

Shifting towards a 2-phase approach: A qualitative study into the price determination process and knowledge management of HWPP projects.

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Abstract - A shift is necessary to steer the construction industry away from a fiercely competitive sector into one that aims to collaborate and co-create. The transition towards 2-phase approach projects aims to achieve this. However, this transition brings with it new challenges, in particular, the financial management of it. This research is done for Heijmans and aims to identify the obstacles during the price determination process of 2-phase HWPP projects to gain the necessary insights to improve the current knowledge base about financial management. And in addition, to fill the gap in knowledge management within Heijmans to improve organisational knowledge exchange and learning. A multiple, embedded case study was conducted looking at three HWPP projects with a 2-phase approach. First, the success factors, obstacles, and solutions related to the price determination process were identified and formulated by thematically analysing twelve interviews across the case projects. A focus group with experts was conducted to validate the results. Finally, a detailed literature review resolved the knowledge management issue. Thematic analysis of interview data identified the following four key obstacles impacting the price determination process of 2-phase HWPP projects: underestimation of the simultaneity of design and price determination, lack of early definition of terms and specification of preconditions, insufficient inclusion of the HWPP and Waterboard during the price determination process, and inadequate attention to forming a uniform culture. A knowledge management cycle was created to address the gap in knowledge management. The findings indicate that the financial management of 2-phase HWPP projects requires a vastly different approach than more traditional works. Moreover, the creation of the KMC lays the foundation to improve knowledge management within the organisation.

Index Terms – Knowledge management, Financial management, Obstacles, Price determination process.

INTRODUCTION

The Dutch construction industry has always been a competitive sector. This notion is evident when reading the dissertation of van Waarden (1989), where competition is stated as a fierce component that characterises the construction industry. This competitive fire began burning more intensely after collusion in the Dutch construction industry came to light and ignited a parliamentary enquiry (Boes & Dorée, 2004; A. G. Dorée, 2004). The enquiry recommended more emphasis on competition, traditional design-bid-build (DBB) contracts, the lowest price as the leading criterium, and a remote public client to prevent further turmoil (PEC, 2002). However, this further increase in competition led to stagnation in innovation, less focus on quality, short-term project-based perspectives, cost and time overruns, and arms-length relations between client and contractor (Creedy et al., 2010; A. Dorée et al., 2003).

A shift is necessary to steer the industry away from a fiercely competitive, self-interested, and short-sighted sector into one that aims to innovate, collaborate, and co-create. In a report published by Rijkswaterstaat (McKinsey&Company, 2019), this shift towards a more sustainable and innovative

sector was addressed. This notion was further substantiated in another report by Rijkswaterstaat, stating various transition goals addressing changes towards cooperation, an open culture, knowledge exchange, and a positive industry image (Rijkswaterstaat, 2021b). Both documents outline the 2-phase approach as a measure to achieve these transitional goals by stimulating cooperation between involved parties and reducing project risks (McKinsey&Company, 2019; Rijkswaterstaat, 2021b). In short, the 2-phase approach entails a joint design stage with the client and contractor where they work on the design and price. At the end of this first phase, a final design is worked out, and a realisation price is determined. Furthermore, between phases 1 and 2, there is a go/no-go moment where the contractor and client can choose to part ways or move on to phase 2, the realisation of the project.

As a result of the McKinsey&Company (2019) & Rijkswaterstaat (2021b) reports, the 2-phase philosophy has taken the construction industry by storm, especially for large, high-risk, complex projects that fall under the High Water Protection Program (HWPP). As stated by a senior market strategist for the HWPP: *'over the last couple of years, there*

has been a noticeable increase in the number of dike projects applying a 2-phase approach'. However, due to the novelty of this approach, the construction industry is still fragmented regarding what it entails exactly. Furthermore, contractors and clients need to figure out how they approach such projects, especially the financial management aspect of it.

Submitting a financial management plan during the tender phase covers the price criterion for two-phase projects. Such a plan describes the extent of transparency, traceability, and depth concerning the budget. It also often outlines how the contractor intends to reach a market conform price and provides calculations for several high-cost drivers. This way, the client has a certain indication of the price and insight into how the contractor has underpinned them. Therefore, the financial management plan can be regarded as a plan of action for the price determination process during which the realisation price will be calculated. Implementing such a plan replaces the need for a fixed price at the start of a tender, which requires contractors to drastically change their approach in tendering such works.

This necessity for adaptation on behalf of the client and contractor is even more evident for HWPP-related projects, as issues regarding climate change, habitat preservation, and nitrogen emissions are highly relevant for such projects and increase complexities, uncertainties, and risks.

The novelty of this approach is noticeable not only in the construction industry but also in the academic world. Literature regarding the 2-phase approach is scarce. Only the thesis by Miedema (2022) focused directly on the 2-phase approach. This study aimed at identifying the elements of the 2-phase approach to provide guidelines to help clients determine if the approach is suitable for their project. Moreover, the literature concerning financial management and the price determination process is also limited. Theses by van der Pas (2021) & Uzun (2022) investigated the price determination process, its success factors and appropriate cost estimation methods for bouwteam projects. Furthermore, these theses only looked at bouwteam projects and did not consider project scope and -characteristics.

The focus of the research presented in this paper concerns the shift toward a 2-phase approach in construction projects and its effect on financial management within Heijmans. The objective is to identify the obstacles during the price determination process of 2-phase HWPP projects, where Heijmans is the contractor, to gain the necessary insights to improve the current knowledge base about financial management. And in addition, to fill the gap in knowledge management (KM) within Heijmans to improve organisational knowledge exchange and learning. The connection between financial management, price determination, and knowledge management can be seen in Figure 1.

To this end, this paper will first delve into the term '2-phase' to provide a clear definition. Afterwards, several success factors are described for the price determination process. Subsequently, the obstacles present during the price

determination process and potential solutions to tackle them are identified. Lastly, the types of knowledge to be exchanged are determined, and a knowledge management cycle (KMC) is created to address the existing knowledge management gap within the organisation. The KMC can be used as a tool to gather, exchange, and use knowledge more effectively.

The outline of the research paper is as follows. The paper begins by covering the background of the study. Afterwards, the research design and methodology are introduced. Next, the research results are presented. Subsequently, the interpretation and implication of the results are discussed in depth, and relevant limitations and recommendations for future research are also described. Lastly, the key findings, interpretations, limitations, and recommendations are summarised in a final concluding section. This section is followed by a data availability statement, acknowledgement, and appendices in that order.

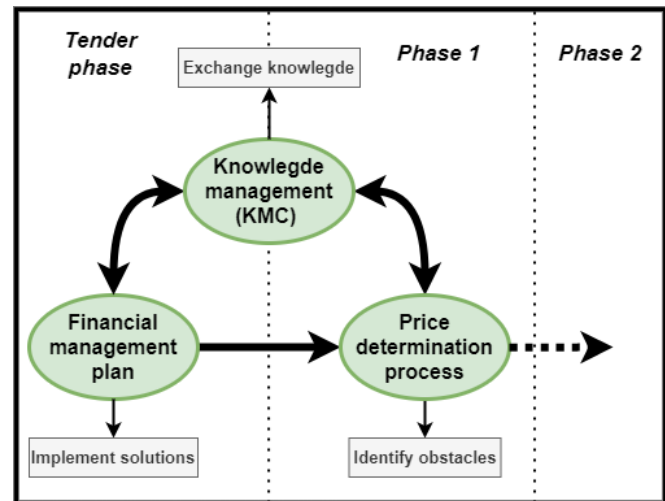


FIGURE 1
CONCEPTUAL MODEL OF THE RESEARCH

BACKGROUND

The research presented in this paper focuses on two topics. Firstly, attention is paid to the financial management and price determination process of a 2-phase approach HWPP project. Secondly, an effort is made to create a knowledge management cycle to stimulate and improve knowledge exchange. However, both topics require background information before this research delves deeper into the underlying methodology and results.

1. Origins of the 2-phase approach and relevant literature

The term 2-phase approach was first coined by Rijkswaterstaat (RWS) in a report called 'Toekomstige Opgave Rijkswaterstaat' (McKinsey&Company, 2019). In this document, RWS calls for a transition toward a financially healthy, competitive, and innovative construction industry (McKinsey&Company, 2019). Four concrete measures were

described to achieve this, of which the two-phase process - hereinafter referred to as the 2-phase approach - was one. The primary purpose of this approach is to reduce project risks by undergoing a joint design stage with the client and contractor and postponing the price determination for the realisation of the project after completing the design/engineering stage (McKinsey&Company, 2019). Moreover, the report refers to Early Contractor Involvement (ECI) and alliancing as having overlap with the proposed 2-phase approach. Besides ECI and alliancing, bouwteams are regularly mentioned as having a 2-phase approach (Tukker et al., 2020; van der Pas, 2021). The 2-phase philosophy can, therefore, already be seen as a broad approach that can come in many different shapes and sizes.

Delving deeper into the tangential relations the 2-phase approach has with other models and contracts, it becomes clear why these are related and used synonymously. ECI is a term often used within the construction industry, but a clear definition is hard to find. A thesis by van Wijck (2018) tried to find a concrete and less unambiguous definition for the term. However, the researcher ended up with two general definitions stating: "*ECI is either consulting a contractor by ways of market consultation or entering a contract with one contractor during the initiation phase of a construction project*" (van Wijck, 2018, p.53). It is clear why this is brought up when talking about 2-phase because the contractor is involved at an earlier stage than construction. The similarities between an alliance and the 2-phase approach are related to the necessity of close cooperation between parties and the possibility of sharing risks (Jansen, 2021; McKinsey&Company, 2019). The bouwteam model also shares certain attributes, such as contractor involvement in the design stage, delayed price determination, and a clear cut-off between the design and realisation stages (Chao-Duivis, 2019; van der Pas, 2021).

The overlap with other contracts- and collaboration forms makes the 2-phase approach a term that is inherently difficult to define. Currently, no literature provides a concrete definition of the 2-phase approach in which specific characteristics are formulated.

II. Knowledge management in construction organisations

Compared with other industries, the construction industry is notorious for its conservatism, fragmentations, and lack of innovation and development (Rodrigues de Almeida & Zafra Solas, 2016; Xue et al., 2014). This notion is supported by a shortage in idea generation, conversion, and diffusion. Some underlying aspects contributing to this are a lack of internal and external knowledge resources and knowledge transfer (Xue et al., 2014). Attending to these aspects will therefore drive innovation and increase overall efficiency.

However, it is important to understand what knowledge is before an attempt is made to improve the organisational knowledge exchange capacity. Knowledge is a product of information which in itself results from data. Generally, data can be regarded as raw facts, such as numbers and observed realities. Information is an organised set of data, and

knowledge is information used through experience and practice to give it meaning (Bhatt, 2001). Two types of knowledge are stated in the book by Nonaka & Takeuchi (1995) about knowledge creation, being tacit and explicit knowledge. Tacit knowledge is difficult to document as it is gained through experience and can be stored as recordings, expert suggestions, or written down know-how/what (Carrillo & Chinowsky, 2006; Nonaka & Takeuchi, 1995; Tserng & Lin, 2004). Due to the experiential and person-bound nature of tacit knowledge, it is not easy to distribute. In contrast, explicit knowledge can be documented and physically stored in the forms of manuals, reports, processes, and drawings, making it easier to share (Carrillo & Chinowsky, 2006; Nonaka & Takeuchi, 1995; Tserng & Lin, 2004).

Knowledge management aims to create value from the existing knowledge inside an organisation (Tserng & Lin, 2004). As defined in a paper by Webb (1998), knowledge management is '*the identification, optimisation and active management of intellectual assets to create value, increase productivity and gain and sustain competitive advantage*'. The importance of managing organisational knowledge is not an unknown concept in the construction industry. In a study by Carrillo et al. (2004), 77,4% of the respondents were aware of the benefits. However, the application of knowledge management is still lacking. The same paper reports that only 45% of the respondents implement knowledge management activities such as communicating lessons learned and using the intranet. However, perceiving lessons learned and the intranet as knowledge management systems is a general misconception (Carrillo & Chinowsky, 2006). Lessons learned are done ad hoc and infrequently, and whilst the intranet is helpful, it should be regarded as an information system (Carrillo & Chinowsky, 2006).

Implementing a knowledge management cycle stimulates the exchange of knowledge and drives innovation (Bossink & Bossink, 2004). Furthermore, knowledge exchange also positively affects project performance (Landaeta, 2008). Other drivers and benefits identified are an increase in sharing tacit knowledge, disseminating best practices/lessons learned, and limiting repeat mistakes (Carrillo & Chinowsky, 2006).

The barriers hampering the implementation of knowledge management can be divided into three categories: individual, social, and technological (Andreasian & Andreasian, 2013; Disterer, 2001; Wiewiora et al., 2009). Individual barriers are related to a perceived lack of power by giving up valuable knowledge, a lack of motivation to share knowledge, or uncertainty about whether knowledge is valuable (Carrillo et al., 2004; Carrillo & Chinowsky, 2006; Disterer, 2001; Wiewiora et al., 2009). The social barriers are, for example, lack of communication between projects, lack of a comprehensive process to manage knowledge, or bureaucratic systems (Carrillo et al., 2004; Carrillo & Chinowsky, 2006; Disterer, 2001; Wiewiora et al., 2009). Finally, the technological barriers include a lack of technological tools and a lessons learned/knowledge

repository (Andreasian & Andreasian, 2013; Carrillo & Chinowsky, 2006).

The importance of knowledge management is evident as it helps organisations exchange tacit knowledge, boost innovation, gain a competitive advantage, and improve communication (Mohajan & Mohajan, 2017). However, limited action has been taken to address this. One way to do this is to create a knowledge management cycle (KMC) that can streamline specific steps and actions necessary to refine acquired knowledge and use it. Based on four well-known KMCs (Begzadic, n.d.; Mohajan & Mohajan, 2017), the Meyer and Zack model was chosen as the foundation on which the KMC presented in this paper was based (Meyer & Zack, 1996). This cycle consists of five stages: acquisition, refining, storage/retrieval, distribution, and presentation/use.

RESEARCH DESIGN AND METHODS

The following section will discuss the research design in detail. First, the research type, -strategy, and time horizon are described. Second, the data collection methods used during the research period are presented. Moreover, data collection methods are applied on three case projects where Heijmans is part of the contracting party. Lastly, the data analysis techniques for the collected data are described.

I. Research design

The research has an exploratory nature as it aims to investigate a problem that has not been thoroughly covered. Moreover, based on the research question, an inductive research approach is chosen, meaning that with the use of specific data and information gathered during the research, a more general theory or conclusion is formulated to answer the research question. This approach, combined with the formulation of the research question, lends itself to be qualitative. Therefore, the data gathered during the research period will primarily focus on the relations between entities instead of variables or numbers.

II. Research strategy

A suitable main research strategy is chosen based on the exploratory nature, inductive approach, and qualitative research type. The chosen strategy for the research is a multiple, embedded case study. This strategy entails that multiple HWPP project cases will be analysed.

Furthermore, this analysis of the case studies will not be holistic but embedded, meaning that only specific parts/aspects of the cases are investigated. For this research, the element of interest is the price determination process. Other aspects covered in a holistic approach, such as construction methodology, risk allocation, and stakeholder management, are not considered.

A cross-sectional time horizon is most applicable to realise the research strategy. Data sets are collected at a certain point in time, analysed, and compared. The research objective does not require a longitudinal time horizon, as no long-term comparisons, reflections, or controls are necessary.

Moreover, the research is limited to around five months; this furthermore complicates the possibility of conducting research with a longitudinal time horizon in mind.

III. Data collection methods

During the research period, several data collection methods were used to gather the necessary data to achieve the stated objectives. The following steps to achieve the research objectives and their corresponding data collection methods and analysis techniques are shown in Figure 2. First, the 2-phase approach is defined (step 1). Next, success factors, obstacles, and solutions are identified regarding the price determination process (steps 2-4). Lastly, the issue of knowledge management is investigated by determining the types of knowledge and creating a knowledge management cycle (steps 5 & 6). More detail about each collection method and analysis technique is given in the following sub-sections.

IIIa. Cases

The primary collection method is the use of case projects for this research (Appendix I). The interviews and documents to analyse emerged from these projects. The cases were selected based on four selection criteria:

- The definition provided in this paper for the term '2-phase approach' should apply to the case project;
- The case project should be part of the HWPP (High Water Protection Program);
- The project is in the first phase of the 2-phase approach or finished the first phase and is working on phase 2;
- Heijmans is involved in the project as a contractor.

Based on the selection criteria, three HWPP projects were chosen, namely Gorinchem Waardenburg (GoWa), Lauwersmeerdijk, and Sterke Lekdijk. For each case, the price determination process during the design/planning phase (planuitwerkingsfase) of HWPP projects was analysed. Furthermore, document analysis, interviews, and a focus group were conducted with personnel from these projects.

In addition to the HWPP case projects, a case was also chosen to develop the knowledge management cycle. The Tender Bureau of Heijmans was chosen as the department on which the specifics of the KMC will be based. A more tangible and concrete example of a KMC can be formulated by focusing on a singular department.

IIIb. Literature review

For this research, semi-systemic literature reviews were conducted when necessary. A semi-systemic review 'seeks to identify and understand all potentially relevant research traditions that have implications for the studied topics (Snyder, 2019, p.335).' A semi-systemic review allows for more academic freedom concerning the set of research that can be reviewed. By not using strict pre-specified inclusion criteria, subjects and topics that came into view during the literature review were also analysed.

The phases provided in the paper by Snyder (2019) were followed to conduct the literature review properly.

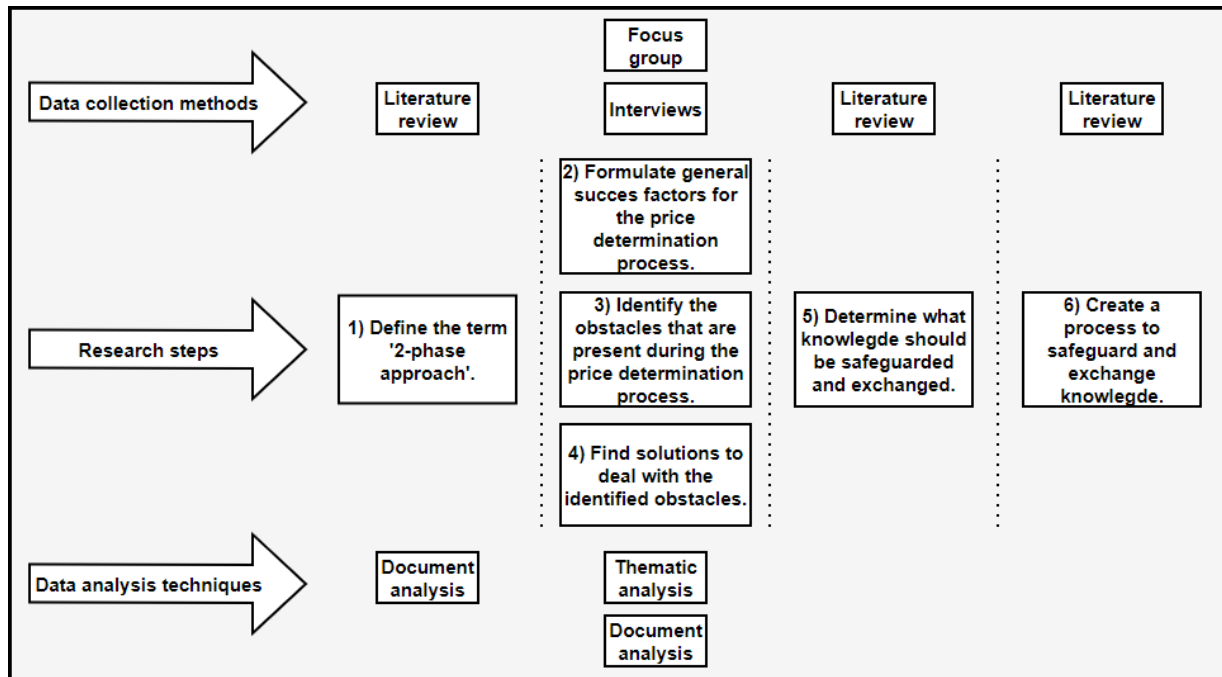


FIGURE 2

RESEACH STEPS AND CORRESPONDING DATA COLLECTION METHODS AND ANALYSIS TECHNIQUES

These phases detail designing, conducting, analysing, and writing the review. Moreover, the formulated guidelines were used as indicators to check the quality of the review.

IIIc. Interviews

Interviews are the primary data collection method used during the research period. Interviews were conducted in a semi-structured way, meaning that interview questions were pre-planned. However, there is a chance for the interviewee, by use of open-ended questions and probes, to explain particular issues in more detail (Alsaawi, 2014). Therefore, an interview guide was made for every interview to provide the necessary structure (Appendix II). Moreover, the creation of the guide helps identify potential problems during the interview and creates a more reliable data collection method (Roberts, 2020).

Participants were selected non-probabilistically by the following two selection criteria:

- Interview participants have worked/are working on one of the case projects;
- Interview participants have been involved during the price determination process.

A total of twelve employees from both Heijmans, the relevant waterboards, and HWPP were interviewed. The time of each interview varied from 45 minutes to an hour. The interviews were recorded via a laptop and a mobile phone with a sound recording app. The devices are placed between the researcher (interviewer) and interviewee, with the device's audio input aimed at the participants. Using two recording devices reduced the risk of losing the data when one file was corrupted or accidentally deleted.

III d. Focus group

A focus group was scheduled with four experts from Heijmans to review the identified obstacles and solutions regarding the price determination process. The group of experts consisted of the project managers of each case project and the head of the 2-phase knowledge team within Heijmans. The focus group aimed to validate the accuracy of the results – gathered from other data collection methods - regarding the identified obstacles and solutions and to provide feedback. In addition, based on a question guide, the participants were asked to provide feedback or address ambiguities (Appendix III). The focus group lasted 1.5 hours and was conducted via an online team call. During this time, several suggestions were made concerning the layout and structuring of the maps, while only a few remarks were aimed at the specific obstacles or solutions. At the end of the focus group, all participants agreed that the presented obstacles and solutions accurately reflected what they experienced and concluded that the results were valid.

IV. Data analysis techniques

Besides collecting the necessary data during the research period, data analysis techniques should be applied to transform the raw data into useful findings. Two analysis techniques were applied for this research and are described in detail in the following sub-sections.

IVa. Document analysis

Documents analysed during the research period came in various forms, such as presentations, e-mails, reports, memos, and flowcharts. These documents were selected based on their

relation to a particular research question. However, most documents were related to one of the three case projects that were investigated. Project documentation ranged from generic and public project information to confidential documents related to financials and costs. These documents were used to gain insight into general and specific aspects of the case projects and to substantiate data collected by other methods, such as interviews and literature review.

The procedure regarding the analysis of such documents is as follows. First, the necessary and valuable documents are identified. This process is dependent on what topic or question should be investigated. After the documents are identified, they are stored, and a list denoting the important aspects of it and their relation to a specific topic or question is written down. The documents are then briefly scanned to find what chapters, sections, or paragraphs contain important data. Lastly, the parts specified as important are reviewed and analysed in detail to extract all important and valuable information from the document.

IVb. Thematic analysis

Analysis of the interviews and focus group is done via thematic analysis, the most common qualitative analysis technique (Alsaawi, 2014). This analysis technique is defined as 'a method for identifying, analysing, and reporting patterns (themes) within data. It minimally organises and describes your data set in (rich) detail (Braun & Clarke, 2006, p.79)'. This analysis comprehensively tries to analyse the themes across the entire data set. The inductive approach specified in the research design is also applied to the thematic approach for analysing qualitative data. This approach results in themes being formed from the bottom-up (dataset) instead of formulated from a specific interest or existing theory (Braun & Clarke, 2006). In concordance with the type of analysis (being broad) and inductive approach, the described themes will be identified more at a semantic level than a latent or detailed level. The semantic level entails that created themes are related to the surface level of the dataset and do not delve deep into certain unique aspects of the data (Braun & Clarke, 2006).

The analyses of the datasets are done according to the framework created by Braun & Clarke (2006). This framework or step-by-step guide consists of six phases to conduct a successful thematic analysis of qualitative datasets. The first phase (familiarisation) aims to get familiar with the data by reading the data multiple times. After that, a clear and detailed understanding of the data is necessary to continue to the next phase. Phase two is the coding phase. Codes are used to identify data extracts that are of interest to the analyst. After the first coding run, all data extracts that fall under the same code are collated together. Phase three takes a step back and looks at the collated codes from a thematic perspective. During this phase, an initial thematic map is made. Each theme can be a result of single or multiple codes. The initial thematic map is then reviewed in phase four. At first, all data extracts for each theme are read to confirm that the theme

forms a coherent pattern with the data. If so, the thematic map is reviewed to see if it accurately reflects the data set. Phase five, defining and naming themes, is the final step to developing the definitive thematic map. Themes are named and reviewed to check if they convey the correct narrative and are not too complex or diverse. The final phase is the writing phase, in which the results of the thematic analysis are written down in the research paper.

This overarching data analysis technique of thematic analysis is supported by, for example, software to make data analysis easier. The main software program to help analyse recorded data is Descript. This program automatically transcribes recorded data and allows for editing and coding of the transcripts.

RESULTS

This study aimed to identify the obstacles during the price determination process of 2-phase HWPP projects and to find solutions. In addition, a knowledge management cycle was made to create a uniform approach to knowledge management inside Heijmans.

The first section starts with defining the term '2-phase approach'. Afterwards, the identified obstacles, solutions, and success factors regarding the price determination process are presented. Lastly, the results of the knowledge management cycle for knowledge safeguarding and exchange are shown.

1. Defining the 2-phase approach

Based on the novelty of the 2-phase approach in the market and the synonymous use of other contract types, it is no wonder that there is fragmentation in the construction industry when it comes to defining the term 2-phase approach. To tackle this – and try to formulate a concrete and all-encompassing definition – the steps described in Snyder (2019) were followed and substantiated with expert opinion. Based on this, the following attributes describe the characteristics of the 2-phase approach.

First, the purpose of the 2-phase approach is to gather more information, leading to fewer uncertainties and less risk (McKinsey&Company, 2019; Miedema, 2022; Tukker et al., 2020; Wijk-van Gilst, 2020).

Second, a project following a 2-phase approach undergoes a joint design stage wherein the client and contractor work together collaboratively (Jansen, 2021; McKinsey&Company, 2019; Miedema, 2022; Tukker et al., 2020).

Third, the price for realising the project is determined after the design or engineering stage is completed. Postponing the price component this way does not mean that this happens in series; on the contrary, the price determination process must be seen as an iterative process that runs parallel with developing a detailed design (Jansen, 2021; McKinsey&Company, 2019; Miedema, 2022; Tukker et al., 2020; Wijk-van Gilst, 2020). The delayed price determination process results in the contractor not having to submit a price for realisation during the tender stage. Instead, a qualitative

document can be submitted. The so-called financial management plan states how the contractor will stay within budget and what measures will be taken to ensure this. Besides a financial management plan, the client can also ask for general direct costs, hourly rates, or unit prices to be submitted (Tukker et al., 2020).

Fourth, there is a clear cut-off or go /no-go moment after the design stage's completion and before the work's realisation (Jansen, 2021; McKinsey&Company, 2019; Miedema, 2022; Tukker et al., 2020). It should be noted that what is meant by completing the design stage can vary between projects. For example, one project may start with phase 2 after a detailed technical design is made, and another may start with phase 2 after the definitive design is made. Then the completion of the technical design is part of phase 2 (Rijkswaterstaat, 2021a).

Based on these four attributes, the following definition of a 2-phase approach project is formulated: *The 2-phase approach aims to reduce uncertainties and risk during the realisation of a project by undergoing a joint design stage with the client and contractor. The completion of the design stage is also the moment when the final execution price for the project is determined. At this stage, there is a clear go/no-go moment where the client and contractor agree or disagree on the determined price and the continuation of the second phase.*

II. Price determination process: success factors, obstacles, and solution

After thematically analysing the data, two thematic maps were created. The first map presents the four major themes and the obstacles (Figure 3). The second map shows the four themes in relation to the solutions (Figure 4). The four themes were formed based on the interview data collected across the three case projects. The names of the themes result from the common denominator found across the data extracts supporting the theme. A tree structure per theme depicts the main obstacle and causes related to the obstacle. During the interviews, many solutions were identified to tackle the main obstacles and underlying causes.

Based on a preliminary data analysis, four success factors were formulated that describe the desired situation for the price determination process: (1) Have a clear understanding of the scope technical issues and their interdependencies. (2) Having no ambiguities when entering the price determination process regarding terms and specifications. (3) Having close interaction between involved project parties regarding design and price. (4) Establish a uniform culture within the project organisation. These success factors are related to the themes and obstacles shown in Table 1. The obstacles should be seen as impeding a project team from reaching the desired situation as sketched by the success factors.

Ila. Scope: underestimation of the simultaneity of design and price determination.

The scope of the project ranges from design technicalities to managing the surroundings. Naturally, such actions and

activities are intertwined and have their dependencies, interactions, and challenges. However, one process is particularly challenging. This is the parallel process of working on the design and determining the price. This process can be visualised on paper as two parallel independent tracks; however, the simultaneity of the actions and activities and their dependencies are underestimated. As one interviewee stated: *'The simultaneity of design and price is something we need to think more carefully about every time'*. Furthermore, this process applies not only to the main task but also to synergy projects and the process of requesting subsidy.

To solve this, the contractor should apply stricter deadlines and freeze the design before continuing with other activities, incorporate a dedicated planner solely focussed on the simultaneity of activities and their dependencies, take the time to identify and catalogue the synergy projects and gain an early understanding about the subsidy request process.

Iib. Preconditions: lack of early definition of terms and specifications of preconditions

A common denominator between all three case projects was the lack of defining terms and specifying preconditions early in phase 1 (alignment phase). During the focus group, one participant mentioned: *'Much can and should be made clear upfront to avoid delays at a later stage'*. The ambiguity surrounding the terms such as 'an honest price' and 'market conformity' is a precursor for discussion and clashes during the project lifecycle, especially when determining the price. Regarding specifications, the lack of clarity, for example, about structuring hourly rates and the budget, can also lead to disagreement.

Such issues can be avoided by defining ambiguous terms at the start of phase 1. The contractor and client should address which terms are still unclear and together come to an unambiguous definition applied throughout the project. Moreover, the contractor, the client, and other contracting parties should create frameworks specifying what costs should be incorporated in the hourly rates of personnel and equipment. Lastly, differences in structuring the budget between internal and external cost experts are a recurring issue. This issue was also voiced by an interviewee: *'of course, if that's not in the right place (certain cost items), you're comparing apples to oranges'*. To address this, both parties should take the time to go through their methodology, write down the differences, and draft a translation document that can be used to interpret each other's budgets more effectively.

Iic. Interaction: insufficient inclusion of the HWPP and Waterboard during the price determination process

One of the core aspects of the 2-phase approach is the close interaction between the contractor and client. The insufficient inclusion of the HWPP and the relevant Waterboards being a recurring obstacle across all cases is a concern.

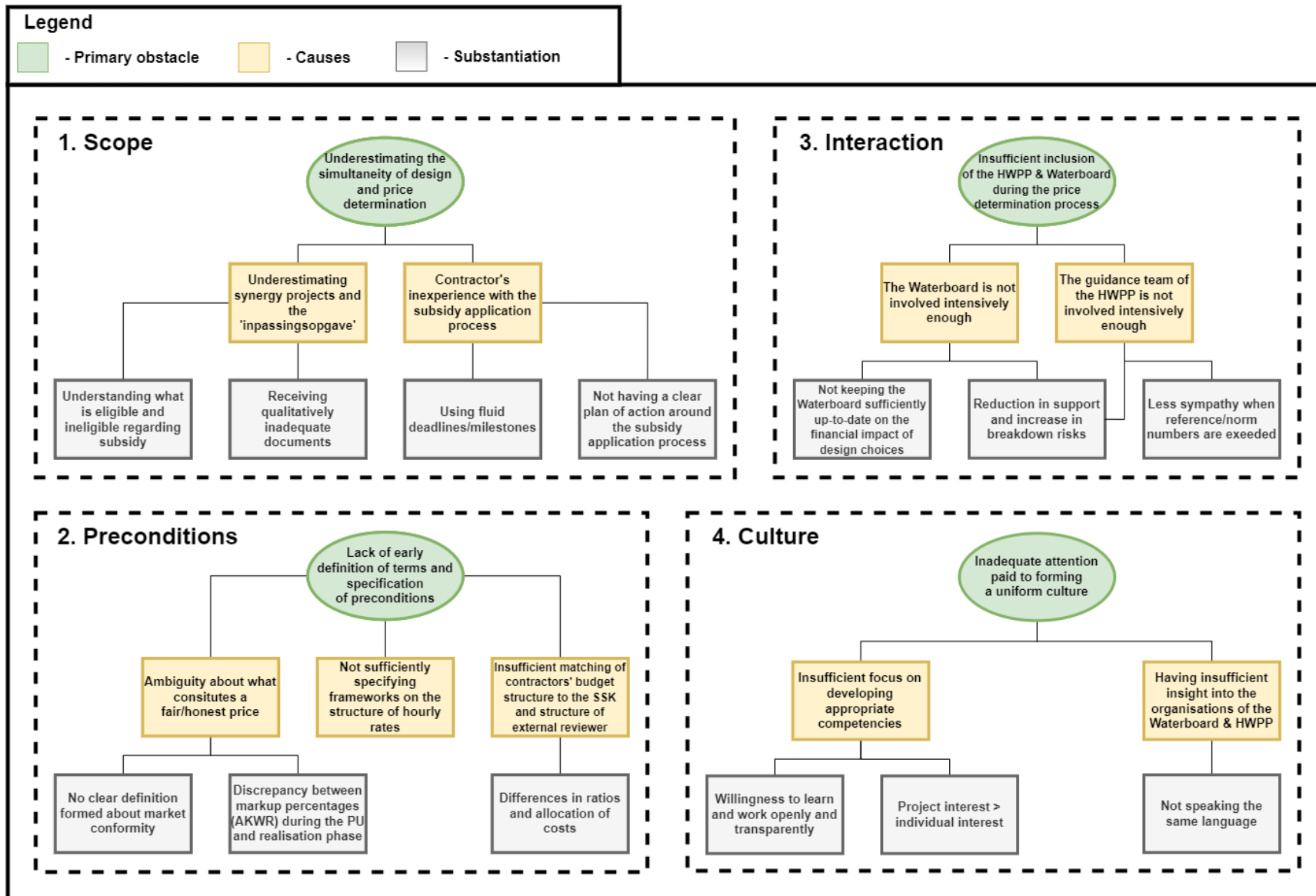


FIGURE 3
THEMATIC MAP OF THE OBSTACLES PRESENT DURING THE PRICE DETERMINATION PROCESS

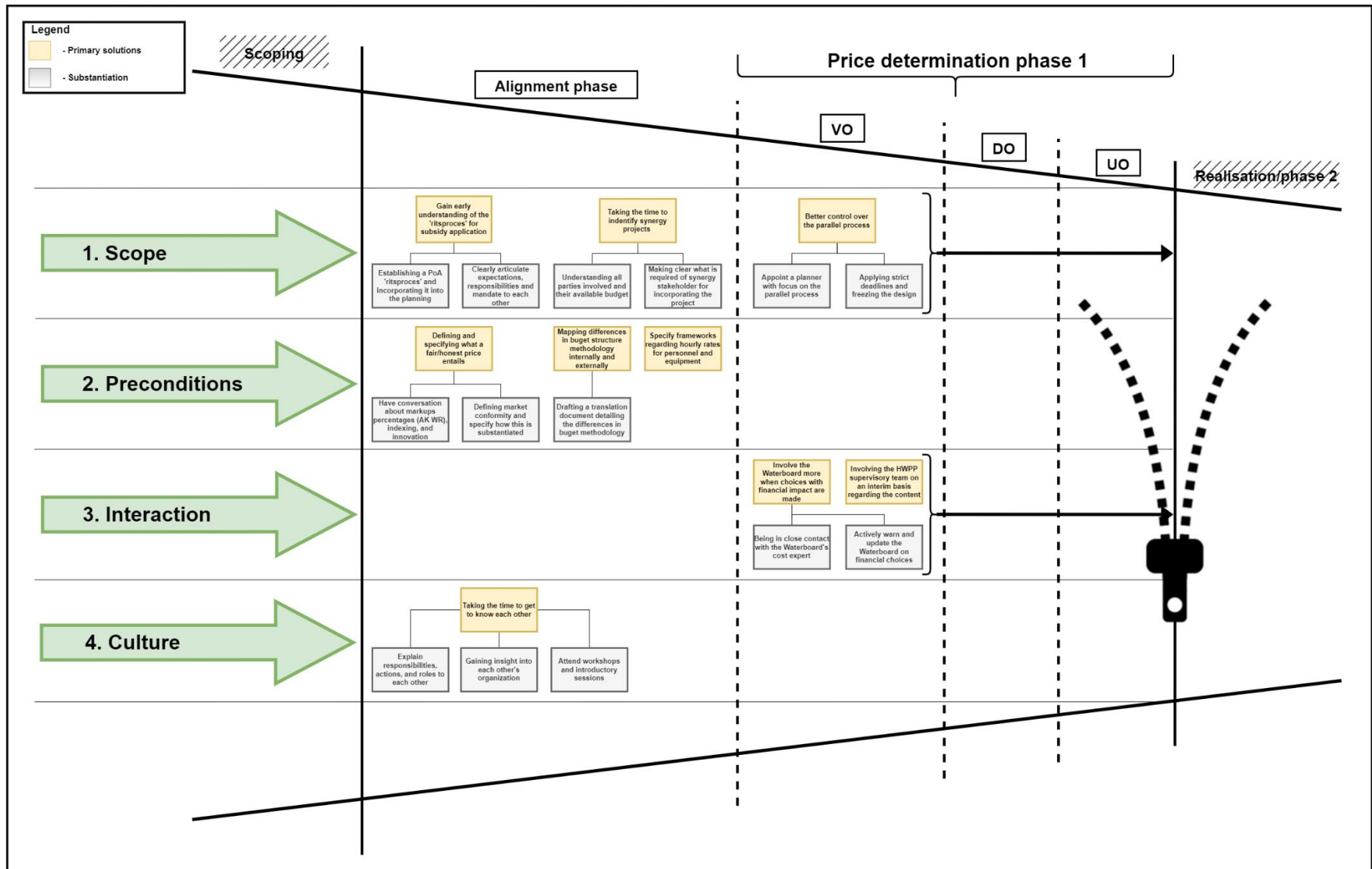


FIGURE 4
THEMATIC MAP OF THE POSSIBLE SOLUTIONS

TABLE 1
IDENTIFIED THEMES, OBSTACLES, AND SOLUTIONS FOR THE PRICE DETERMINATION PROCESS

Theme	Main obstacle	Solution(s)
Scope	Underestimation of the simultaneity of design and price determination	<ul style="list-style-type: none"> - Gain an earlier understanding of the closing process for the grant application (ritsprocess) - Taking time to identify the synergy projects (budget, scope, design, requirements) - Managing the parallel process better with stricter deadlines and a dedicated planner
Preconditions	Lack of early definition of terms and specification of preconditions	<ul style="list-style-type: none"> - Define and specify at an early stage what an 'honest price' entails - Map differences between parties in structuring the budget and take note of these - Create frameworks for hourly rates of personnel and equipment specifying what costs are and are not taken into account
Interaction	Insufficient inclusion of the HWPP and Waterboard during the price determination process	<ul style="list-style-type: none"> - Involve the Waterboard more during choices with a financial impact - Involving the HWPP supervisory team on an interim basis regarding the content
Culture	Inadequate attention to forming a uniform culture	<ul style="list-style-type: none"> - Taking the time at the start to get to know each other by way of workshops and introductory sessions

The Waterboards are kept well-informed concerning design choices and the evolution of the design. However, the same involvement and communication about price determination, compared to the design, is lacking. Both the contractor and Waterboards acknowledged this sentiment. Waterboard members frequently voiced statements such as: *'I think the contractor should give us clearer/more frequent warnings during the process, especially regarding financial choices'*. The lack of inclusion is also noticeable when looking at the supervisory team of the HWPP. This team is responsible for reviewing and assessing the project documents on behalf of the subsidiary, the HWPP. Due to the HWPP playing the role of financier, this party is more distant from the project than the Waterboard. However, the role of this supervisory party is significant, and the lack of interaction between the contractor and HWPP leads to the supervisory team being less up-to-date with regard to intrinsic knowledge, for example, concerning the choices underpinning the determined price. All case project managers, during the interviews, stated that this lack of content knowledge led to avoidable clashes and discussions during reviews and assessments of the budget.

To solve this, the contractor should seek more interaction with the Waterboards and HWPP. The Waterboard should be more involved during the determination of the price. Contractors should keep the client up to date concerning decisions and choices that influence the price. However, the contractor should also ask the Waterboard to appoint someone with sufficient mandate who can fill this role and be involved. Regarding the supervisory team of the HWPP, both the contractor and HWPP should agree on holding interim meetings where the contractor can provide detailed and substantive knowledge about the price component.

Ild. Culture: inadequate attention paid to forming a uniform culture

The final theme tackles the broad topic of culture and addresses the inadequate attention paid to forming a uniform culture. One of the causes is the lack of attention to forming and developing a team with the right set of competencies. The

most valuable competencies mentioned by all interviewees were being transparent, open, sensitive, and able to place project interest above individual interest. This set of competencies is an essential aspect concerning the two-phase approach as the collaborative nature requires the contractor and client to approach it differently than they were used to in the last twenty years. Moreover, the gap in culture is also related to the contractor's insufficient knowledge of the client's organisation and the HWPP. Not only regarding the organisational structure but also responsibilities and obligations. An interviewee stated: *'Being unfamiliar with the organisations involved and having little experience with how the processes work, this can make you greatly misjudge certain things.'*

To address this obstacle, the contractor should take the time - at an early stage - to get to know the Waterboard and HWPP. The contractor should conduct workshops and introductory sessions where parties and representatives can express their responsibilities, roles, and mandates to each other. Such sessions and workshops allow the involved parties to get to know each other organisations and, in a way, learn to speak each other's language.

The presented themes show the obstacles and solutions regarding the price determination process in every aspect of a project, from the technical aspects regarding scope and preconditions to the softer management themes regarding interaction and culture. However, at the core of these obstacles is a lack of experience, data, specifications, etc. This boils down to a lack of knowledge exchange, which is noticeable within project organisations (cross-organisationally), between projects, and between business units (Tender Bureau) and projects (inter-organisationally). This aspect is tackled in the next section by focusing on knowledge management.

III. Knowledge management cycle

After reviewing the literature about knowledge management in construction and the different frameworks of knowledge management cycles (KMCs), a KMC for the Tender Bureau of Heijmans was made using the five steps of the Meyer and Zacks model (Meyer & Zack, 1996). The cycle presented in Figure 5 visualises the five knowledge management steps. Moreover, it shows what technologies and social initiatives can and should be used during each step. Each step in the KMC and how it relates to explicit and tacit knowledge is briefly explained below.

IIIa. Acquisition

Acquiring data, information, or ‘raw material’ is the first step in the KMC. Sources of such raw material include quality, scope, depth, credibility, accuracy, timeliness, relevance, costs, control, and exclusivity. The key principle of this phase is the notion of ‘garbage in, garbage out’. Data that lacks sufficient quality can compromise the overall integrity and outcome of the cycle (Meyer & Zack, 1996).

Explicit knowledge is acquired by gathering, for example, project documents related to financial management.

However, the notion of ‘garbage in, garbage out’ should be considered. So when knowledge acquisition is focussed on the financial aspect of a project, no attention should be paid to, for example, documentation regarding ecology or stakeholder management.

Acquiring tacit knowledge requires a different approach. First, an effort must be made to find the knowledge bearers and extract their experience and know-how. For example, by conducting an interview with a cost expert and recording it, it is possible to pick his/her brain and acquire specific pieces of tacit knowledge.

IIIb. Refinement

The primary purpose of the refining step is to add value to the raw data and information. Refinement can be done by converting data, adding valuable context, integrating it with other data sets, or removing irrelevant content (cleaning the data). This phase outputs usable, valuable, and understandable knowledge products that can be used throughout the organisation (Meyer & Zack, 1996).

When explicit knowledge is acquired, refining it into a coherent and integrated knowledge product is essential. The refinement steps lay out the procedure to form knowledge

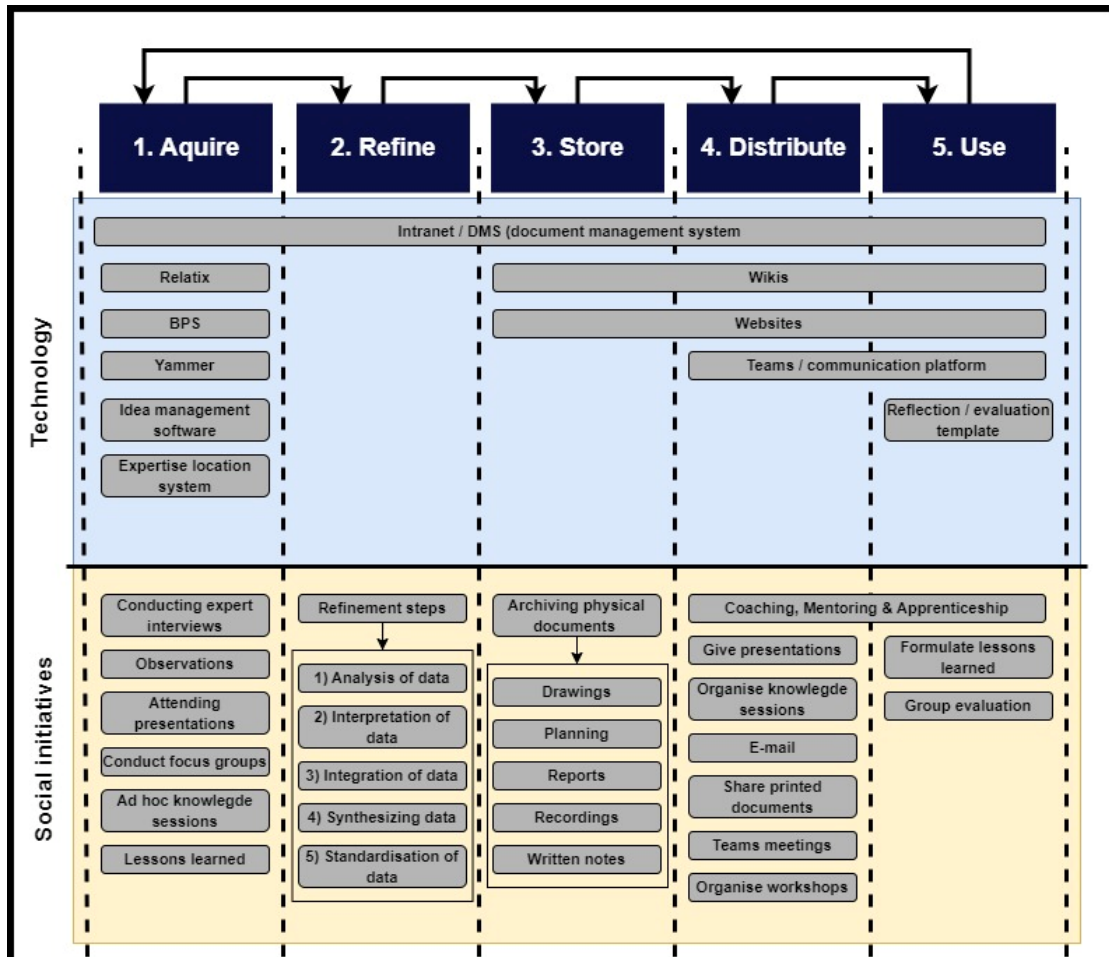


FIGURE 5

KNOWLEDGE MANAGEMENT CYCLE WITH TECHNOLOGICAL SYSTEM AND SOCIAL INITIATIVES

products from the original data ‘mess’. An example could be integrating several e-mail chains and memoranda into one single PDF file with footnotes or extra remarks were needed.

The same holds for refining tacit knowledge; however, this may not be as easy as compiling several documents. Instead of documents, the knowledge can be packaged in a video or audio recording. The interviewer should therefore listen to the interview, extract the parts containing tacit knowledge, interpret it correctly, and draft a coherent document in which the tacit knowledge is substantiated with the necessary context.

IIIc. Storage/retrieval

The storage and retrieval steps connect the acquisition and refinement of data with the distribution and presentation stages. Storage can range from simply using binders for sheets of paper to hard drives storing project drawings or BIMs (Meyer & Zack, 1996).

There is little difference between storing and retrieving explicit and tacit knowledge. Most organisations have guidelines and protocols specifying how documents with a certain classification or label should be handled. However, the only difference between explicit and tacit knowledge is that, for example, the refined interview document mentions the interviewee's name. Therefore, extra steps to guarantee proper storage and retrieval should be added to the existing protocol related to privacy and anonymity.

III d. Distribution

Distribution relates to how the retrieved knowledge is delivered to the users. The way of distribution can vary based on the amount of knowledge, its complexity, and the number of end users. Mediums such as one-on-one conversations, teams meetings, and large conferences are all potential ways of distributing refined and stored knowledge (Meyer & Zack, 1996).

Explicit and tacit knowledge products should be distributed by technological systems, such as the intranet and teams, and by social initiatives, such as workshops and in-person presentations. The appropriate way of distributing knowledge products depends on their target audience and complexity. For example, explicit knowledge that is adequately refined may be understood without needing a presentation or workshop. Tacit knowledge, on the other hand, is often complex because it is based on expert experience and know-how. Therefore, distributing a refined document may not be enough for everyone to understand and grasp the information thoroughly. By, for example, conducting a knowledge session with the interviewed expert present, the knowledge products can be distributed more effectively.

IIIe. Presentation/use

The final stage refers to implementing and using refined and distributed knowledge. Throughout the process, the value of the knowledge created culminates at this point. Using knowledge does not only mean providing it to the end users but also ensuring it is useable. A complex drawing, for example, could benefit from a couple of notes specifying key aspects. Furthermore, this stage also serves as a reflection of the added value of the overall process. How effectively the knowledge is implemented provides insight into the value created by the overall process (Meyer & Zack, 1996).

After distributing the explicit and tacit knowledge products to the intended audience, they must also be used. An evaluation process must be set up to gauge how helpful the shared knowledge was to ensure that the knowledge management cycle functions properly.

After completing the cycle and implementing the knowledge gained effectively, new knowledge may be created or formed. This new explicit or tacit knowledge will then again be acquired, and the cycle repeats.

IV. Application of the KMC

Figure 5 presents the KMC made for the case of the Tender Bureau of Heijmans. However, the cycle is applicable on multiple levels, be it inter-organisational, cross-organisationally, or between projects. This broader application of the cycle is visualised in Figure 6. In this figure, three examples are given showing the KMC being used between the Tender Bureau and HWPP projects, between projects themselves, and between projects and the external and internal actors within the project organisation. The coloured lines correspond with the processes at the bottom right corner. Each process describes the steps and actions to be taken using the examples above them. Both explicit and tacit knowledge products are addressed.

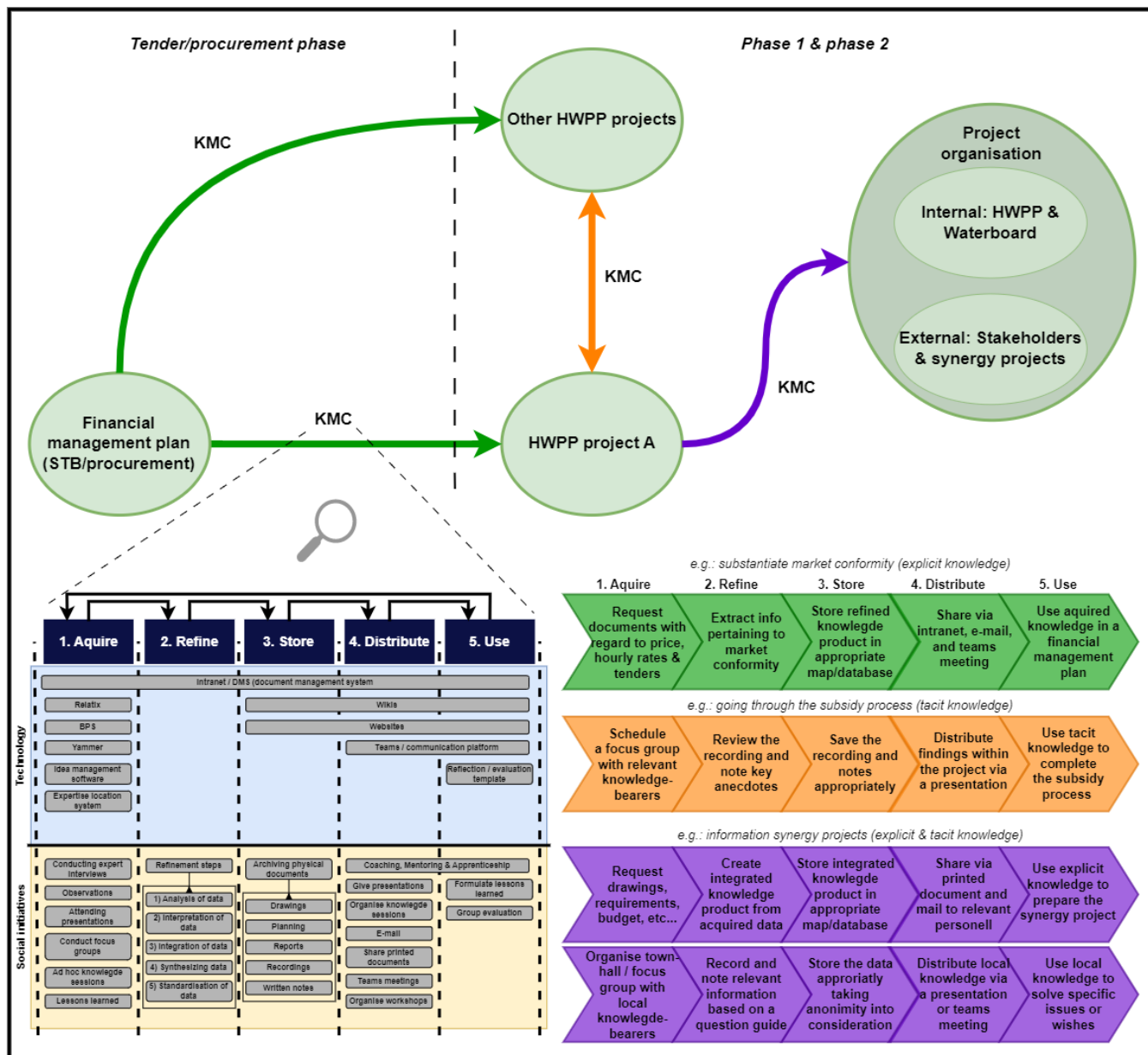


FIGURE 6

THE APPLICABILITY OF THE KMC IN THE ORGANISATION, BETWEEN PROJECTS, AND WITHIN PROJECT ORGANISATIONS

DISCUSSION

This chapter discusses the results presented in this study by first summarising the key findings of this research paper. Afterwards, the results are interpreted in relation to the stated research objectives and relevant literature. Next, the limitations of the research are addressed. Finally, the chapter concludes by providing insight into the practical application of the findings and recommendations for future research.

I. Key findings

Based on a preliminary data analysis, four success factors were formulated that describe the desired situation for the price determination process: (1) Have a clear understanding of scope technical issues and their interdependencies. (2) Having no ambiguities when entering the price determination process regarding terms and specifications. (3) Having close interaction between involved project parties regarding design and price. (4) Establish a uniform culture within the project organisation.

Completing the thematic analysis resulted in the formulation of four themes: scope, preconditions, interaction, and culture. Within these themes, the thematic analysis identified four key obstacles impacting the price determination process and hampering the project team from reaching the desired situation: underestimation of the simultaneity of design and price determination, lack of early definition of terms and specification of preconditions, insufficient inclusion of the HWPP and Waterboard during the price determination process, and inadequate attention to forming a uniform culture.

The analysis further identified several solutions to improve the price determination process and financial management of 2-phase approach projects. Some of these solutions are: gaining insight into the subsidy process and synergy projects at an early stage, defining ambiguous terms such as an honest price and market conformity, specifying frameworks for hourly rates, supplying both the Waterboard and HWPP with more content knowledge and keeping them up to date regarding financial choices, and taking the time to get to know each other at an early stage.

After the thematic analysis regarding the price determination process, a pivot was made into knowledge management (KM). The shift towards KM addresses the formulated success factor related to learning and knowledge exchange. A deep dive into the literature resulted in determining two types of knowledge that should be safeguarded and exchanged within the organisation: explicit and tacit. Explicit knowledge can be documented and physically stored in the forms of manuals, reports, processes, and drawings, making it easier to share (Carrillo & Chinowsky, 2006; Nonaka & Takeuchi, 1995; Tserng & Lin, 2004). On the other hand, tacit knowledge is more difficult to document as it is gained through experience and can be stored as recordings, expert suggestions, or written down know-

how/what (Carrillo & Chinowsky, 2006; Nonaka & Takeuchi, 1995; Tserng & Lin, 2004).

Based on the literature review about KM, a knowledge management cycle (KMC) was made to fill the KM gap within Heijmans based on the cycle of Meyer & Zack (1996). The Tender Bureau of Heijmans acted as the case on which the cycle was created. The cycle follows the five steps of acquiring, refining, storing, distributing, and using explicit and tacit knowledge. Moreover, the cycle is substantiated by technological systems and social initiatives that can be used and implemented per step in the KMC.

II. Interpretation of the results

The identified obstacles during the price determination process of HWPP projects show similarities and differences compared to the existing literature. Obstacles related to the insufficient specification of costs, such as hourly rates and not keeping the client sufficiently up to date regarding design choices with a financial impact, are also mentioned in the thesis by van der Pas (2021). Furthermore, the thesis by Miedema (2022) looked into two HWPP projects from the client's perspective and voiced the difficulties regarding the subsidy application and its importance in awarding phase 2. However, due to this research focusing solely on projects that have much in common, obstacles regarding synergy projects, the process for subsidy application, and the interaction with the guidance team show the emergence of specific HWPP project-related obstacles.

The same holds for the formulated success factors and solutions. The critical success factors presented by van der Pas (2021) show overlap on certain issues. For example, early agreements about price composition, the alignment of cost estimation and design, and expressing responsibilities to each other are similar to the solutions presented in this paper. However, focusing on a set of case projects with comparable characteristics resulted in more specific and practical solutions. Examples of this are related to gaining more insight into the subsidy process (ritsprocess), dealing with synergy projects, and defining and specifying issues related to an honest price.

Furthermore, regarding the theme of culture, it should be noted that culture is not only limited to the obstacles named under this theme but also intersects with the overarching culture within Heijmans. The obstacles mentioned are specific to the culture at a case level. However, more broad cultural obstacles and solutions can be found when looking at the organisational level of Heijmans.

The relevance and validity of the research results pertaining to financial management were corroborated during a knowledge exchange session during which four HWPP projects were presented. During the three-hour session, many obstacles and challenges were presented that matched all the identified obstacles in this research paper.

Lastly, creating the KMC aims to fill the knowledge management gap within Heijmans. The inspiration for the cycle is based upon an already-existent KMC created by

Meyer & Zack (1996). The cycle is substantiated by technological systems and social initiatives based on the literature about barriers to knowledge management (Andreasian & Andreasian, 2013; Disterer, 2001; Wiewiora et al., 2009). The technological systems and social initiatives described per step are formulated from the perspective of the Tender Bureau of Heijmans. This focus on a specific department ensured that the provided actions per step were tangible and concrete. Attention is also given to the differences in actions and approaches to the steps based on the type of knowledge, be it explicit or tacit (Nonaka & Takeuchi, 1995). However, the creation of the KMC based on a single department does not influence the generalisability of the cycle. As Figure 6 demonstrated, the KMC can be applied on various levels, be it inter- or cross-organisational or even between individual projects. Only the technological systems and social initiatives used can vary depending on where the KMC is applied.

The lack of knowledge management became apparent during the same knowledge exchange session. Without a straightforward process of sharing knowledge effectively, the session resulted in several presentations with limited participant interaction and no afterwards evaluation. The knowledge management cycle presented in this paper and the stated technologies and social initiatives lay the groundwork for creating a more knowledge-oriented organisation.

III. Limitations

Before and during the research period, several methodological limitations have been identified that limit the overall quality of the data collection methods and analysis techniques. These limitations can be generic and impact the study as a whole, whilst some are data collection method specific.

The first limitation is that the quality of the interview data depends on the researcher's competencies. An experienced interviewer can conduct an interview that produces valuable data. On the other hand, an inexperienced researcher can also conduct the same interview but with lesser results.

Second, the novelty of the 2-phase approach limits the amount of literature that can be reviewed and analysed. Therefore, this scarcity in academic literature diminishes the quality of the overall analysis. A rich library of resources would ensure that no important aspects, insight, and knowledge are omitted from the results.

Third, focusing on HWPP cases with an embedded nature, focusing on price determination, results in an output that applies to projects that share similarities with the investigated projects. However, this focus does limit the generalisability of the research output as it is related to a specific set of projects and scope.

Fourth, the chosen research strategy, a multiple, embedded case study, allows for comparing cases to identify similarities or discrepancies. This comparison is beneficial for construction projects because of the inherent variance between projects. However, it is important to note the balance

between the number of case studies and the amount of detail one needs during the research. Too many case studies can result in a loss of detail, making the research output very generic. On the other hand, a singular case study, for example, can provide much detail about one or multiple aspects of a project; however, it loses the benefit of comparing the findings to other cases and makes the research less generalisable.

Fifth, the subjectivity inherent to thematic analysis poses the risk that valuable data is lost during the analysis of the interview data, coding phase, and creating/formulating themes, obstacles, and solutions.

IV. Recommendations

The results pertaining to the obstacles and solutions regarding financial management have already, in part, been applied in practice. Various solutions provided by this research have been implemented in tenders for 2-phase projects where financial management is a criterion. With regard to knowledge management, the cycle functions as the first tool to fill the gap in knowledge management present within Heijmans.

Besides the practical application of this research, there is still much to learn and explore about 2-phase projects and knowledge management within the construction industry. Therefore, the following three recommendations for future research are:

1) Follow up research on the case projects mentioned in this paper, or other HWPP projects that fit the 2-phase approach definition, when realisation is done to determine the benefits of the 2-phase approach.

2) Research a different sector of civil engineering projects with a 2-phase approach (roadwork or utilities) to identify the similarities and differences between the identified obstacles and solutions and to find project or sector-specific obstacles.

3) Further research into knowledge management and the knowledge management cycle by expanding the capabilities and applicability of the cycle throughout Heijmans. Identify barriers and obstacles blocking it and develop different tools and systems to improve knowledge management.

Identifying and formulating the success factors, obstacles, and solutions related to the price determination process of 2-phase HWPP projects provide detailed insight into the complexity of such projects and the challenges the transition towards a 2-phase project brings. Furthermore, the KMC not only improves knowledge development and transfer regarding the financial management of 2-phase projects, but it also lays the foundation for potentially increasing awareness, inter- and cross-organisationally, surrounding the importance of knowledge management in the construction industry.

CONCLUSION

This paper aimed at achieving the stated objectives of identifying the obstacles during the price determination process of 2-phase HWPP projects to gain the necessary insights to improve the current knowledge base about financial management. And in addition to fill the gap in knowledge management within Heijmans to improve organisational knowledge exchange and learning.

At first, based on a preliminary data analysis, the following four success factors were formulated that describe the desired situation for the price determination process: (1) Have a clear understanding of scope technical issues and their interdependencies. (2) Having no ambiguities when entering the price determination process regarding terms and specifications. (3) Having close interaction between involved project parties regarding design and price. (4) Establish a uniform culture within the project organisation.

Completing the analysis resulted in the creation of four themes, each containing different obstacles and solutions. The four themes are scope, preconditions, interaction, and culture, with the key obstacles per theme being the underestimation of the simultaneity of design and price determination, lack of early definition of terms and specification of preconditions, insufficient inclusion of the HWPP and Waterboard during the price determination process, and inadequate attention to forming a uniform culture.

Naturally, the following solutions were defined to solve the obstacles during the price determination phase. The following solutions are vital to solving the main obstacles: gaining insight into the subsidy process and synergy projects at an early stage, defining ambiguous terms such as an honest price and market conformity, specifying frameworks for hourly rates, supplying both the Waterboard and HWPP with more content knowledge and keeping them up to date regarding financial choices, and taking the time to get to know each other at an early stage.

Moreover, the lack of knowledge management was addressed. First, the types of knowledge to safeguard and exchange were described. Second, a knowledge management cycle (KMC) was made. This cycle provides a systemic process in which knowledge is acquired, refined, stored, distributed, and used. Each step of this process is substantiated with the use of technological systems and social initiatives to provide concrete examples that can be used. The cycle can be applied on various levels in the organisation and in projects to help transfer and acquire knowledge.

The practical application of this research is twofold. First, the results pertaining to identifying concrete, tangible, and specific obstacles and solutions provide the Tender Bureau of Heijmans with insight that can be used to improve the drafting of financial management plans for HWPP projects and other projects that apply a 2-phase approach.

Second, the knowledge management cycle functions as the first tool to fill the gap in knowledge management present within Heijmans. The actions per step and processes to execute these effectively will evolve through time and

gradually improve knowledge management. Moreover, The applicability of this tool will vary based on what departments and projects implement and use this tool.

The findings presented in this research paper indicate that the financial management of 2-phase HWPP projects requires a vastly different approach compared to more traditional works. This difference is noticeable in the drafting of financial management plans during the tender phase and the price determination process in phase 1. Moreover, the creation of the KMC lays the foundation to improve knowledge management within Heijmans.

DATA AVAILABILITY STATEMENT

Some or all data, models, or code generated or used during the study are proprietary or confidential in nature and may only be provided with restrictions. This status is applied to the following data:

- Data gathered during interviews;
- Data gathered during focus groups;
- Confidential documents.

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APPENDICES

List of appendices:

- Appendix I: overview of case projects
- Appendix II: interview guide
- Appendix III: focus group guide

REFERENCES

- Alsaawi, A. (2014). A CRITICAL REVIEW OF QUALITATIVE INTERVIEWS. In *European Journal of Business and Social Sciences* (Vol. 3, Issue 4). <http://ssrn.com/abstract=2819536><http://www.ejbss.com/recent.aspx><https://ssrn.com/abstract=2819536><http://www.ejbss.com/abstract=2819536>
- Andreasian, G., & Andreasian, M. (2013). Knowledge Sharing and Knowledge Transfer Barriers. A Case Study [Linnaeus University]. <https://www.diva-portal.org/smash/get/diva2:639925/FULLTEXT01.pdf>
- Begzadic, B. (n.d.). Knowledge Management Cycles and Their Usefulness in Organisations.
- Bhatt, G. D. (2001). Knowledge management in organisations: examining the interaction between technologies, techniques, and people. *Journal of Knowledge Management*, 5(1), 68–75. <http://www.emerald-library.com/ft>
- Boes, H., & Dorée, A. (2004). Public procurement at local level in the Netherlands: towards a better client-contractor cooperation in a competitive environment. *Construction Engineering and Management*, 32(2), 717–727. <https://doi.org/10.1080/0961321032000172382>
- Bossink, B., & Bossink, B. A. G. (2004). Managing Drivers of Innovation in Construction Networks. *Journal of Construction Engineering and Management*, 130(3), 337–345. <https://doi.org/10.1061/ASCE0733-93642004130:3337>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Carrillo, P., & Chinowsky, P. (2006). Exploiting Knowledge Management: The Engineering and Construction Perspective. *Management in Engineering*, 22(1), 2–10. <https://dspace.lboro.ac.uk/>
- Carrillo, P., Robinson, H., Al-Ghassani, A., & Anumba, C. (2004). Knowledge management in UK construction: strategies, resources and barriers. *Project Management Journal*, 35(1), 46–56.
- Chao-Duivis, M. (2019). De zaak van de smeltende dinosaurus.
- Creedy, G. D., Skitmore, M., Wong, J. K. W., & Wong, J. K. (2010). AN EVALUATION OF THE RISK FACTORS LEADING TO COST OVERRUN IN THE DELIVERY OF HIGHWAY CONSTRUCTION PROJECTS. *Construction Engineering and Management*, 136(5), 528–537.
- Disterer, G. (2001). Individual and social barriers to knowledge transfer. *Proceedings of the Hawaii International Conference on System Sciences*, 220–227. <https://doi.org/10.1109/HICSS.2001.927138>
- Dorée, A. G. (2004). Collusion in the Dutch construction industry: An industrial organisation perspective. In *Building Research and Information* (Vol. 32, Issue 2, pp. 146–156). <https://doi.org/10.1080/0961321032000172382>
- Dorée, A., Holmen, E., & Caerteling, J. (2003). CO-OPERATION AND COMPETITION IN THE CONSTRUCTION INDUSTRY OF THE NETHERLANDS.
- Jansen, C. (2021). Over “twee-fasen-proces”, “bouwteam met UAV-GC” en alliantie: mogelijke oplossingen voor een verbeterde beheersing van informatierisico bij de aanbesteding en realisatie van geïntegreerde projecten. *Tijdschrift Voor Bouwrecht*, 8, 692–710.
- Landaeta, R. E. (2008). Evaluating benefits and challenges of knowledge transfer across projects. *EMJ - Engineering Management Journal*, 20(1), 29–38. <https://doi.org/10.1080/10429247.2008.11431753>
- McKinsey&Company. (2019). Toekomstige Opgave Rijkswaterstaat: Perspectief op de uitdagingen en verbetermogelijkheden in de GWW-sector.
- Meyer, M. H., & Zack, M. H. (1996). The Design and Development of Information Products. *Sloan Management Review*, 37(3), 43–59.
- Miedema, J. J. (2022). Insights into the design of the two-phase deliver model in the design phase of infrastructure projects.
- Mohajan, H., & Mohajan, H. K. (2017). A Comprehensive Analysis of Knowledge Management Cycles. *Journal of Environmental Treatment Techniques*, 4(4), 184–200.
- Nonaka, I., & Takeuchi, H. (1995). *The Knowledge Creating Company Author* (Vol. 3). Oxford University Press.
- PEC. (2002). De bouw uit de schaduw. Final report of the parliamentary enquiry committee on fraud in the construction industry.
- Rijkswaterstaat. (2021a). A27 Everdingen-Hooipolder Visiedocument.
- Rijkswaterstaat. (2021b). Op weg naar een vitale infrasector.
- Roberts, R. E. (2020). Qualitative interview questions: Guidance for novice researchers. In *Qualitative Report* (Vol. 25, Issue 9, pp. 3185–3203). *Peace and Conflict Studies*. <https://doi.org/10.46743/2160-3715/2020.4640>
- Rodrigues de Almeida, P., & Zafra Solas, M. (2016). Shaping the Future of Construction A Breakthrough in Mindset and Technology.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Tserng, H. P., & Lin, Y. C. (2004). Developing an activity-based knowledge management system for contractors. *Automation in Construction*, 13(6), 781–802. <https://doi.org/10.1016/j.autcon.2004.05.003>
- Tukker, E., Boes, H., van den Berg, H., de Koning, J., Steenberg, J., Fijneman, J., Merema, J., Kalt, J., van Alphen, J., Vos, M., Voorend, R., & van der Linden, S. (2020). Handreiking “Aanbesteden van twee fasen contracten.”
- Uzun, M. (2022). Price formation in Bouwteam projects Negotiating versus aligning the prices during the Bouwteam phase for infrastructure works and services in the Netherlands. <https://purl.utwente.nl/essays/89634>
- van der Pas, E. M. (2021). The 2-phased price determination process in Bouwteam projects in the Netherlands: An approach towards understanding the price in a construction project: Practical recommendations for the price determination process in Bouwteam.
- van Waarden, B. F. (1989). *Organisatiemacht van belangenverenigingen: de ondernemersorganisaties in de bouwrijverheid als voorbeeld*. Ambo.
- van Wijck, D. (2018). *Early Contractor Involvement in the Netherlands*.
- Webb, S. (1998). *Knowledge management: linchpin of change* (1st ed.). Routledge.
- Wiewiora, A., Bambang Trigunaryah, A., Murphy, G., & Chen, L. (2009). Barriers to effective knowledge transfer in project-based organisations. *Proceedings of the International Conference on Global Innovation in Construction*, 220–230. <http://eprints.qut.edu.au/>
- Wijk-van Gilst, N. (2020, September 21). Korte introductie twee-fasen-proces. Instituut Voor Bouwrecht.
- Xue, Xiaolong, Zhang, Ruixue, Yang, R. J., Dai, & Jason. (2014). Innovation in Construction: A Critical Review and Future Research. *International Journal of Innovation Science*, 6(2), 111–125.