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# Knowledge-based Management of IT Projects with Methods of Artificial Intelligence to Increase Efficiency

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ABSTRACT: The success of IT projects in companies is increasingly becoming a competitive factor. This study aims to analyze whether selected artificial intelligence (AI) methods and knowledge-based management (KBM) can provide benefits in the management of IT projects. The approach of knowledge management is of particular importance for companies, as the continuous and unpredictable changes are nowadays the standard in many business sectors. Consequently, knowledge has become an essential corporate resource. The deductive research approach in this paper has a qualitative exploratory design based on semi-structured interviews followed by Qualitative Data Analysis (QDA). The categories and coding used within the QDA were generated through an interview guide. The participants surveyed are proven experts in their field and hold high-ranking positions in industry, retail, consulting, and the public sector. This study shows that using artificial intelligence in conjunction with knowledge management is neglected in companies. AI is perceived and pursued, but knowledge management approaches are not consistently carried out. The limitation of this study is not limited to a specific type of IT project but focuses on classic project procedure models that are frequently found in practice. The study results can aid organizations in making their project management processes more efficient while benefiting from the resource of available implicit

and explicit knowledge inside their organizations. No comprehensive framework for using AI methods and knowledge management in IT projects was found in the existing literature. Therefore, this study fills the research gap.

KEY WORDS: Artificial intelligence, Knowledge management, Project management

## Introduction

The ability to recognize and conduct transformations in their own organization is one of the most important for companies nowadays. Knowing about the requests from their markets with their participants and the need to offer the right products to the right place, at the right time and quality is essential for the survival of a company.

## Problem definition

The pressure on IT departments to implement projects that contribute to the success of the company remains high to reach their goals in the dimensions of time, quality and effort. For the question what project management is about, Reich, Gemino and Sauer (2008, 4–14) describe it "as an arena in which action is paramount and in which tasks, budgets, people and schedules must be managed and controlled to achieve expected results." But the achievement of the project objectives is not an end in itself. In a research study in 2019 from Capgemini Germany, only 15% of the interviewed companies will decrease their IT budget comparing the previous year. 50% of them will have an increased budget, and nearly 35% will have the same budget level than last year. In fact, the main target of the IT budget of 72% will be the digitization of the processes and increasing the efficiency of the organization. (Dumslaff und Heimann 2018). The main issue for these companies is very often the fact that there is no sufficient manpower working in the IT and project departments to manage the upcoming demands. Also, the need to handle the knowledge of the employees is an increasingly serious topic where companies are fully aware of this circumstance. A 2021 study examined how and when project manager frustration and anxiety affects the behavior of project team members in an organization (Wang et al. 2021). One result of this study is that the

satisfaction of the project managers is directly reflected in the project team and the project outcome. With these challenges, it is becoming increasingly difficult to achieve the stated goals of IT projects. This result is supported by The Standish Group International from 2015 which shows that only 6% of all grand projects were completed as planned and only 11% of all large projects were completed as planned. (The Standish Group International, Inc 2015, 3). Project management in the context of other methods or technical trends has already been studied. In this context, Ning and Shang (2021) explored quality management approaches based on resilience theory using innovative construction projects as examples. Another study aims to determine how Big Data has a positive impact on project performance or how this impacts improving the quality of construction projects. As a result, it was found that it facilitated the development of technological capabilities, leading to significant quality performance (Sang et al. 2021). A quality feature that could become increasingly important in the future is to be able to achieve the required quality with principles of sustainability. Ershadi and Goodarzi (2021) studied this circumstance in more detail in the context of construction projects in 2021. An important part of planning and conducting project management is the part of knowledge management (KM). That is also valuable to examine as already Gemino, Lee and Reich mentioned (Gemino et al. 2007, 9–44; Lee und Lee 2000, 281–288; Reich, B.H., Gemino, A, Sauer, C. 2008, 2–14. As Want et al. (2007, 200–212) point out that projects are knowledge-intensive but IT projects in a particular way. This could be justified by the fact that IT projects often aim at developing new software which is an imaginary product. On the other hand, the number of IT trends with knowledge-intensive skills requirements is growing rapidly. Independent from the type of IT project or the selected procedure model often there are the following parameters given to hit the project goals. Lech (2014, 554) uses the knowledge taxonomy of project knowledge in order to describe the parameters of resources, time and cost to reaching the target of a specific project, schedules and milestones. In projects, all forms of knowledge are used in many places and someone in projects must be aware of it. Hanisch et al. (2009, 148–160) also refer to the need that managing knowledge in projects is one of the most important tasks of a project manager and the necessity to focus research in the field

of project-based companies is growing. Hanisch et al. also refer to the need that managing knowledge in projects is one of the most important tasks of a project manager and the necessity to focus research in the field of project-based companies is growing (Hanisch et al. 2009, 148–160). Lech mentions that there are two types of knowledge that an project manager must have at his disposal. One is the generic project management knowledge available in the body of knowledge guides like PMI Project Management Institution, and the other is the product-related project management knowledge. This includes best practices for performing projects involving the implementation of a specific system or topic (Lech 2014, 570). Judging by these facts, it should also be in the project manager's interest to manage the knowledge in the projects as efficiently as possible. This will also be noticeable in IT controlling. IT controlling can be seen as a system for preparing decisions within the framework of the deployment and use of IT resources (Gadatsch 2021, 1). The issue regarding knowledge or rather the management of knowledge in projects is well-known and there are a lot of frameworks and modelling e.g. from Gasik or the examinations from Lech but, nevertheless, the question of whether selected artificial intelligence (AI) methods and knowledge-based management (KBM) can provide benefits in the management of IT projects is still unanswered. For the ability to perform knowledge management in IT projects, emotional intelligence is also necessary. In this context, Khosravi et al. (2020) studied how emotional intelligence among project members affects performance and project outcomes.

## Methodology

Empirical social research is research that examines a specific part of the social world in order to facilitate the further development of theories. Gläser and Laudel point out that although the research process can be described as empirical, it is based on the theory that considers social reality and draws theoretical conclusions from it. Empirical social studies are usually divided into quantitative and qualitative studies. However, qualitative social research is criticized because it would be conducted without theoretical references and arbitrary processes and therefore is not subject to methodological control

(Gläser und Laudel 2010, 24–25). According to Mayring, the goal of content analysis is to analyze material that comes from any source of communication. He further points out that it is about the communication content and formal aspects of the communication. As a further challenge, Mayring points out that the results of qualitative content analysis can strongly reflect the author's definitions and are thus too specific to be evaluated as generally valid (Mayring 2015, 11). According to Kuckartz (2014, 15), the quality of the information depends on the selection of the interview participants who take part in the expert interviews or whose answers are subsequently evaluated. Chreswell (2009, 18), on the other hand, points out that if a concept or phenomenon needs to be understood because little research has been performed on it, then it merits a qualitative approach. Therefore, the research has a qualitative exploratory design based on semi-structured interviews with proven experts, followed by qualitative data analysis (QDA). The QDA is conducted using MAXQDA, software for qualitative data analysis (MAXQDA - Software für qualitative Datenanalyse 1989 - 2022).

Following Kuckartz, Figure 1 illustrates the process of answering the research questions presented in the follow-up. After the interviews have been conducted, a deductive approach is used to form the categories. In the third and fourth steps, the corresponding categories are coded to the text passages of the interviews and then analyzed, and in the final step, the results are presented.

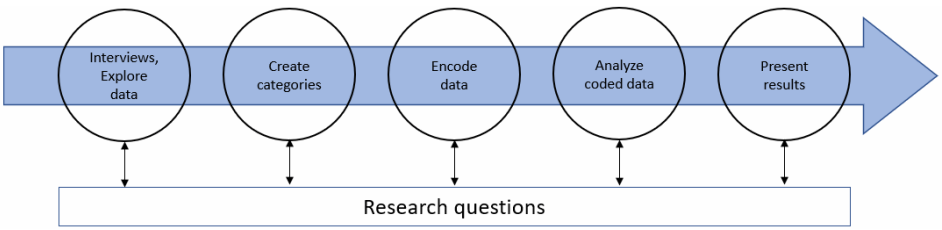


Figure 1. Process of deductive QDA following Kuckartz

This paper focuses on the last two steps of analyzing the coded data and presenting the results. The results are examined according to their content and within variables, which are the assignment of occupations and roles in

this study. Possible distinctions in the experts' answers could be explained by their different roles in everyday professional life. This circumstance is thus taken into account.

*Selection of the experts*

A basic breakdown of experts can be divided into three areas. On the one hand, there are those experts who have technical know-how. Secondly, there are experts who have process knowledge, which goes hand in hand with informal or hidden knowledge. The third group of experts consists of the interpretive knowledge, which has ideas, ideologies and explanatory patterns (Kruse et al. 2015, 176). In selecting the experts, care was taken to select all three types of experts described by Kruse et al. All of the participants interviewed are proven experts in their field and hold high-ranking positions in industry, commerce, consulting, and the general public sector. The persons with whom the interviews were conducted are now presented in the following.

Expert 1 (Financial expert): Senior Professional in the SAP Finance environment of one of the largest retail groups in Europe based in Cologne. Initially expert in preparing and analyzing balance sheets and experienced in national and international finance projects.

Expert 2 (Senior Project Manager): IT Project Manager and Scrum Master with many years of experience in planning and implementing various IT projects in national and international company. Many years of experience in planning and execution of various IT projects in national and international companies. Consulting experience in a variety of industries including consumer goods, electronics manufacturing, public sector and management consulting.

Expert 3 (Managing Director): Years of IT project experience, starting as an IT consultant and project manager until taking over the team leader position. For about eight years member of the management and for two years managing director of a medium-sized IT and management consultancy. Very high expertise in all aspects of project management.

Expert 4 (Senior Project Manager): Decades of experience managing IT departments and executing major projects in a technical auditing group. Pervasive experience in the SAP area and deep technical understanding of artificial intelligence methods.

Expert 5 (Senior Project Manager): Currently working as a freelance IT Manager / CIO / CTO with years of experience in leading IT positions, including CIO of one of the largest hotel portals in Germany and Vice President IT of a large energy company. Extensive experience in implementing and supervising all kinds of large-scale IT projects.

Expert 6 (Senior Project Manager): Certified project manager (IPMA) with extensive experience in managing IT and organizational projects in various industries such as a tourism group, logistics company, and the energy industry.

Expert 7 (Financial expert): Senior Commercial Expert with a lot of experience in finance and controlling across different sectors such as service and industry as well as in public sector. Specialized also in the implementation of projects focusing on IT systems in the environment of corporate finance.

Expert 8 (Senior Project Manager): IT Program and Project Manager focused on IT infrastructure projects with decades of experience with a technical testing services provider. National and international project assignments in all aspects of IT infrastructure.

Expert 9 (Senior Project Manager): Senior Manager at one of the world's largest accounting firms, working in the Consulting Public Sector division. Deep and long experience in SAP Analytics, Business Intelligence, and Artificial Intelligence and in leading project teams and departments.

Expert 10 (Managing Director): Director and therefore responsible for the SAP portfolio for the public sector at one of the largest auditing companies in the consulting sector. Decades of professional experience in the planning and implementation of IT projects in the area of SAP as well as in the management of teams and departments.

## Results and discussions

According to Creswell, "in a qualitative study, researchers formulate research questions, not objectives or hypotheses" (Creswell 2009, 129). Therefore, the following research questions (RQ) were posted:

*RQ1: Are methods of artificial intelligence and knowledge management capable of achieving monetary benefits in the planning and control of IT projects?*
*RQ2: What are the prerequisites for the use of these methods?*
*RQ3: What are the limitations of using artificial intelligence methods in project management?*

Before the previously mentioned research questions can be answered with the help of QDA, the presentation of the code configuration is necessary. After conducting the interviews, this is the second step in the process, according to Kuckartz, which was already clarified in Figure 1 in advance. The actual codes were developed using a deductive research approach based on the text under investigation. During the investigation, however, supplementary and for the answer to the research questions, relevant further codings occurred so that these correspond to the inductive approach. A corresponding coding and overview can be found in the table 1.

Table 1. Code configuration system

| **Main-code** | **Sub-code** | **Code Frequency in all documents** | **Inductive/ deductive** |
|---|---|---|---|
| Competitive advantage | without limitations | 14 | deductive |
| Competitive advantage | with limitations | 9 | deductive |
| Limitations | Individual interests | 1 | inductive |
| Limitations | Historically grown structures | 2 | inductive |
| Limitations | Complete new tasks | 2 | deductive |
| Limitations | No final decision-making power | 2 | inductive |
| Limitations | No limitation | 4 | inductive |

| | | | |
|---|---|---|---|
| Limitations | Tasks with human interaction | 10 | deductive |
| Monetary benefit | No | 0 | deductive |
| Monetary benefit | Partial | 3 | inductive |
| Monetary benefit | Yes | 13 | deductive |
| Prerequisites | Approach for improvement | 3 | inductive |
| Prerequisites | Technical infrastructure | 4 | deductive |
| Prerequisites | Stakeholder / employees management | 5 | deductive |
| Prerequisites | Knowledge transfer | 10 | deductive |
| Prerequisites | Complete data | 12 | deductive |
| Total: | | 94 | |

Table 1 already shows that most of the codes were created by deductive methods. The deductive codes were assigned 10 times, whereas the inductive codes were derived six times.

### *Investigation of the research questions*

The research questions will be investigated using the coded segments from the interview. Therefore, each answer to the respective research question is based on the experts' exploratory summaries of the assigned codes, presented in Table 1. The summary of the statements thus leads to answering the research questions. In the following step, the individual experts and their roles are compared with each other. In the following step, the individual experts and their roles are compared with each other.

### *Single-based expert analysis*

*RQ1: Are methods of artificial intelligence and knowledge management capable of achieving monetary benefits in the planning and control of IT projects?*

The following table 2 will show the summarized answers of each expert in regards of research question 1 (RQ1).

Table 2. Summary table for RQ1

| Expert | Sub-Code: Partial | Sub-Code: Yes |
|---|---|---|
| Expert 1 (FE) | | Yes, the use of AI in project management has a monetary benefit mainly caused by the accompanying time savings. |
| Expert 2 (SPM) | | Yes, the use of AI in project management has monetary benefits. The use of AI can extend to multiple application scenarios in PM. |
| Expert 3 (MD) | In part, there could be a financial benefit, but it all depends on the data set. | |
| Expert 4 (SPM) | There could be a financial benefit but at the moment companies are not ready to use it. | Yes, there is a monetary benefit to using AI in project management. The use of AI can extend to multiple application scenarios in PM, which are repeated repeatedly. It also leads to a reduction in the workload of employees. |
| Expert 5 (SPM) | | Yes, there is a monetary benefit to using AI in project management. |
| Expert 6 (SPM) | There could be a financial benefit but in the agile environment it is difficult and even if the company is not even ready organizationally. | Yes, there is a monetary benefit to using AI in project management. |
| Expert 7 (FE) | | Yes, there is a monetary benefit to using AI in project management. The example from various functionalities in the SAP Finance area, i.e. from accounting. |
| Expert 8 (SPM) | | Yes, the use of AI in project management has a financial benefit in terms of processes. |
| Expert 9 (SPM) | | Yes, the use of AI in project management has in terms of recurring tasks. |
| Expert 10 (MD) | | Yes, the use of AI in project management has in terms of recurring tasks that we also already use today. |

Answering Research Question 1 (RQ1): The statements of the experts surveyed provide a clear picture that they believe the methods of artificial intelligence and knowledge management have the potential to possess a monetary advantage in project management. However, it is striking that three experts answered the question in the affirmative but at the same time saw significant limitations, such as the fact that companies are not yet ready to use these methods present. In addition, no expert answered the research question in the negative.

*RQ2: What are the prerequisites for the use of these methods?*

The following table 3 will show the summarized answers of each expert in regards of research question 2 (RQ2).

Table 3. Summary table for RQ2

| Expert | Sub-Code: Complete data | Sub-Code: Knowledge transfer | Sub-Code: Approach for improvement and Stakeholder / employees management |
|---|---|---|---|
| Expert 1 (FE) | All information and parameters must be completely available to AI. | comprehensive and continuous know-how transfer. | |
| Expert 2 (SPM) | Precise structured and up-to-date data | Comprehensive and continuous know-how transfer and the possibility to learn in a playful way | That AI and knowledge management can bring about a clear improvement in projects |
| Expert 3 (MD) | Technical setting and solid qualitative database necessary. | | |
| Expert 4 (SPM) | Data quality and the right AI method | Build knowledge and make it centrally available to all employees | The employees must be informed about the possibilities and take away the fear that they will lose their jobs. |

| | | | |
|---|---|---|---|
| Expert 5 (SPM) | Data quality and the right AI method | | |
| Expert 6 (SPM) | Historical and current data to forecast future scenarios | | |
| Expert 7 (FE) | | | Nevertheless create added value due to investment costs |
| Expert 8 (SPM) | | Employees must be trained, knowledge must be made available | Employees must be prepared for the topic and their fears taken seriously. |
| Expert 9 (SPM) | | Knowing what you can do with an AI in the first place. | |
| Expert 10 (MD) | | To have the possibility to try out the knowledge and to learn in a playful way. Training courses and starting with small projects and then increasing. | Regular communication with employees is important. |

Answering Research Question 2 (RQ2): The vast majority of experts see data availability and high data quality as prerequisites for using AI and KM. This involves the use of current and historical information to forecast future scenarios. The experts see essential prerequisite in communication with the employees. On the one hand, any fears of job loss must be taken seriously and responded to appropriately, and on the other, employees must be trained. This includes content-related training but also knowledge of what AI can do and where its limits are.

*RQ3: What are the limitations of using artificial intelligence methods in project management?*

The following table 4 will show the summarized answers of each expert in regards of research question 3 (RQ3).

Table 4. Summary table for RQ 3

| Expert | Sub-Code: Tasks with human interaction and No final decision-making power | Sub-Code: Completely new tasks | Sub-Code: No limitation |
|---|---|---|---|
| Expert 1 (FE) | | | In principle no limitation |
| Expert 2 (SPM) | Tasks in which empathy, compassion and social skills are important. | | |
| Expert 3 (MD) | Decisions made by the AI should be questioned | | |
| Expert 4 (SPM) | No personnel decisions - indications yes but no decisions | | In principle no limitation |
| Expert 5 (SPM) | | Completely new tasks | |
| Expert 6 (SPM) | | | In principle no limitation |
| Expert 7 (FE) | Basically, applicable everywhere but still no contacts to important stakeholders | | In principle no limitation |
| Expert 8 (SPM) | What cannot replace is the empathic interpersonal conversation | Fulfillment of spontaneous requests | |
| Expert 9 (SPM) | When it comes to togetherness and especially when it comes to escalations | | In principle no limitation |
| Expert 10 (MD) | when it comes to the assessment of people | | |

Answering Research Question 3 (RQ3): In general, the experts hardly see any restrictions regarding the technical functionalities of an AI method in project management. However, they are critical of entirely new tasks since the AI usually has to be trained for them and spontaneous requests, which can also lead to problems with the AI. One technically possible implementation that

the experts in project management do not recommend is in connection with human interaction. The AI should not perform corresponding tasks where intuition, compassion, and social and emotional intelligence are required. In addition, some experts see the individual interests of individual departments or segments in a company as an obstacle, which either covertly or openly position themselves against the use of AI in project management.

***Role-based expert analysis using cross tabulation analysis***

In the following, the frequency of the codes for the respective roles of the experts is examined. This reveals possible overlaps and deviations in the number of responses, suggesting a conclusion about the importance of the topic for each role. Since research question 1 was answered positively by all experts, a role-based evaluation is not performed at this point, since all roles consequently show the same result.

*Role-based expert analysis for research question 2:*
*What are the prerequisites for the use of these methods?*

Table 5 shows the role-based expert analysis for research question 2. In particular, the role of the Senior Project Manager is to see the requirements in the completeness of the data and the knowledge transfer. On the other hand, the Managing Directors' role sees the prerequisites in a similar criticality as the financial experts. One explanation could be that the Senior Project Managers encounter a more comprehensive range of essential prerequisites in their day-to-day work than the other two roles.

Table 5. Role-based expert analysis RQ 2

| **Sub-codes** | **Managing Director** | **Senior Project Manager** | **Financial expert** |
|---|---|---|---|
| Complete data | 1 | 4 | 1 |
| Knowledge transfer | 1 | 4 | 1 |
| Approach for improvement Approach for improvement and Stakeholder / employees management | 1 | 3 | 2 |

*Role-based expert analysis for research question 3:*
*What are the prerequisites for the use of these methods?*

Table 6 shows the role-based expert analysis for research question 3. It is striking that the opinion that AI should not take over tasks in which social and emotional intelligence is necessary is mentioned by all three roles. This shows the importance of this fact. Beyond this, however, no significant similarities between the roles can be identified.

Table 6. Role-based expert analysis RQ 3

| **Sub-codes** | **Managing Director** | **Senior Project Manager** | **Financial expert** |
|---|---|---|---|
| Complete new tasks | 0 | 2 | 0 |
| No limitation | 0 | 3 | 1 |
| Tasks with human interaction | 1 | 4 | 1 |
| No final decision-making power | 1 | 0 | 0 |

## Conclusions

The experts' statements agree on all points concerning the monetary benefits. Nevertheless, some experts express reservations about the skills of companies. They believe that most companies are not yet ready to implement such projects in reality. Nevertheless, it can be observed that these experts also see a monetary advantage if AI and KM were to be used in IT projects. As a prerequisite, in addition to the willingness of companies, it is evident from the study that the underlying quality of data that AI must use is an essential prerequisite. Current and historical data must be available in quantity and of the appropriate quality for an AI to make forward-looking predictions. Likewise, communication with employees is crucial. Particularly noteworthy is the possible fear of employees losing their jobs and being replaced by AI. Also, the necessary knowledge transfer at this point is an essential prerequisite for successfully using AI in project management. Knowledge management modules have the most significant overlap with AI use here. This includes content training and knowledge of what AI can do and where its limits lie.

Middle and top management confidence in AI and potential failures at the outset must be present in companies. Spontaneous tasks that still need to be learned by the AI, especially tasks in which human social intelligence is necessary, should not be done by the AI. These can be escalation talks or criticism talks and communication with essential project stakeholders.

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