively based analytical procedures, the researchers selected template analysis. Saunders et al. (2009, p.506) describe this technique as the way to identify and explore themes, patterns and relationships. Moreover, this approach is applied to deal with rich unstructured qualitative data following the primary data collection phase, and it implies coding a large volume of text from answers so that elements about a particular topic can be assembled in one place (category) to complete the interpretative process (Waring & Wainwright, 2008, p. 85-87). Typical stages within the template analysis usually include defining the codes for

41

the initial template, then revising the template and the analysis of the data (Saunders et al., 2009, p.507; Waring & Wainwright, 2008, p. 87). At the very end, this approach allows to summarize broad topics in narrower and more meaningful categories following more explicit structure.

All the interviews conducted were audio recorded and this records served as a source for analysis. The researches preferred not to create transcription of interviews, as the number and average long duration of them make this task complicated and potentially not necessary. During interviews major notes were done, following the structure of the interview guide (Appendix 1). Then, these notes were elaborated and accompanied on the basis of revision of interview records. These revisions had an iterative nature while information was systemized and classified. Therefore, in the current document direct citations from interviews are not used and all the findings are presented in aggregated way in order not to overload the reader with excessive information.

Following the general flow of the data analysis strategy presented above (Figure 2), next sections describe in detail steps involved into the process of managing the empirical data in the current study, in particular:

1. Data reduction: Coding of the initial interview template;
2. Date reduction: Initial data revision;
3. First level of summarizing: grouping major data from the interviews into thecomparable categories;
4. Second level of summarizing: merge the empirical data categories with thetheoretical framework.

Presentation and discussion of the findings follows the similar sequence of steps. In Chapter 5 steps 1, 2 and 3 from the list above are applied separately for the major case and complementary interviews. After that conclusions are made for both parts and compared between each other, resulting in the final summary for the empirical part. Finally, in Chapter 6, as the step 4, these empirical summaries are merged with the theoretical framework.

4.4.1. Coding of the initial interview template

One of very commonly used analytical approaches is the coding of data into categories in order to help identify the qualitative content areas that are of highest importance or greatest prevalence (Weathington et al., 2012, p.406; Bryman & Bell, 2015, p. 585). Content categories may be defined beforehand, based on existing theory and/or relevant literature, or they may be developed from the data themselves once they are collected (thematic coding) (Weathington et al., 2012, p.406). Sense-making of the rich data collected starts with sorting and labelling responses into thematic categories (Weathington et al., 2012, p.407). Therefore, as coding is considered the first step for classification for the sake of following categorization of data (Ghauri & Gronhaug, 2010, p.151), codes were assigned to the initial interview questions list. The results of codes assignment are presented in the Table 5, reflecting the structure of the interview guide (Appendix 1).

Table 5. Codes assigned to the interview questions

Data Code

2. Warm-up: WU 2.1. DUR. WU 2.2 EXP. WU

3. Main body: MABO *Importance of knowledge management* IMP. MABO 3.1. VAL. IMP. MABO 3.2.

EXMPL.PROD. IMP. MABO 3.3. EXMPL.PRJ. IMP. MABO *Existing call for knowledge management* CALL.MABO 3.4. MISS.CALL.MABO 3.5. XYSTAGE.CALL.MABO 3.6. IMP.CALL.MABO *Current Knowledge*

Management system CKMS.MABO 3.7. PRO. CKMS.MABO 3.8. LL. CKMS.MABO 3.9. RR. CKMS.MABO 3.10. AVAL.CKMS.MABO 3.11. TIME.CKMS.MABO 3.12. SRCH.CKMS.MABO 3.13. CONS.CKMS.MABO

3.14. EXTLS.CKMS.MABO · tools TOOLS.EXTLS.CKMS.MABO · training TR.EXTLS.CKMS.MABO · are they helpful? USE.EXTLS.CKMS.MABO · How often? OFT.EXTLS.CKMS.MABO *Gaps and motivation* GM.MABO 3.15. GAP.GM.MABO 3.16. MT.GM.MABO *Closure* CL What would you like to add or ask us? ADD.CL

4.4.2. Initial data revision

As it was already mentioned, the template approach implies some flexibility regarding the initially created codes structure. Saunders et al. (2009, p.507) suggest that as data collection proceeds, some of the codes can be revised and change their place or level in the template hierarchy or can be removed from it. As a part of revision process, some codes can be added or existing can be eliminated.

Following this, for further analysis part of the information from the initial list of interview questions (WU; DUR. WU; EXP. WU) serves as general information in order to understand the level of familiarity of the respondents with the internal processes and companies' culture and informal traditions. This kind of data helps the researchers to estimate the credibility of data gained from the interviewees and its relevance to the comparison within the case. These results, similar to the case descriptions, are aggregated and presented separately from the discussion of the major interview results (which are comments for the others codes from the Table 5).

A new code (Researchers' summary) is also introduced as an aggregation made by the researchers regarding the diverse data from different parts of the interview, which influenced the authors' understanding of different aspects of the interview topics and

helped to produce their own judgment. No data from the initial interviews was eliminated during further stages of analysis.

4.4.3. First level of summarizing: major categories

As the interview questions were open and allowed answers with flexible explanation, the final answers could cover few topics spread between different questions and categories. Also, in many cases an answer covered few closely related questions simultaneously. For that reason, in order to summarize data from different interviews (both for the Company Z and complementary organizations) and to present it in a briefer and more structured way favourable for comparison, the initial codes (Appendix 1 and Table 5 above) were grouped in the way presented in the Table 6. Allocation of a code to a category means that a significant part of data from an answer to a relevant question was used in this code, but not only there. Also, in the Table 6 the meaning of each category is described, which is relevant for the following discussion.

Table 6. Structured categories for the initial interview data

| Category Code Meaning | |
|---|---|
| Overall characteristic of the existing project management practice in the company, which CKMS.MABO; Researchers' understanding of the summary | reflects the researchers created on the basis of all amount of information discussed during the interviews |
| 1Brief characteristic of PM in a company | Reflects the general perception of IMP. MABO; VAL. IMP. helps to understand better the global environment where KMS exists. This description mostly |
| Importance of knowledge | EXP. WU; MABO; 2 3 |
| experience | CALL.MABO; Existing call for knowledge (required/identified) |
| management general understanding and | MISS.CALL.MABO; XYSTAGE.CALL.MABO; IMP.CALL.MABO MABO; EXMPL.PROD. IMP. MABO; EXMPL.PRJ. the KM value in the IMP. MABO organization as seen by |
| 4Current Knowledge Management System | the interviewee Major necessity in knowledge (nature, type) currently faced by the company |
| 4.1. General existing practice | CKMS.MABO; IMP.CALL.MABO; LL. CKMS.MABO;RR. CKMS.MABO; ADD.CL |
| 4.2. Process | PRO. CKMS.MABO Existence of a separate KMS process and its maturity |
| 4.3. Training | TR.EXTLS.CKMS.MABO Practices regarding educating staff about the KMS process and its elements |

| | | |
|--|--|--|
| | | Existence and description of the control function towards the KMS practices and outcomes |
| 4.4. <i>Control</i> | CKMS.MABO; PRO. CKMS.MABO AVAL.CKMS.MABO; | Easiness to access different types |
| 4.5. <i>Availability of data</i> | USE.EXTLS.CKMS.MABO | required for staff |
| SRCH.CKMS.MABO; | of data and lessons learned | |
| 4.6. <i>Time</i> | 44 | Considerations regarding the time available for the KM issues and general attitude of the company regarding it |
| 4.7. <i>Tools</i> | Category Code Meaning | |
| | EXTLS.CKMS.MABO; | |
| 4.8. <i>Culture Awareness</i> | TOOLS.EXTLS.CKMS.MABO; | |
| of | TR.EXTLS.CKMS.MABO; | Characteristic of the tools (mostly IT) available for the KM issues |
| | USE.EXTLS.CKMS.MABO | |
| | CKMS.MABO; | |
| TIME.CKMS.MABO; | AVAL.CKMS.MABO; LL. | Considerations regarding the overall company's ambiance and spirit (mostly informal) |
| SRCH.CKMS.MABO; | CKMS.MABO | supporting or depressing the KM efforts |
| CONS.CKMS.MABO | TR.EXTLS.CKMS.MABO; | Characteristic of the average |
| 4.9. <i>OFT.EXTLS.CKMS.MABO familiarity with existing Formal and natural employees about the understanding and KM practices motivating existing KM practices</i> | | factors, encouraging staff to participate in KM |
| 4.10. <i>Motivation</i> | GM.MABO; MT.GM.MABO 4.11. | initiatives |

Current success

factors Researchers' summary Existing drivers of the KMS

5 Existing Gap GM.MABO; GAP.GM.MABO KMS areas of primary attention and consideration

The most obvious barriers

6 Obstacles ADD.CL; Researchers' summary negatively influencing the existing KM practices

Such summary in the form of the categories presented above makes it possible to evaluate the situation from a perspective of each interview and compare the results. Thus, the data becomes comparable and can serve for the purpose of the common understanding relevant to the research objectives in scope of qualitative study (Ghauri & Gronhaug, 2010, p.199).

Moreover, the categories defined in the table above are correlated to the recommended elements of the KMS, taken from the relevant literature review (Table 2), and contain information, which allows addressing all the components of the developed theoretical framework (Figure 1). Therefore, it is possible to state that the table above is created to summarize data from interviews in the most transparent for future comparison and analysis way, and, at the same time, to compare these findings later with the theoretical framework. This comparison of the empirical findings with the theoretical framework is done later in the Chapter 6.

For the purpose of a more comprehensive overview, on the basis of summarized data from interviews in the Company Z and complementary organizations, the data display technique is used to organize and assemble data in the form of summary diagrammatic display (Saunders et al., 2009, p.503; Adams et al., 2007, p.164). This way of presenting data allows to visually define the position of the Company Z in comparison with the other organizations, using the following major dimensions:

- Level of development and usage of KM-related tools;
- Level of development of formal KM process;
- Level of influence of the company's internal culture on the KM practices.

Application of the data display technique serves is complementary and aims to define similarities in the KMS implementation and usage in different organizations. And, these observations are used to cross-check the findings from the major case, and also contribute to the revision of the theoretical framework.

4.4.4. Second level of summarizing: merge with the theoretical framework

The next stage of analysis is to combine the empirical data in the form of overall summary and compare it with the previously suggested theoretical framework based on the literature review. This allows to identify differences between existing KMSs and the theoretically suggested ones, and then suggest explanations for these explicit distinctions based on the interview data. All this leads to the revision of the theoretical framework and, as a result, merging the theory and practice for the best solution (Bryman & Bell, 2015, p. 27). Table 7 below presents the way to compare the empirical findings with the theoretical framework through linking the major empirical summary categories from Table 6 with relevant elements of the theoretical framework. The table explains the implied meaning of major elements, which guide the analysis and the further interpretation and revision of the theoretical framework based on the information about the factors prevailing in practice.

Table 7. Analytical linkage between the empirical findings and the theoretical framework

| PM | Elements of the theoretical framework | Compatible |
|--|---------------------------------------|--|
| | | (Categories) |
| | used in Table 6 | Existence and nature of linkage between the general strategic goals of the |
| | Focus of comparison | |
| Alignment of organizational and strategy 3; 4 | | Application 6;7;8 Loop: update and feedback 6;7;8 |
| <u>Organizational environment</u> | | <u>KMS elements</u> |
| Culture 5;6 | | Control 6.1;6.4. |
| Formal processes 6 | | Training 6.3.;6.9. <u>Motivation</u> |
| <u>Organizational and structural factors 5;6</u> | | <u>6.10.</u> |
| Social environment 5;6 | | Coordination 6.1. |
| <u>Stages of KM process</u> | | Data quality check 6.1. IT Tools 6.7. |
| <u>Identification 5;6;7;8</u> | | company and project-based KMS |
| Dissemination 6;7;8 | | practices |

Influence of the general company's internal environmental elements on the project-based KMS practices

Level of maturity of the projects-based KMS and its comprehensiveness

Level of development of elements of the KMS

To sum up, this section describes how the empirical data is systematized and analysed. The findings from the analysis are discussed in the Chapter 6 along with the revised theoretical framework.

4.5. Reliability and validity

For ensuring the quality of data, research design methods and the overall accuracy of study results three criteria are generally used: reliability, validity and generalizability (Adams et al., 2007, p.236). Reliability refers to the consistency with which observations or measurements are made in a research (Weathington et al., 2012, p.57), while validity of a resulting theory and other researcher's conclusions and interpretations means that they describe reality "with a good fit" (Gummesson, 2000, p.93). Generalizability can be defined as an ability to draw conclusions about a particular phenomenon, which is outside this particular (narrow) research study (Adams et al., 2007, p.239). Sometimes this criterion is also referred as "external validity" (Meyer, 2001, p.347; Saunders et al., 2009, p.158).

In the current research, the authors used the criteria for reliability and validity suggested by Meyer (2001, p.344) for qualitative research. First of all, the researchers try to be objective and stay neutral and reasonably free from research bias (Meyer, 2001, p.344). Secondly, the detailed description of the study methods, procedures, analytical process is provided in the paper, so that interpretations made in this case study could be traced by other researchers. This way the authors aim to reach both intersubjectivity and reliability, even though in qualitative research the latter is challenging, and it is expected that different researchers come to different results in replicated studies (Meyer 2001, p.348).

Construct validity, as the legitimacy of the application of a given concept or theory to established facts, is ensured through use of triangulation, i.e. complementing data obtained through interview with information from documentation in order to strengthen the evidence and include multiple viewpoints (Meyer, 2001, p.345-346). Triangulation was also pursued through collection of similar data in additional organizations based on the authors' assumption that the propositions can make sense in similar situations but in different contexts.

Cross-checking and amplification of information as well as thorough exploration of respondents' opinions and understandings allow achieving internal validity of the research; it is aimed at avoiding ambiguity and contradiction and establishing strong connections in data (Meyer, 2001, p.347).

However, given the nature of the study, the authors do not aim to reach external validity (or generalizability) in this research. Instead, as it was mentioned before, the researchers look to achieve analytical generalizability, in which a previously developed theory is used as a template with which to compare the empirical results of the case study (Yin, 2009, p.38; Meyer, 2001, p.347).

4.6. Ethical considerations

That is a responsibility of all researchers to act in an ethical manner while answering to their questions honestly and accurately (Weathington et al., 2012, p.40; Ghauri & Gronhaug, 2010, p.20). Ethics are moral principles and values that influence the way a researcher or a group of researchers conduct their research activities (Ghauri & Gronhaug, 2010, p.20). Thus, research ethics concerns the issues of formulating research topic, designing research, gaining access to data, collecting, processing and analysing it, and presenting findings in an appropriate manner (Saunders et al., 2009, p.184).

The authors tried to incorporate the following components into this study that make it an ethical one according to Weathington et al. (2012, p.32-36):

- Competence: the researchers as a team believe that they have the competence to gather and analyse the data to be collected;
- Accuracy: the researchers collect the data objectively and accurately;
- Validity: the researchers ensure that the results will answer the posed questions;
- Voluntary informed consent: the researchers make sure that they do not coerce or force people to participate in interviews, and the latter are familiarized with the purpose of the research and take part in it of their own free will;
- Confidentiality: The researchers maintain the confidentiality of all parties involved in this study, in particular, they do not use the real name of the organizations explored and names of the interviewees, both are being coded.

In addition, the authors of this paper follow ethical considerations regarding work of other researchers, providing correct and complete references to other studies, whenever used, in accordance with the thesis manual of the Umeå School of Business.

5. FINDINGS

The purpose of this Chapter is to present the empirical data obtained during interviews in the Company Z and complementary organizations following the overall flow of the Data Analysis strategy described in detail in the Chapter 4. The findings are presented through the perspective of the theoretical suggestions defined previously, in particular, in the light of major categories relevant for successful KMS.

5.1. Company Z's case

The presentation of the major case findings aims to justify the relevance of the case to the research objectives with the demonstration of the proper credibility of data.

5.1.1. Company profile

The Company Z was founded in 1992 and is headquartered in New York with a global presence in American, APAC and EMEA regions.

Building on its pioneering development of cross-asset trading and risk management products for energy and financial services companies, the Company Z now offers transaction lifecycle management software within three broad categories: energy, commodities and financial services. The company's clients are leading energy and commodity companies, financial services firms, multinational corporations and commodity-intensive corporates, public utilities, hedge funds and central banks.

As a part of the Company Z, Professional Services Division provides world-class turnkey implementation solutions for its customers from pre-sales assistance through "go-live" events. Comprehensive implementation solution teams include dedicated professionals who are experienced project managers, business analysts, technologists and trainers with in-depth industry-specific business expertise.

Implementation support services include, but are not limited to:

- Complete turnkey product implementations, encompassing all implementation phases from project definition to the final production "go-live"
- Business and functional design, gap analysis, and transition planning ·
- Legacy interface technical design, development, testing and deployment
- System upgrades and regression testing services
- Assistance in deploying add-on modules and new business solutions.

For the purposes of the current research, the authors focus on Professional Services Division in EMEA region where the Company Z currently operates about 10 sizable projects. This division is of particular interest for the researchers due to the fact that the Company has recently reorganized from a regional to a global management structure. In addition, and partly the reason for the reorganization, the Company is continuing to develop and improve its delivery capabilities and quality assurance processes. One of the strategic processes selected for development is its Knowledge Management System.

The development of the product (software) is not covered due to the limited access to that part of the company, however, the researchers tried to explore how the knowledge about the product is transferred from a client through project teams to developers.

The documentation provided by the Company Z allows describing the technological side of its KMS. Knowledge Portal (IT tool) in the Company Z consists of four main parts as it is presented at Figure 3:

- Global Professional Services Portal with Methodology
- documentation;
- Learning Portal with training courses and materials;
- Quandora: a platform for Q&A;
- SharePoint Portal with all Project Documentation.

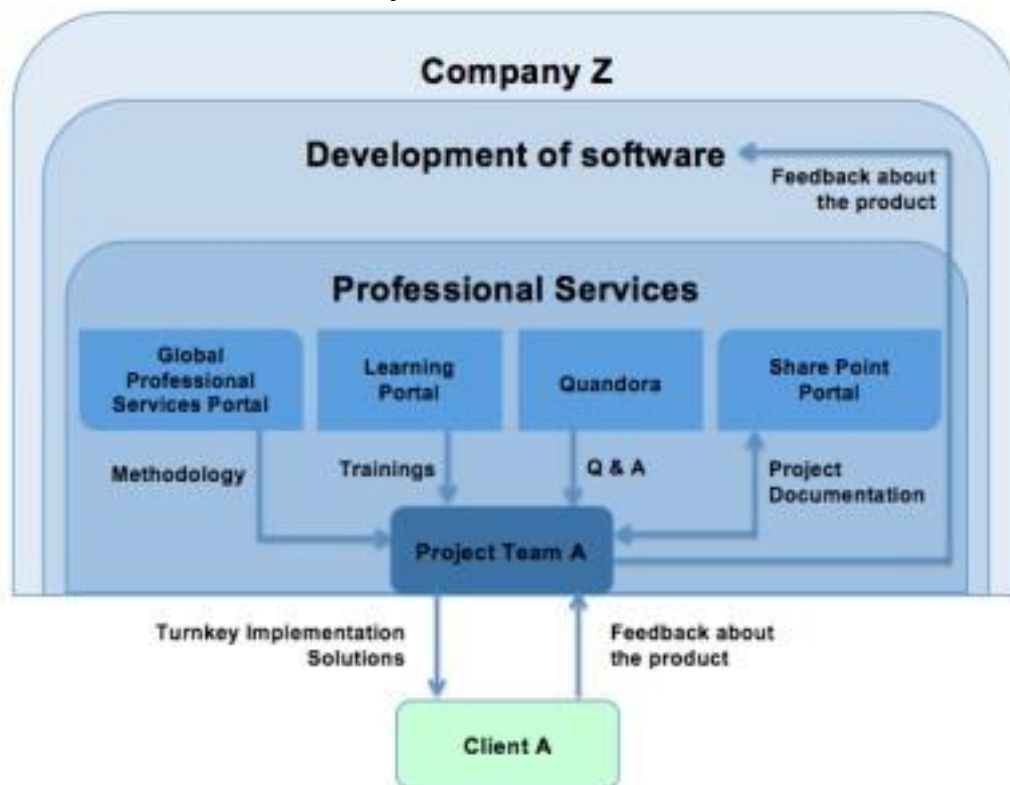


Figure 3. Knowledge Management tools and flows in the Company Z

5.1.2. Overview of the respondents

In total, 9 (nine) interviews were conducted in the Company Z, following the interview guide presented in the Appendix 1. All the respondents come from the Professional Services Division, which represents core client-oriented project management activities in the company. When selecting potential interviewees, the researchers tried to include all the major roles participating in project activities either on project team member level, or team/group management, or general supervision level. In this way the comprehensive diversity of views and opinions was achieved. Moreover, majority of interviews were conducted with subject matter experts or their managers, i.e. those roles that are highly interested in specific knowledge sharing and constant learning

from tasks similar to those they face. This need is also strengthened by the repetitive nature of tasks within separate projects and the vitality of the subject matter knowledge (technical

50

or business) for implementing the company's solutions on the customer side. Composition of the roles interviewed is presented in the Figure 4.



Figure 4. Major roles of the interviewees in the Company Z

All the interviewees selected had previous experience in either participating or managing project activities, and are currently involved, directly or indirectly, in that kind of activities in the Company Z. Average record of work of the respondents is more than 5 (five) years. Thus, it is possible to assume that both the projectized nature of the Company Z and the interviewees' roles and experience fit the target to explore project-based KM, and their selection is justified for obtaining credible results.

5.1.3. Findings from the interviews

Information gathered from the respondents in the Company Z during interviews was coded and classified as described in p.4.4 (Data preparation and analysis process). Then, the answers of all the respondents were interpreted, summarized and united into the categories defined in Table 6. Such convergence of all the relevant information received from different respondents in a brief and meaningful manner does not seem to be an over-generalization as the responses complement each other and allow drawing more complete picture of the case.

At the same time, the summarization is not intended to provide the reader with an absolutely comprehensive overview of the existing KM practices in the company. The researchers concentrated their attention on identifying how the company's employees perceive existing KM practices and facilities and reflecting the diversity of such statements or conclusions, even though in some cases they may seem doubtful from the point of view of other company's insiders. This potential gap between the expressed perception and factual status is already a valuable insight as it may point at some problems either in internal communications or in other company's internal activities.

Brief characteristic of PM in the Company Z

The most relevant finding was that the Company Z nowadays is going through the process of restructuring its approach to PM. The Company used to occupy almost a monopolistic position in its segment for many years; however, increasing competition in

51

the market forced it to take actions in order to increase efficiency of PM activities. Among different ongoing changes two processes seem to be the most interesting with regards to KM, namely: centralization of PM control and administration functions; and acknowledging the role of KM as a way of getting additional competitive advantage. The significance of these changes for KM practices in the Company Z will be discussed later in this section.

Importance of knowledge management - general understanding and experience

The importance of previously accumulated knowledge for improvement of current and future projects is highly recognized by all the respondents. Different examples of the successful usage of the past data were described. At the same time, there is an understanding that different types of knowledge require specific attitude, and not all of them can be easily obtained in the course of preparation for upcoming activities. These remarks were valuable for the researchers as they proved that among different major PM roles, fully represented by the respondents, there is a common understanding of the potentiality of KM, and attempts to apply to past knowledge are frequent, even though not systematic, but they bring clearly visible successful outcomes.

Existing call for knowledge (required/ identified)

Answers to this question did not reveal any surprises. All the respondents expressed their desire to have more access to the previous knowledge within their functions. At the same time, no particular knowledge area was prevailing. Subject matter experts want to be able to work with clear business and technical data, structured by areas, which is required for the purposes of the customization of products for particular clients. It was expressed that accumulation of this kind of data will help to increase efficiency of project implementation due to standardization and repetitive usage of successful solutions as frequently as possible. But, there are some acknowledged limitations caused by customization necessary to address the diversity of clients' features and requirements. Thus, a strong demand for questioning and answering (Q&A) tools was identified, calling for elaboration of instruments which may help to get information or consultancy on a non-typical subject as easy and fast as possible.

On the management level there is a demand for data, which may help to plan project more precisely and estimate required time, costs and resources with high accuracy. This mature planning is highly required for negotiations with clients as well as for margin estimations and overall assessment of efficiency and effectiveness of PM activities of the Company.

Current Knowledge Management system

In overall, based on the interviews results, the current KM process within project activities of the Company does not seem to be centralized and formal. Existing practice is to search for and share information mostly in an informal way, and employees spend quite much time on it (more about it later in this section). Despite the abundance of different IT tools, communication through e-mails prevails and can take different forms (for instance, usage of e-mail groups for Q&A purposes). Overall there are capabilities

52

for data collection, search and Q&A practices, but they need to be aligned and made clearer for users.

The most important finding for the researchers regarding the overall KMS in the Company Z was that KM practices can differ from team to team and are dependent on local team management. Moreover, KMS existing in the Company is perceived differently by managers and team members. The more optimistic view is typical for management level where the KMS is seen as quite well developed and sufficient for existing purposes. At the same time, project team members pointed at some particular obstacles or gaps in the current practices that need to be addressed (these gaps are described further in this section).

· Process

Overall conclusion is that there is no institutionalized KM process in the Company (regarding project-based knowledge in particular). Formal requirements are scattered and not coherent. The most regular KM activity seems to be saving project documentation on the SharePoint portal. At the same time, post project implementation lessons learning activities are occasional and not sufficient. As it was mentioned in the paragraph above, the current KM process is mostly realized through direct contacts or communications by e-mail (including supporting channels). As a consequence, the existing KM process seems to be more a set of repetitive Q&A activities, rather than systematic process of knowledge accumulation and sharing.

· Training

The obtained data allows concluding that specific KM-related trainings are not a part of the regular practice in the Company. Changes in KM process are communicated mostly through e-mails, short conference calls, sharing video materials and presentations. As a result, most employees (and especially newcomers) have to learn about the existing KM capabilities on the go. For them it seems easier and faster to find a relevant person and address him/her a question, rather than to apply to the existing tools.

· Control

Given the absence of institutionalized KM process in the Company, there is also a lack of centralized control of KM on different levels. From the information gained it is possible to define some areas, which may require additional control, in particular: storage of post-implementation project data and LL reports, training activities, relevance and quality of data on the knowledge portals, timely reaction to

questions/requests published in Quandora. However, the situation with the information generated for purposes of product/process enhancement seems to be better. Here there is an understanding of whom requests need to be sent to, even though reaction and required changes themselves may be quite slow. Furthermore, it was identified that some control functions are being gradually improved. For instance, for Quandora portal, responsible content-owners are appointed to check the quality of responses within accountable subject areas.

· *Availability of data*

From the one side, the overall impression is that in the Company Z there are enough tools and ways to save and find the required data: if the formal data exists, it may be found. From the other side, the company's knowledge is mostly tacit, kept and shared

53

by individuals in an informal way. Also, the structure and quality of the formal data can be improved further.

· *Time*

Following the information in the Process paragraph, from the formal point of view there is no time dedicated specifically for KM activities (aside from project reviews, which are a part of PM methodology). In this way, it is implied that employees are to find time for LL and KM within overall PM activities. However, projects rarely go as planned (in terms of time), and PMs (teams) may work on several projects simultaneously, and/or start a new one right after finishing a previous one. In that case they rarely spend time even on formally acknowledged project reviews.

Another finding is that due to mostly informal nature of knowledge sharing the respondents on the team members level reported to spend up to 20% of overall working time either searching/asking around for required information or consulting their colleagues. Especially it is topical for active implementation phases of projects.

Similarly, to the perception of the overall KMS, the views regarding the time issue are different on the management level and the team members level. On the one hand, some managers believe that it is a personal responsibility to create place and time for learning more and that there are formal ways to report the time spent on knowledge sharing. On the other hand, when it comes to, many respondents state that they do not have time to post information or answer a question in Quandora regularly and do it with a proper quality.

· *Tools*

As it was described in the section 4.1, there are few IT tools in the Company Z to support KM activities, but sometimes their purpose and the rules how to use them are confusing. Some respondents claim that it is difficult to find information there; first, because there is too much unstructured information, second, the data is not added there proactively. Also, there is still an issue with relevance and quality of the data. That is why Q&A part of Quandora is considered to be more useful, partly confirming the assumption that it is easier to ask a question than to search for information. Even though Quandora is a powerful tool and a huge step forward on the way of KMS

development for the Company, but without active usage it does not fulfil its dedicated purpose.

· *Culture*

Based on the factors described in the current chapter, the overall project-based knowledge learning and sharing practices in the Company Z can be characterized as mostly informal, oriented to direct communications between employees. At the same time, the corporate culture creates supportive and favourable environment for such informal communications.

· *Awareness of employees about the existing KM practices* All the respondents demonstrated high level of awareness of the existing KM practices in the Company Z, which is clearly explained by an impressive average work track record in the firm. At the same time, some respondents assumed that the situation might be different for newcomers, since an initial KM-related training is absent. However, the necessity to stay efficient and productive urges project team members to search for the

54

information actively and find ways within the Company to do it (due to the specific nature of the data required it may be found only internally). This fact is favourable for fast learning about existing KM capabilities.

· *Motivation*

Following the paragraph above, it is possible to conclude that employees are motivated to find data. However, the situation is not that clear when it comes to motivation to share data and dedicate time for that. Even though the majority of the respondents declared that it is their natural desire to share knowledge and they do not need additional incentives, there is still a problem with dedicating time for it. Although some managers say that there is still a reserve of time within PM practice, it is not obvious what would motivate employees to find this time when they are not even formally obliged to do it. At the same time, coercion does not seem a good alternative if the Company Z aims to obtain information of proper quality.

There is no single solution for the motivation issue, as all the interviews revealed complete diversity in the values of different employees. In some cases, providing additional time is already enough, in other cases financial incentives could be considered.

Similarities in the given answers allow assuming that if employees spend less time on consulting colleagues (especially on repetitive basis), it may encourage them to find time to post relevant information on the portal or to reply once in Quandora (as such answers then may be found by many other interested people). As a result, the time saved may be dedicated to other activities with more benefits for an employee him/herself. Moreover, the shift from informal communications to transparent Q&As in the system may help to reveal the most knowledgeable and active participants, which seemed quite complicated before. Such identification and acknowledgement can be a valuable outcome for some participants as it positively influences their

professional image in the Company with possible favourable formal results (for instance, promotion).

It is also assumed that in order to encourage employees to share knowledge and support their natural motivation for doing it, some formal triggers are required in any case. For instance, some indicators related to knowledge sharing and Q&A participation can be included as annual targets.

Finally, any support from senior management to promote KM activities (especially regular assistance, control and appraisal) is already motivating as it helps to integrate KM into the overall culture of the organization much faster.

· Current success factors

The main strength of the existing KMS highlighted by the majority of the respondents is the Company's positive and supportive environment and willingness of colleagues to help and consult. Gradual development of IT tools for the KM is another positive trend, and it is only a part of all the activities launched to increase the efficiency of KM. These changes, accompanied by the overall acknowledgement of the importance of KM and support from the management side, make future perspectives look positive. It can be considered another motivation factor for employees to participate in the on-going initiatives.

55

Existing gaps and obstacles

The biggest disadvantage of the existing KMS in the Company Z seems to be that even though some knowledge is collected and saved, it is not used properly. Moreover, the efforts to establish a relevant system are mostly focused on tools but not on the process and such supporting elements as control, comprehensive trainings and formal acknowledgement of knowledge sharing activities and respective dedication of time to them. As a result, the knowledge still stays tacit, not easily available for sharing.

Development of the tools seems to be the top priority for the Company Z now. However, many interviewees commented that these tools need to be simplified; in particular, their number can be reduced, while their purpose and formal rules of use, including the content control, need to be clarified. Inseparable part of this process is introduction of comprehensive trainings. The practice shows that without a proper training knowledge about a new system and how to use it is not kept properly and lost almost immediately after reading informational e-mails, thus, the intended purpose is not achieved. Moreover, there is a lack of post-control after introducing a new system and conducting an initial promotion of it. Therefore, it is almost impossible to track how many employees got familiar with the system or at least read an e-mail about it. The suggestion could be to use more formal approach for trainings (when they are in place) to assure that all the relevant categories of employees go through it. Post-training testing can be introduced as well.

Another popular remark concerned time issues, and it was already commented above. To sum up, it is possible to state that employees require more clarity regarding how

much time can be spent on knowledge sharing issues and how it should be done formally. These rules should serve as an unambiguous and transparent guidance.

The researchers do not see any significant gap in particular KM areas. The key point is to continue all the initiated activities and at the same time not to forget to devote attention to all the elements of KMS in order to develop them evenly. Once all the basics (tools, process, control, promotion and support) are ensured at appropriate level, the system will start working in full, and its development will progress naturally.

Conclusions

The obvious challenge for the Company Z is to turn the overall situation with the KM around and move from explicit to tacit knowledge accumulation and sharing. Apart from direct beneficial contribution of KM practices to the success of projects, formalizing KM process can save up to 20% of working time (based on the interview results), which may positively influence other company's operations as well. Moreover, another task is to encourage staff not to concentrate only on search of data and Q&A tools, but also proactively publish and share findings and useful data.

This kind of equal distribution between KM activities will serve as an organic driver of the overall system development: constant sharing and help within the established process will become an integral part of the corporate culture.

An important issue mentioned before is the difference in perception of the current situation between employees on management level and team members level. This vision should be aligned before progressing with all other changes regarding the KMS.

56

To sum up all the findings for the Company Z, it is possible to assume that the current period of time is the best moment to push efforts to implement efficient KMS to the end. The Company Z is in a uniquely favourable position for this: significant knowledge has been accumulated, and the management is eager to share with employees its strategic vision of the importance of KMS as a competitive tool, and some initiatives have already started. If this potential is not used properly now, later it may lead to disappointment of employees and complete absence of their support, as a result of burning out and lack of trust to company's initiatives.

5.2. Complementary interviews

As it was already discussed in the section 4.1., to compare the findings from the case study of the Company Z, additional interviews were conducted in other companies. All the interviews followed the same interview guide as in case of the Company Z (Appendix 1. Interview guide). Overall results of the interviews were summarized as it was defined by the data reduction procedure for the current research (section 4.4.). In this way the comparability of the data was achieved allowing to cross-check findings from the major case through the perspective of other companies' experience.

5.2.1. Overview of the companies and respondents

For additional interviews 10 (ten) companies were selected with various geographical location, representing 7 (seven) different countries/regions. In each company one respondent was interviewed, only in one organization two people participated together. All the respondents represent different roles within PM activities and possess significant professional experience with an average track record in a company of more than 5 (five) years.

The selected organizations are of different sizes - from small companies with 100-500 employees to global corporations with more than 150 000 employees. The companies represent 5 (five) different industries, with slight dominance of IT consulting sector.

Ensuring such diversity of the companies and respondents is determined by the researchers' desire to obtain credible data and produce conclusions and suggestions relevant for project-based organizations of different types.

5.2.2. Findings from the interviews

Systemized results of the interviews are presented in Appendix 2 (Complementary interviews), following the structure described in the section 4.4. These results include necessary details for every company, while overall summary is given below for major categories.

Brief characteristic of PM in the Companies

Some of the additional companies are fully projectized with all their operational activities done through a set of projects. In other companies PM function is a complementary one, mostly in IT, which supports the core business of a company. This difference and significance of PM function in general within an organization definitely

57

influence the role of project-based KM in developing company's competitive capabilities. However, it was found that in average all the companies face the same obstacles and go through similar stages when developing their project-based KMS (this common trend will be discussed in the section 5.3).

Importance of knowledge management - general understanding and experience

The researchers recognize the fact that formal acknowledgement of importance of project-based KM corresponds to the importance of PM in organizations in general and its methodological maturity. However, in the current research conclusions regarding the importance of KM are made on the basis of individual opinions of respondents, which are believed to constitute companies' position on the topic. Majority of the interviewees support the idea that KM helps PM to be more successful judging from their experience.

Existing call for knowledge (required/ identified)

All the respondents were unanimous when expressing their needs in knowledge: they require it for precise planning of future projects (especially delivered for external clients), and specific business and technical data is necessary for some particular needs of project implementation. This unanimity is easily explained by standardization of PM in organizations nowadays. In addition, majority of the respondents called for powerful Q&A capability that would allow saving time when getting required support and consultancy.

Current Knowledge Management system

In overall, findings from the complementary interviews were in line with the case study in the Company Z. Most companies lack formal approach to project-based KM, control over it and do not pay enough attention to trainings. Time issue is also topical for them, as employees do not have enough time for LL and knowledge sharing. Moreover, they focus mostly on IT tools implementation, which is less efficient when not supported by relevant process and encouragement.

At the same time, there is an example of a mature project-based KM (Company B), whose success can be explained by equally mature development of all the suggested elements of project-based KM. In this particular case the level of development can be defined by the size of the company, its leading position and long presence in the market, projectized nature of the business, and maturity of own PM methodology. Obviously, these factors are not enough for a company to be successful in KM, but their existence definitely contributes to creating a facilitating environment for that.

Some companies demonstrated relative balance: even though their KM is not that developed from the perspective of tools and processes, their supportive corporate culture and existing processes are already enough to achieve their current purposes in KM area (for instance, Company E). That is why KMS of such companies can be considered successful and efficient as they evolve in line with all the organizational requirements and other processes.

Another quite interesting finding is that both huge and small companies in terms of numbers of their employees and operations can have the least developed KMSs. For instance, in the Company H (not more than 500 employees) staff is mostly concentrated on current operations, with blurred job responsibilities, and does not have enough time for KM practices. This example is another good confirmation that mature processes and formally dedicated time are very important for KMS development. Another extreme is huge bureaucratic companies, which are not capable to introduce mature and transparent processes both for PM in general and for KM in particular. And in the case of the Company I this inability can be explained by the size of the organization and big structural and cultural distances between different departments. These organizational and structural factors (included into the theoretical framework presented at Figure 1) impede KMS implementation.

However, almost all the additional companies demonstrated dominance of informal communications and tacit knowledge in their existing KM practices. These elements compensate insufficient development of some other elements, explained above.

Existing gap and obstacles

Once again, findings from the complementary interviews regarding the existing gap in KM and obstacles were in line with the case study in the Company Z.

From every interview and discussions of KMSs of the companies considered, more or less similar results were obtained about what should be done in order to make KMSs more efficient. Such uniformity in opinions can indicate template approach to development of KMS in organizations. Based on both direct statements of the interviewees and conclusions of the researchers, it is suggested to focus primarily on the development of clear and transparent KM process. Then, this process should be controlled and promoted within an organization, involving all the necessary people and familiarizing them with it. More attention needs to be devoted to creating facilitating conditions for KM practices and KMS realization, namely: allocation of time, implementation of quality control for KM and introduction of appraisal system based on activity of employees in KM initiatives. Due to the prevailing informal nature of communications and limited search capabilities within existing KMSs, the need for more developed Q&A instruments was also expressed.

As for IT tools (if they exist in an organization), only few concerns were revealed, as their functionality is perceived as satisfactory. However, the data contained there should be more structured and organized.

To conclude, all the respondents agreed that KMSs in their organizations are missing the “actions” part. In other words, there are relatively few rare cases when some changes were implemented as a result of accumulated knowledge, especially when it concerns more global changes in company’s processes. However, at project level the situation is better, as knowledge application depends on a project manager and a team. At the organizational level, lack of implemented changes that were suggested by employees is seen as one of the factors demotivating staff to share LL.

5.3. Summary of the empirical data

The results presented above allow concluding that the general findings from the case study in the Company Z and the complementary interviews are quite similar. They support an assumption about the existence of template approaches to implementing KMSs, which are followed by most companies. In particular, majority of the companies focus on the development of KM IT tools, neglecting the importance of the process and other contributing elements of a KMS, such as trainings, control functions and motivation.

In order to give a clear overview of the existing trends in the development of KMSs, the researchers positioned the studied companies according to the level of development (weak, moderate or strong) of three elements of their KMSs. These elements are considered the most important both from the point of view of respondents and from the literature review and include the following:

- Axe “Tools”: level of development of IT tools for project-based KM purposes,
- Axe “Process”: level of maturity of formal project-based KM process,
- Size of a bubble, dimension “Culture”: aggregated characteristic of level of favourable internal culture for KM purposes (readiness of colleagues to help, communications traditions, etc.)

In order to allocate the companies objectively on the diagram, for the dimensions described above particular numerical meanings were allocated with a scale from 1 to 100:

- Absence of quality: 0
- Weak: 0 - 25
- Moderate: 25 - 75
- Strong: 75 - 100

Then, based on the result of interviews, the companies were evaluated with the expert judgement of the researchers, taking into the consideration all the available information. As a result, the table with numerical estimations was created (Table 8) and served as a basis for the Figure 5 development.

Table 8. Numerical estimations of the level of development of the three selected KMS elements

| # | Code | Process | Tools | KM culture |
|----|-----------|-----------|-----------|------------|
| 1 | Company Z | 40 | 80 | 60 |
| 2 | Company A | <u>30</u> | <u>40</u> | <u>60</u> |
| 3 | Company B | <u>85</u> | <u>85</u> | <u>80</u> |
| 4 | Company C | 45 | 70 | 40 |
| 5 | Company D | 45 | 60 | 40 |
| 6 | Company E | 70 | 50 | 70 |
| 7 | Company F | <u>50</u> | <u>30</u> | <u>40</u> |
| 8 | Company G | 60 | 70 | 50 |
| 9 | Company H | 40 | 30 | 70 |
| 10 | Company I | <u>20</u> | <u>30</u> | <u>30</u> |
| 11 | Company J | 40 | 20 | 30 |

These levels above were determined for each organizations according to the researchers' expert judgment on the basis of the information in p.5.1 for the Company Z and Appendix 2 for the others organizations. Common categories used through the data preparation process and clear feedback obtained from the respondents make the data compatible and allow the researchers to determine positions of companies quite objectively. The Figure 5 below presents the results of such mapping and is prepared

using the display technique, which allows organizing and assembling data into summary diagrammatic display (Saunders et al., 2009, p.503).

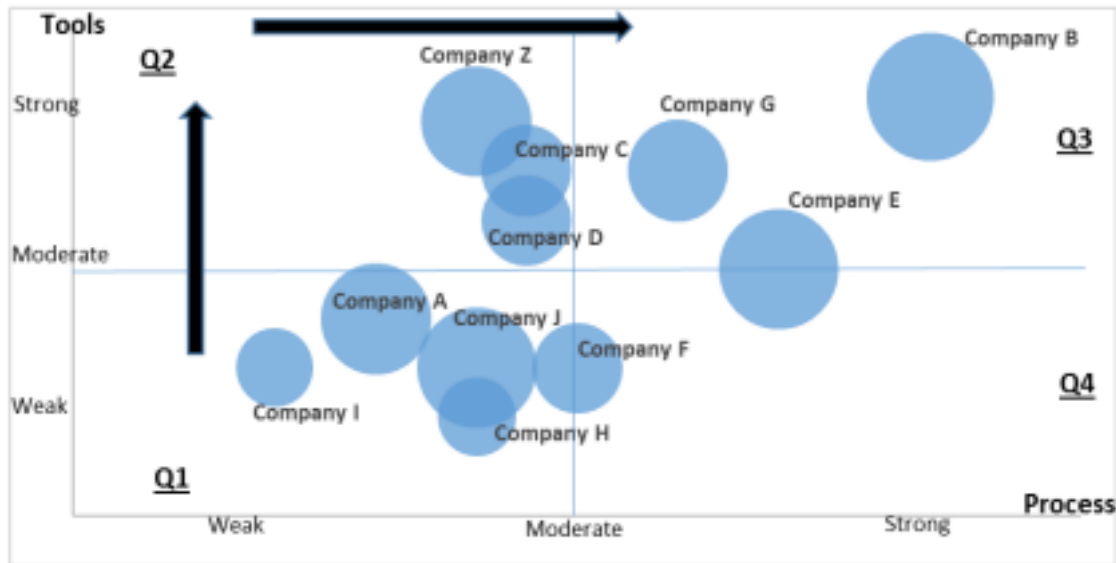


Figure 5. Positioning of the studied companies according to the level of development of their KMSs

From the Figure 5 it is clearly seen that the companies are grouped within different quadrants. Using the available data about some of the companies and stages of their development, it is possible to suggest that there is a common trend in balancing maturity of IT tools and process, if to consider development of KMS in time. Almost all the companies start from Quadrant 1 (weak processes and weak IT tools) and move to Quadrant 2 (stronger IT tools, weak processes), investing mostly in technological part, while KM processes and other elements are still neglected. And only after that, companies attempt to move to Quadrant 3 (strong IT tools and processes). However, at this stage it can already be more difficult due to the lost time and trust and necessity to refurbish already established process (created in informal way). In this research there is only one example (Company E) of reasonable balancing between IT tools and processes. No examples were identified when KM process is developed prior to implementing KM IT tools. All these findings are in line with some of the previous studies in the area of KM and helped the researchers make relevant suggestions that are presented further.

6. Discussion of the findings

In the Chapter 6 the authors compare the empirical findings summarized in the previous Chapter with the results of the theoretical exploration conducted at the beginning of the study. Based on this comparison, the initial framework for creating

KMS in PBOs that was developed as a result of the Literature review (Chapter 3) is reconsidered, and the final revised framework is presented.

6.1. Comparison of the empirical findings with the theoretical framework

The initial theoretical framework presented in the Chapter 3 was developed on the basis of the Table 2 that summarized previous academic research on the topic. In order to align the theoretical and empirical findings the authors of this paper applied the same approach and created a summary Table 9, which serves as a basis for revising the initial

theoretical framework. As in the case with the Table 2, those elements of project-based KMS, which prevail in views and beliefs from the reviewed literature were selected by the researchers to be included into Table 9. In other words, not necessarily all the empirical findings presented in the previous sections are included here, but only those that are meaningful and may confirm or change the researchers’ understanding how successful project-based KMSs are arranged. It is important to notice that all the empirical findings fall under the categories selected initially based on the literature review, but they are adding new aspects to those categories.

In order to make the results of comparison clearer, Table 9 below contains general conclusions stating whether previous insights obtained from the theoretical literature review have been confirmed or not in regards to each of the relevant element of KMS.

62

Table 9. Comparison of the theoretical and empirical findings

| Summary categories | Major findings from the literature review for project-based |
|--------------------|---|
|--------------------|---|

| KM | Empirical findings |
|----|--------------------|
|----|--------------------|

Role of KM, contribution to success, competitive advantage, strategic alignment.

Meaning of successful KM

Strategies to implement KM

Stages of KM

(identification, dissemination, sharing)

KM is a source of sustainable competitive advantage (Nicolas, 2004, p.20); it aims to ensure that the right knowledge is available in the right forms to the right entities at the right times for the right costs (Holsapple, 2008, p.837).

KM is successful if it’s efficient (in terms of speed and cost of knowledge transfer) and effective (i.e. knowledge is satisfactory adopted, used and implemented) (Ciabuschi et al., 2011, p.131).

KM is expected to follow socialization strategy, thus combining knowledge communities with technology, systems and databases in order to exchange and pool knowledge (Nicolas, 2004, p.23; Duffield & Whitty, 2015, p.314).

In their study, Duffield & Whitty (2015, p.314) say that the established literature on project-based lessons learned processes comes to essentially three KM process steps: identification (capture), dissemination (transferring) and application (implementation). And, knowledge application still stays ignored – more efforts are put into lessons identification, given all the diversity of tools available for that, while knowledge application stays deprived of required attention (Duhon & Elias, 2008; Keegan & Turner, 2001; Williams, 2007, cited in Duffield & Whitty, 2015, p.314).

Theoretical insights supported by the empirical data. Highly acknowledged more on individual level and not so often on company's strategic level (as in the case of the Company Z, supported by judgements of other interviewees).

Theoretical insights supported by the empirical data. Relevant data is available, structured and easy to be found. As a result, the time is saved and quality for precise planning, forecasting and implementation is increased. At the end, it all contributes to company's competitive advantage.

Another trend in KM revealed.

Figure 5 (Positioning of the companies) is a good way to demonstrate the prevailing role of formal technological strategy with high dependence of KM and LL practices in companies on informal social interactions and environment.

Theoretical insights supported by the empirical data. The companies are mostly focused on identification and data saving. Dissemination is mostly done in informal way. Knowledge application is more frequent on individual level, and practically missing on the level of processes changing.

63

Summary categories Major findings from the literature review for project-based

KM Empirical findings

New contributing aspects revealed.

Following the stated in previous sections, a trend is observed

Importance of IT tools

Culture

Responsible roles and control

Processes

Leading role of IT tools as major facilitators in project-based KM stays topical also in some studies (Ayas, 1997, p. 64; Terzieva, 2014, p.1090), as IT has a positive effect on knowledge transfer success, however, organizations should use IT solutions cautiously trying not to over-rely KMS on them (Ciabuschi et al., 2011, p.147).

In their research Mas-Machuca and Martinez Costa (2012, p. 1305) classified three groups of critical facilitating factors for KMS, and one of them is cultural factor, which is defined as a corporate culture, which is based on the values of trust, transparency, honesty, collaboration, professionalism, flexibility and commitment.

It is critical to consider the importance of the managerial and coordinating role for combining on practice all the building blocks of the project-based KM, especially given the complexity and flexible nature of the project environment and nature (Keegan & Turner, 2001, p. 78; Newell et al., 2006, p.167; Owen et al., 2004, p.27; Pemsel & Wiewiora, 2013, p. 42). It is critical to define some organizational responsibilities for transferring knowledge and experiences from projects (Blessing & Görk, 2000, cited in Disterer, 2002, p. 513).

Many obstacles identified by the researchers are related to existing (or missing) KM procedures and processes tools in organizations. Multi-project environment requires a set of tools and formal procedures implementing knowledge transfer practices (Schindler & Eppler, 2003, p. 228; Akhavan et al., 2014, p.106; Formentini & Romano, 2011, p.546).

that when companies start to implement KMS, they mostly focus on IT Tools, sacrificing the process part. At the same time, regardless the level development of IT tools, they are not transparent enough for users, and still the significant part of communications is done through e-mails, following the informal nature of knowledge sharing. That is why, a necessity for more advanced Q&A were expressed, and this issue is not discussed enough in the literature.

Theoretical insights supported by the empirical data. Mutual support and informal knowledge sharing and consultancy are common. At the same time, formal processes are rarely embedded into the corporate culture.

Theoretical insights supported by the empirical data. Control function on different levels (the whole process, quality, single steps) is dispersed and occasional. It is considered as one of the weakest points of existing KMSs.

Theoretical insights supported by the empirical data. In most of the observed examples processes must be developed further and formalized more. This issue is closely related to the control gap.

64

Summary categories Major findings from the literature review for project-based

KM Empirical findings

New contributing aspects revealed.

In almost all the cases commonly recognized facilitating

Role of facilitating factors for projects based KMS (motivation, training, quality check, promotion, awareness of the process, time issues).

Recommended steps to implement successful KMS

Acknowledged barriers and impediments (summary)

There are three groups of critical facilitating factors for KMS: strategic, cultural and technological (Mas-Machuca & Martinez Costa, 2012, p. 1305; Akhavan et al., 2014, p.116). For PBOs, PM methodology and learning are essential (Schindler & Eppler, 2003, p.227).

Alignment of organizational strategy; supporting organizational culture; open and flat organizational structure; IT corresponding to knowledge needs; adequate KM training for employees; awareness about importance of KM; proper documentation procedures; support of staff's motivation; networking within KM (Akhavan et al., 2014, p.116).

Barriers to successful KM fall into three main categories: individual, organizational and technological (Riege, 2005, p.23). In project-based organizations, the most common obstacles are related to time constraints, organizational issues, and cultural aspects (Williams et al., 2012, p.42; Schindler & Eppler, 2003, p.221; etc.) elements should be improved as their current level of development does not contribute enough to KMS success. The empirical research helped to identify the significance of an element, which was not discussed in the reviewed literature before: that is common understanding of status of KMS and gaps for its development on different levels of the hierarchical structure. Moreover, the role of some previously recognized elements should be reconsidered (see p.5.2).

Inconsistence revealed.

Despite the clear vision of required steps, the examples studied demonstrate rare alignment of them.

New contributing aspects revealed.

As for the most commonly mentioned organizational obstacles there were dedicated time issue and lack of alignment between all the elements of KMS. Technological issues were related to the necessity to unify and simplify existing IT tools. At the individual level, lack of evidence that LL and knowledge sharing is appraised and that it helps to improve organization's performance, serves as an influential demotivating factor for KM process participants.

65

The comparison presented above in Table 9 allows concluding that in the current research the empirical data confirmed most of what was known from the academic literature. In practice, clearly, the temporary nature of projects imposes additional requirements for knowledge sharing between PM teams, what was expected from the literature review (Disterer, 2002, p. 512). This challenge serves as a major trigger for the studied companies to put more efforts into reinforcing their learning capabilities.

A knowledge management system is recognized by practitioners as an important tool for overall organizational success, especially important in project-based environment. The organizations try to implement all that elements which are considered in the literature as parts of successful KMS. Examples of KMS implementation in PBOs demonstrate awareness of practitioners of the required actions to be done in order to

develop KMS. However, not always all the required steps are done or aligned, while it is highly recommended by academic researchers (Formentini & Romano, 2011, p.548). And the final result is often not as good as desired, which confirms the confusion despite the perceived clarity of the required steps (Duffield & Whitty, 2015, p.311).

This surprising finding can be explained mostly by how the process of implementing KMS is performed: the alignment of all the KMS's elements should be its primary focus rather than concentration on over-technologizing. Moreover, some elements are neglected (including formal trainings, control, and some others described above), which negatively influences the whole process and distorts efforts put into development of other elements. It is also worth noting that empirical evidence confirms that project closing still serves as the most important phase to identify and capture new knowledge and to prepare the knowledge for transfer to other projects, as it was suggested in some studies earlier (Disterer, 2002, p. 513). At the same time, it is clear that knowledge in PBOs must be captured not only on this stage. And, this fact also falls into the gap regarding the alignment of all KM elements and actions.

Empirical part of the current research not only confirmed the initial theoretical insights regarding the elements and steps towards the successful KMS, but it also helped to identify some new additional factors. The most meaningful of them are:

- *Differences in formal attitude of the organization and its management to implementing KMS and individuals' expectations about it.* The researchers found that companies keep focusing mostly on technological issues, while individuals often point to the necessity of more mature process, introduction of control over the process and formal acknowledgement. These findings conflict to some extent with previous studies, in particular with the analysis evolution of KMS. In his paper Nicolas (2014, p. 24) stated that more companies nowadays are adopting the socialization strategy, while the current research indicated that in practice formal actions of the companies are far from it;
- *An importance of reaching common understanding of the current status of KMS and its purpose in a company between employees on different levels of its organizational structure.* This issue was absolutely neglected in the reviewed theoretical studies; however, it was highlighted by some respondents. If there is a gap in such understanding, it may depress most of the efforts to improve or develop a KMS, as most probably their focus will be dispersed without bringing any desired changes. This identified gap seems to be a valuable addition to the previously discussed strategic factors that influence the success of project-based KMS implementation (Mas-Machuca & Martinez Costa, 2012, p. 1305);

66

- *A crucial role of formal trainings.* The respondents acknowledged that without proper direct trainings and strict post-control, preferably linked to evaluation of employees' performance, implementing new changes related to KMS is significantly less efficient. And, this gap can even lead to the failure of an entire KMS, even if all the other actions are done correctly. In project-based organizations trainings are even more important, as due to the already mentioned temporary nature of projects learning outcomes may not last. Switching between tasks of different nature rarely allows repeating on practice

what was learned before (Williams, 2008, p.249). Every new project may bring another aspect in regards to KM, that is why strong initial formalization within the overall process is vital for further self-orientation of practitioners;

- *A fundamental need for careful alignment between different elements of KMS, especially during the implementation phase. Overconcentration on some particular element (for instance, on IT tools, as it has been already stated) leads to disproportions in a system and requires more efforts to catch up with other required elements. This inconsistency in actions always has a negative effect on employees involved and distorts their positive expectations. The authors of this paper believe that the best approach in this case is to go slower but more consistently, and some empirical examples confirm that (for instance, Company E, p. 4.2.2).*

To sum up, the comparison of the theoretical and empirical findings did not reveal any revolutionary discoveries or novelties, but it confirmed that learning between projects should consider individual, social and organisational contexts through which projects are formed and which are constantly produced by project activities (Hartmann & Dorée, 2015, p. 350). But, the study allowed defining some differences, which must be considered by managers while working with KMS. And this is exactly what the researchers targeted to achieve: based on the empirical findings to understand which factors, huge or small, are missing when implementing KMS and add them to the theoretical framework in order to create the comprehensive view of the proper implementation process for project-based KMS.

6.2. Revised theoretical framework for KMS in PBOs

This section aggregates all the relevant findings that were described in detail and analysed from different perspectives in the previous chapters. They are presented as an addition to the initial theoretical framework (Chapter 3). This way the researchers aim to provide managers with an overview of all the important features that KMS implemented in project-based organizations need to have. These characteristics are not listed in a specific order, as circumstances in firms may differ; thus the most relevant of them should be selected and adapted to each particular case. At the same time, an alignment and comprehensiveness keep being relevant and should not be forgotten.

All the findings presented in Chapters 5 and 6 allow updating the initial vision of the elements required in a mature and successful project-based KMS that was produced on the basis of the literature review (Figure 1). The revised framework is presented at Figure 6; it includes some new elements and few important changes, which are explained below.

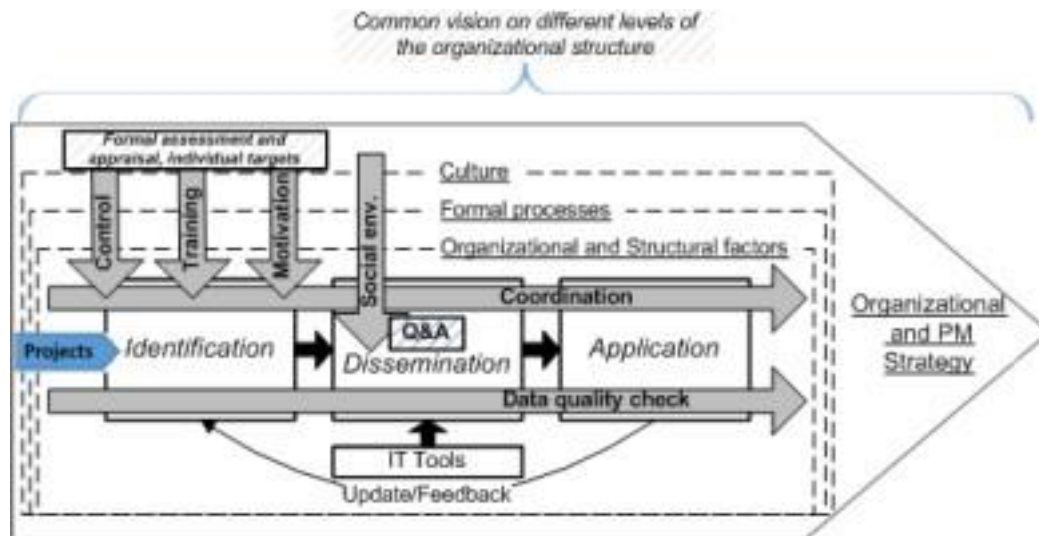


Figure 6. Revised framework for KM in project-based organizations

Hence, in addition to the elements and factors presented and explained in p.3.7. within the initial theoretical framework, from the point of view of the researchers and based on the analysed data, there is a comprehensive list of project-based KMS's elements and actions, which must be considered during KMS implementation:

Strategic elements:

- The development and implementation of KMS must be comprehensive with alignment of all the elements suggested here. Even if some of them may not be considered by some companies as required, neglecting them may lead to potential negative effects. So, all the elements should be discussed and assessed during the planning phase;
- Major target of implementing KMS is to convert tacit knowledge into explicit, as this is what helps to make it accessible, opens a door to increasing competitive strengths and saves time. This target should be in minds of those who implement KMS and should serve as a lighthouse in this process;
- Without a common understanding of current KMS status and KM needs of an organization and employees through the whole hierarchy, successful implementation is not possible.

Practical elements:

- KMS must be integrated as a part of corporate formal and informal culture. The feeling of doing right while sharing information and understanding that it is formally acknowledged and these efforts will be praised are the best motivating drivers for employees to become a part of KM process. Due to the specifics of project-based organizations, this integration is even easier there, as the nature

of projects requires constant learning. Incorporated into everyday practice of every employee, formal KM process evolves by itself as participants find additional motivation from examples of others around;

- It must be clearly explained in corporate policies which time and how can be used for LL and KM practices;
- Within project-based KMS Q&A instruments and capabilities must be seriously considered due to the importance of getting non-typical information and consultancy during project implementation phases. This issue is closely related to

68

time saving and quality control. Existence of formal Q&A capabilities makes it possible to trace participants' activities and introduce formal assessment and motivation mechanisms. At the end, all this helps to achieve the target of converting tacit knowledge into explicit;

- Following the global issue of alignment between KMS elements, it is highly recommended to try to reach maturity of processes before implementing IT tools, as their specifications are dependent on process requirements, and not vice-versa;
- When implementing IT tools, their simplicity and user friendliness are highly appreciated;
- Correct promotion and motivation:
 - When promoting formal KMS, the focus can be done on personal benefits for employees: available data → faster search → less time wasted → increased personal performance → appraisal;
 - Linking knowledge sharing (publishing) activities with formal assessment of employees' performance;
 - Continuously highlight positive examples and experience regarding KMS usage. These efforts must create encouraging environment for all employees in the organization.
- Control:
 - Clear allocation of responsibilities between employees at all the stages of KM (for instance, overall process, Q&A): it allows increasing transparency, quality and personal motivation. Without everyday supervision, guidance and promoting KMS may not develop and be continuously improved as required (related to quality control issues stated below). Such personal responsibility for the whole process from the side of top management should be considered;
 - Introduction of strict quality control and relevance checks of data in knowledge portals, and of answers in Q&A sessions;
 - Ensuring timely responses and reaction to posted questions. Additional assistance from the side of responsible roles may be required to guarantee feedback to all the questions raised;
 - Ensuring implementation of process changes on the basis of suggestions and overall analysis of the KM process and data flow.
- Comprehensive direct trainings regarding all the novelties in scope of KMS implementation are required with following test and post control. Without such strict control, the knowledge is lost and the changes in KMS do not work in practice.

Thus, the entire KMS should be seen the same way on different levels of the organizational structure. Such activities as Control, Training and Motivation should be

implemented and supported through all the organizational elements as Culture, Formal processes and Organizational and Structural factors. Moreover, they all should be complemented by formal assessment and appraisal. At the dissemination stage, an importance of Q&A capabilities is highlighted, as it derives from existing social environment and has significant influence on the overall success of KMS (as explained in the list above).

To sum up, the researchers suggest managers to have this picture in mind and use the recommendations above as a checklist when planning implementation of project-based KMS in their organizations. In this way it is expected to facilitate scope elaboration and risks identification in such initiatives.

69

7. CONCLUSIONS

This chapter includes an overview of the conducted research and shortly presents its findings, thus, answering the research question. Theoretical and practical implications of the results of the study are provided as well as its limitations are acknowledged. Lastly, suggestions regarding future research are given.

7.1. Summary of the study

This research intends, on the one hand, to reduce confusion created by the multiplicity of existing approaches developed to guide the process of implementing KMS in project based organizations and, on the other hand, to close a breach between these theoretical approaches and their application in practice, which is often characterized by various obstacles. These purposes framed the research question and objectives and determined the direction for an exhaustive literature review performed by the authors. As a result of this review, a guiding theoretical framework mapping implementation of KMS in PBOs was developed to support the collection and analysis of data.

Based on the research question and exploratory nature of the study, the authors opted to design the research as a case study and investigate how KMS is implemented in the Company Z and which factors hinder success of this system. The Company Z was selected as a representative example of a project-based organization with a knowledge management system that is sufficiently developed but faces obstacles typical for most PBOs. The data was collected through semi-structured interviews with employees of the Company Z and from documentation. In order to ensure quality of the research and increase its reliability and validity, the researchers collected data through interviews in ten other project-based organizations.

The data gathered was analysed using two approaches: template analysis and data display. The findings were then converged and used to revise the initial theoretical framework and complement it with critical factors required for successful implementation of KMSs in PBOs.

Such extensive theoretical and empirical research allowed the authors to find an answer to the question posed for this study: *How could knowledge management system be implemented in project-based organizations in a successful way?* **Multi-stage**

approach and diversity of data sources ensured the credibility and validity of the outcome. Thus, according to the researchers, the objective of developing a comprehensive framework, which would include vital elements and critical factors for implementing a successful KMS in PBOs, has been achieved.

The final framework is a combination of the most common and relevant elements, conclusions and recommendations given by academics in the previous studies and of new factors and issues that were under-explored before but were revealed by the researchers through empirical data collection within the current study.

However, the authors of this paper see its major value not only in consolidation of these parts but in the finding that the primary focus in implementing KMS in PBOs should be on aligning all these required elements and ensuring that all of them are balanced and developed evenly. Failure or under-development of any element jeopardizes success of

70

the whole system. Thus, a high level of maturity needs to be reached throughout the whole KM process with appropriate degree of technologisation and socialization.

In general, a KMS should comply with overall strategy of a company. Its major target should be seen as conversion of tacit knowledge into explicit one. In addition, it is vital to ensure that employees at all hierarchical levels of an organization acknowledge the significance of KM in general and, which is even more important, have a common understanding of existing KM system.

Moreover, KMS should be properly implemented at all the stages of KM process: from identification of knowledge to its dissemination and application, with special attention to the last phase, which is often neglected.

Temporary nature of PBOs creates specific obstacles that are mostly related to time pressures. On the one hand, employees are short of time to devote to any KM activity; on the other hand, organizations have fewer opportunities for training all employees regarding KM process. In this case the importance of Q&A instruments is increasing in order to make knowledge accumulation and sharing in such organizations successful.

Major recommendations from the practical point of view can be summarized the following way:

- integration of KMS into everyday practice of employees within formal and informal corporate culture and ensuring appropriate motivation;
- resolving all the process issues (establishment of overall KM process, addressing time issues, introduction of proper coordination control function, allocation of responsibilities within KMS) prior to implementation of IT tools;
- focus on simplicity and user-friendliness of IT systems for KM purposes; · creation of a strict formal training system that covers all the elements of KMS, includes post-training control and links training activities and assessment of employees' performance.

The researchers believe that if PBOs ensure incorporation of all these critical elements and factors into their KMSs, chances for success increase significantly and possible obstacles can be avoided.

7.2. Theoretical and Practical Contribution

The current research is believed to contribute to both theory and practice. From *a theoretical standpoint*, the researchers present the framework for implementing KMS in project-based organizations in a successful way. This framework is built on the advances of the existing academic literature and embodies the most relevant elements mentioned in other studies. On the one hand, the researchers intended to eliminate confusion between numerous approaches offered previously and suggested a more systemic and comprehensive model. On the other hand, the authors paid special attention to obstacles that prevent PBOs from successful implementation of KMSs, with time pressure, cultural and organizational issues being the key impediments. Moreover, new aspects of the KMS implementation process in project-based organizations were identified (in particular, need to align views regarding KMS at different levels of employees, importance of formal trainings, role of Q&A capabilities). These findings are extending the horizon of theoretical considerations regarding the KM. By bringing

71

together the best from theory and practice in the single theoretical framework, the researchers aimed to fill the gap between the theory and practice. Besides, the suggested framework is expected to inspire and trigger further research in the area of knowledge management in the era of projectification.

From *an empirical point of view*, given the exploratory nature of the current study, it gives an overview how project-based KMSs are realized and function in practice within different geographical and industrial contexts. The authors believe that for the organizations that were studied participation in the research was useful and allowed looking at their KMSs in a new light and considering new aspects of them.

Furthermore, since the framework is developed as a summary of previous theoretical and practical research experiences, by itself it can be considered as an example of learning from the past and knowledge application. So, the framework may be used as a reference point for practitioners involved in implementing KMS in project-based organizations. In particular, firstly, it can serve as a checklist in order to identify whether their KMS incorporates all the elements essential for its success and whether some typical barriers impede its implementation. Secondly, managers can use the framework as a guideline regarding the elements to be included into existing KMS and especially those systems that are to be built from scratch. And finally, practitioners can follow the given recommendations in order to increase chances of KMS's success and overcome identified barriers.

7.3. Limitations of the study

The researchers acknowledge that the current study has several limitations. Firstly, the authors didn't intend to statistically generalize the results of the research. And even

though, the relevance of the findings for PBOs in other countries and industries was proved through crosschecking them for the complementary organizations, the researchers recommend careful application of the framework in different contexts.

Secondly, time limits and resource constraints influenced the number of interviews that could be conducted in other PBOs (apart from the Company Z), which forced the authors to abandon the idea of multiple-case study design. That is why the researchers used this additional data from the other organizations for the purpose of triangulation.

Thirdly, lack of immediate access to KM tools in the Company Z prevented the researchers from deeper assessment of their advantages and disadvantages, thus, making it impossible to elaborate more specific recommendations regarding improvement of these tools.

Lastly, the fact that the interviews were conducted in English language, foreign both for the researchers and some of the interviewees, as well as use of Skype and other conference call tools, may raise some dependability concerns, however, this choice of techniques was dictated by the resources and time available. Future research may overcome these limitations through conducting face-to-face interviews and, where possible, in native language of the interviews and/or respondents.

7.4. Future Research

The researchers believe that the importance of knowledge in project management area as well as the need in comprehensive yet feasible approaches to implementing KMS in practice will continue growing. That is why, it is expected that further exploration of this topic will benefit both PM theory and practice.

The researchers see several directions for future studies. First of all, similar research question can be addressed using multiple case study design, which would allow collecting primary data from a larger number of interviews in each case, which was not possible in the current research. It would allow drawing a more complete picture of existing KMSs and conducting more comprehensive comparison of them. Including organizations from even more diverse set of countries and industries or, on the contrary, limiting cases by geographical or some other principle could provide more insights into the problem.

Secondly, the current research can be complemented by applying a quantitative method in order to, for instance, evaluate practicability and/or effectiveness of recommendations presented in the academic literature, or estimate the relevance of identified common barriers in different contexts, or get a feedback regarding usefulness and feasibility of given recommendations. For that a survey design can be used with respective random sampling, larger sample and statistical generalization.

Thirdly, it is suggested to investigate the impact of existing barriers within KMSs on its efficiency and effectiveness as well as on the success of projects in order to further

justify the importance of these systems in PBOs and investments into their constant improvement.

Finally, separate studies may be devoted to specific obstacles for successful implementation of KMS in PBOs, e.g. culture and motivation. In particular, it would be interesting to investigate cross-cultural differences in regards to existence and relevance of one or another impediment in knowledge management process.

Alternatively, researchers may study barriers that appear in the process of sharing and transfer knowledge about products between the production units and implementation projects (the current research touched upon this issue only slightly and focused on knowledge management within and between projects).

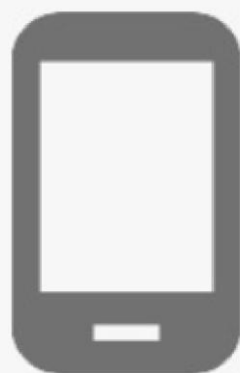
In this final chapter the authors answered the research question set at the beginning of the paper. For that the researchers elaborated a comprehensive framework aimed to pave the way for more successful implementation of knowledge management systems in project-based organizations as well for further investigation this area. In spite of the fact that recommendations within this framework were developed based on KMS in the Company Z, the results of crosschecking the findings with other project-based organization prove its relevance in general.

7) CODING AND IMPLEMENTATION

7:36



Firebase Phone Authentication



Phone Number

please enter your mobile number

+92xxxxxxxxxx

CONTINUE

9:13



Firebase Phone Authentication



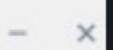
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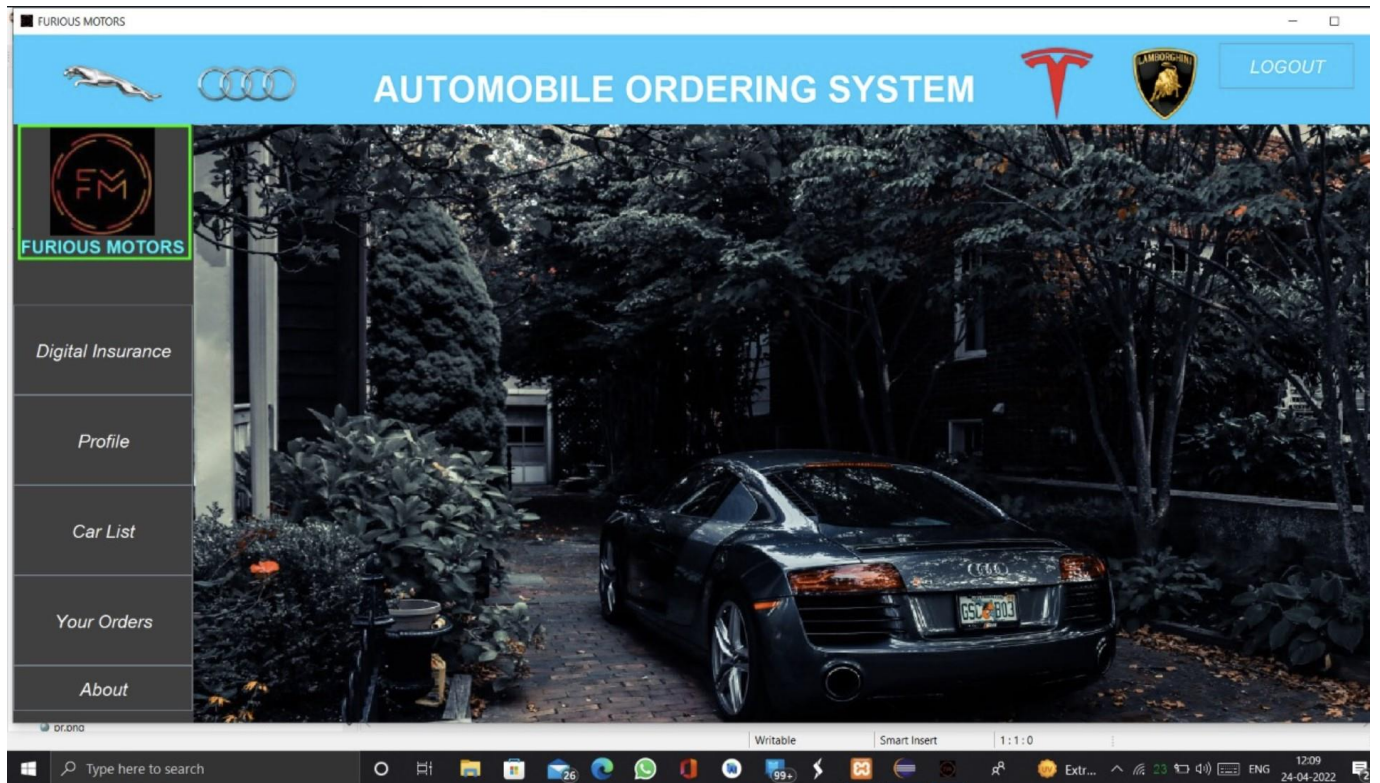
please type the verification code we sent
to +916369301815

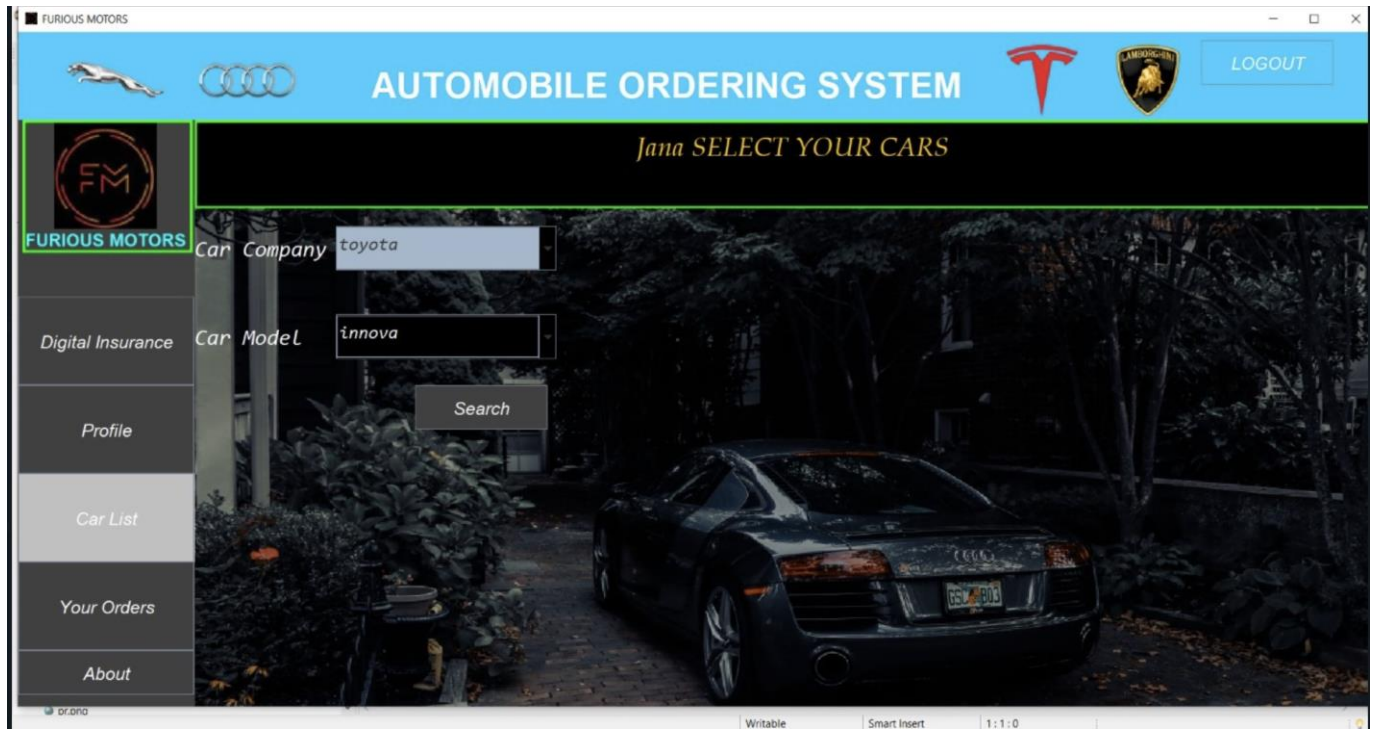
328108

Didn't get OTP? [Resendb>](#)

SUBMIT







```

import java.sql.Connection; import
java.sql.DriverManager; import
java.sql.PreparedStatement; import
java.sql.Statement; import
java.util.HashMap;

import javax.swing.BorderFactory; import
javax.swing.ImageIcon; import
javax.swing.JButton; import javax.swing.JFrame;
import javax.swing.JLabel; import
javax.swing.JPanel; import
javax.swing.JPasswordField; import
javax.swing.JTextField; import
javax.swing.border.Border; import
com.mysql.jdbc.ResultSet; public class loginpage
implements ActionListener {

    JFrame frame=new JFrame();
    JButton login=new JButton("login");
    JButton reset=new JButton("reset");
    JLabel userid=new JLabel("USER ID");
    JLabel message=new JLabel();
    JLabel tmessage=new JLabel();
    JPanel dmessage=new JPanel();
    JPanel smessage=new JPanel();
    JLabel password=new JLabel("PASSWORD");
    JTextField user=new JTextField();
    JPasswordField pass=new JPasswordField();
    ImageIcon nnn=new ImageIcon("Screenshot 2021-09-22 143220.png");
    ImageIcon logo=new ImageIcon("FMLOGO.png");
    Border border=BorderFactory.createLineBorder(Color.GREEN, 5);
    JButton register=new JButton("Register");
    JLabel registerlabel=new JLabel("Create Account:");
    String username;
    String dob;
    String address;
    String email;
    String contactnumber;
    String i;
    ImageIcon p=new ImageIcon();
    JButton forgot=new JButton("Forgot Password");

loginpage()
{

    frame.setVisible(true);
    frame.setSize(500,500);
    frame.setLayout(null);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setResizable(false); userid.setBounds(50, 50, 100, 100);
    password.setBounds(50, 80, 100, 100);
    user.setBounds(120,85,120,30); pass.setBounds(120, 120, 120,
    30); message.setBounds(150, 250, 150, 100);
    tmessage.setBounds(50,20 ,420, 25);
    tmessage.setText("AUTOMOBILE ORDERING SYSTEM");
    tmessage.setFont(new Font("consolas",Font.ROMAN_BASELINE,25));

```



```

dmessage.setBounds(0,400,250,60); dmessage.setLayout(new
GridLayout(4,0)); dmessage.setBackground(Color.CYAN);
smessage.setBounds(300,50,180,400);
//smessage.setLayout(null);
smessage.setBackground(new Color(51,204,255));
JLabel t1=new JLabel("CONTACT US");
JLabel t2=new JLabel("                JANARTHAN.T: 6369301815");
JLabel t3=new JLabel("                SATHISH KUMAR.S: 6380166615");
JLabel t4=new JLabel("                RAHUL.K: 9361194681");
JLabel t5=new JLabel();

dmessage.add(t1);
dmessage.add(t2);
dmessage.add(t3);
dmessage.add(t4);

t5.setIcon(nnn);
t5.setBorder(border);

smessage.add(t5);
dmessage.setFont(new Font("consolas",Font.ROMAN_BASELINE,15));
login.setBounds(100,175,100 ,50); login.addActionListener(this);
login.setFocusable(false); reset.setBounds(200,175,100 ,50);
reset.addActionListener(this); reset.setFocusable(false);
register.setBounds(175,350,100 ,50); register.addActionListener(this);
register.setFocusable(false);
registerlabel.setForeground(Color.DARK_GRAY);
registerlabel.setBounds(0, 350,175, 50);
registerlabel.setFont(new Font("consolas",Font.BOLD,20));
forgot.setBounds(100,225,200,30);
forgot.addActionListener(this);
forgot.setFocusable(false);
frame.getContentPane().setBackground(new Color(51,204,255));
frame.add(login); frame.add(reset); frame.add(userid);
frame.add(password); frame.add(user); frame.add(pass);
frame.add(message); frame.add(tmessage);
frame.add(dmessage); frame.add(smessage);
frame.add(register); frame.add(registerlabel);
frame.add(forgot); frame.setTitle("FURIOUS MOTORS");
frame.setIconImage(logo.getImage());

}

@Override
public void actionPerformed(ActionEvent e) {
    // TODO Auto-generated method stub
    if(e.getSource()==reset)
    { user.setText("");
      pass.setText("");
      message.setText("");
      ;

    }
    if(e.getSource()==login)
    {

```

```

        String usern=user.getText();

        try {
            Class.forName("com.mysql.jdbc.Driver");
            Connection
conn=DriverManager.getConnection("jdbc:mysql://localhost:3306/jana","root","");
            Statement stmt=conn.createStatement();
            Statement stm=conn.createStatement();

            String sql="Select * from janarthan where
userid='"+user.getText()+"' and password='"+pass.getText().toString()+"'"; String
sq="Select * from janarthan where
userid='"+user.getText()+"'"; java.sql.ResultSet rs=
            stmt.executeQuery(sql);

java.sql.ResultSet r= stm.executeQuery(sq);

while(r.next()) { username=String.valueOf(r.getString("user_name"));
i=String.valueOf(r.getString("user_name"));
dob=String.valueOf(r.getString("dob"));
address=String.valueOf(r.getString("addressad"));
contactnumber=String.valueOf(r.getString("contactno"));

}

if(rs.next()) {
        message.setForeground(Color.green);
        message.setText("LOGIN SUCCESSFUL");
        new
welcomepage(usern,username,dob,contactnumber,address,i);
        frame.dispose();

    }
    else
    { message.setForeground(Color.red);
      message.setText("LOGIN FAILURE");
    }

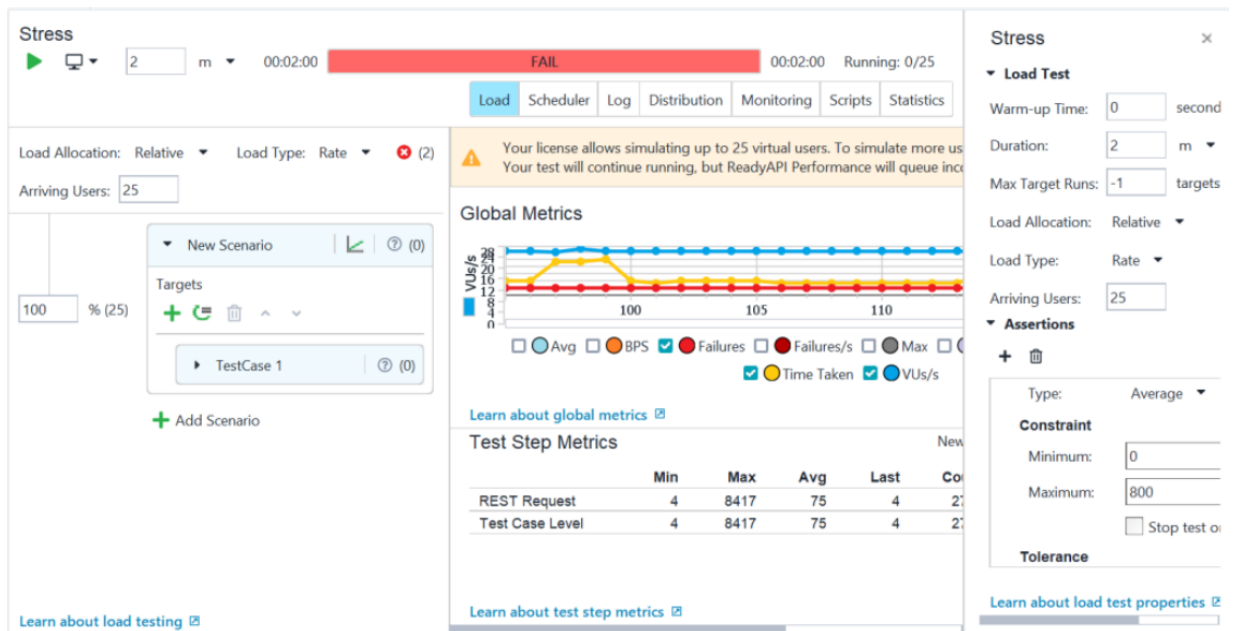
    }
    catch(Exception e1){
        message.setForeground(Color.red);
        message.setText("USER ID NOT FOUND");
    }

    }

if(e.getSource()==register)
{ new signupage();
  frame.dispose();
}

```

Testing:



Minutes of meetings held and activity reports: 1st meeting -1st February 2022- Discussing the existing resources available at the clinic. 2nd meeting-28th February 2022-Challenges faced with the existing system. 3rd meeting-15th March 2022- Solutions for challenges

4th meeting-22nd March 2022-Discussion of desktop application or website and the selection of mode.

5th meeting-29th March 2022-Decision made to develop website.

And programming languages discussion. 6th meeting-5th April 2022- Web design

7th meeting-12th April 2022-SQL database

8th meeting-3rd 2022-Front-End design 9th

meeting-10th 2022-Backend-design

10th meeting-17th April 2022- Developing some modules

Weekly activity report

Sathish Kumar;Harish

1st week:Talk to companies,analysing papers,existing research work

2nd week:Existing system analysis(3 of us)

3rd week:Solutions for challenges(3 of us)

4th week:Front end design,Back end design,Architecture