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THE
DESIGN
THINKING
Approach to Projects

☑ **A B S T R A C T**

Project success is one of the most studied topics in project management. Notwithstanding this vast literature base, project results continue to disappoint stakeholders. Turner and Cochrane (1993) argued that the traditional measure of success, completing the project on time and within budget, is based on the assumption that in projects both the goals and the method of achieving them are well understood at the start of the project. For some projects however, the objectives and/or the methods are not clearly defined. These projects are only successful if they achieve a unitary, beneficial change with value for users.
A domain that has great experience in dealing with these type of problems, where only the aspired end value is known, not the goals and methods, is Design Thinking. The study reported in this paper explored the question What aspects of the Design Thinking approach should be integrated into Project Management in order to contribute to the successful management of projects?
Based on an analysis of the literature, we developed a conceptual framework that characterizes the differences between the Rational Analytic approach and the Design Thinking approach to projects. We deployed an experimental research strategy to empirically explore what new insights a design thinking approach gives to project managers. Our findings indicate that with the aid of a Design Thinking tool, the project managers were able to adopt a design thinking approach. In applying this approach, they played an active role both in the problem definition phase of the project and in synthesizing new solutions that create value for users. Based on the insights gathered from the experiment, we propose that the following three aspects of Design Thinking should be integrated into Project Management: 1. Framing and reframing, 2. Focus on the wants and needs of users and 3. Use of visual aids.

1. Introduction

Project success, both the determination and the achievement, is one of the most researched topics in project management (Joslin & Müller, 2015). Most studies on project success highlight the three traditional 'iron triangle' criteria of project success: delivering the result within time, within budget and conform specifications "despite the fact that this method is currently subject to widespread criticism" (Bakker et al., 2010). More recently, Turner and Zolin (2012) expand project performance factors beyond these standard considerations and suggest inclusion of measures of user appreciation. Considering the perspectives of users and (other) stakeholders in project success makes sense, as project results continue to disappoint stakeholders (Cooke-Davies, 2002).

Some research focuses on the definition of projects and it's relation to project success. Turner and Cochrane (1993) propose a new definition of projects. They argue that traditional definitions of projects are based on the assumption that in projects both the goals and the method of achieving them are well understood at the start of the project. These objectives become part of the definition of success, and the project manager is said to be successful if they deliver them on time and within budget. For some projects however, the objectives and/or the methods of achieving them are not clearly defined. These two parameters – how well defined are the goals, and how well defined are the methods – result in a 2 x 2 matrix that Turner and Cochrane have named the "goals-and-methods matrix". What should be clear in any project, is the fact that a project is only successful if it "achieves a unitary, beneficial change" (Turner & Cochrane, 1993). This beneficial change is also described as "purpose" or "value for users".

A domain that has great experience in creating value for users is the domain of design. Designers and engineers often create products where at the start of the problem solving ONLY the aspired end val-

ue is known, NOT the goals and methods (Dorst, 2011). In research literature, the term 'Design Thinking' has emerged as a way of thinking which leads to transformation, evolution and innovation, to new forms of living and to new ways of managing business (Tschimmel, 2012). The term Design Thinking has been part of the collective consciousness of design researchers since Peter G. Rowe used it as the title of his 1987 book "Design Thinking" (1987) . It has gained popularity and is widely seen as an exciting new paradigm for dealing with problems in sectors as far afield as IT, Business, Education and Medicine (Dorst, 2011). It has become a label for the awareness that any kind of business and organization can benefit from designers' way of thinking and working (Tschimmel, 2012). Studying the way designers work and adopting some 'designerly' practices could be interesting to organizations, because designers have been dealing with open, complex problems for many years (Dorst, 2011).

Problem solving where only the aspired value is known, not the goals and methods, can be related to Type-4 projects, as described in the goals-and-methods matrix (Turner & Cochrane, 1993). Type-4 have a greater chance of failure (Turner & Cochrane, 1993), because project management traditionally assumes that in projects both goals and the methods of achieving them are known at the start of the project. Cochrane and Turner therefore propose new methods in dealing with these types of projects, such as working with multi-disciplinary teams, a facilitator to negotiate agreement between parties, milestone planning and configuration management. But as projects still continue to disappoint users, what can Project Management learn from Design Thinking?

Design Thinking has provided useful new insights into the general management domain, especially where it concerns complex, wicked, problems (Dorst, 2011). Type-4 projects show similar characteristics to design-problems. However, in Project Management literature and research, little mention is made of Design Thinking. Only recently, Ben Mahmoud-Jouini et al. (2016), related design thinking to project management. So, what novel ways of approaching open, complex problems is the project management community missing out on? The research question of the study reported in this paper was formulated as: What aspects of the Design Thinking approach should be integrated into Project Management in order to contribute to the successful management of projects?

The remainder of the paper is organized as follows. The next paragraph reports a review of the concepts of design thinking and how these are reflected in project management literature. In paragraph 3, this conceptual analysis is summarized in a conceptual framework, comparing the Design Thinking approach to project management with the Rational Analytic approach. This paragraph

also describes the research strategy and design we deployed to empirically explore the influence of the application of Design Thinking on project managers in their approach to projects . Paragraph 4 will report the findings of our empirical exploration, with the final paragraph of this paper reporting our conclusion and suggestions for further research.

The goal of this study is to contribute to the missing link between project management and design thinking. And to give project managers insight in the benefits of applying design thinking in their approach to projects.

2. Literature

The section consists of two parts: firstly the concept of Design Thinking is explained using a variety of academic sources. Secondly, an overview is given of the occurrence of (related) concepts of Design Thinking in Project Management research literature.

2.1 Design Thinking

The concept of Design Thinking has been defined in the literature in a variety of ways. This section will start with the most commonly used terminology to describe the phenomenon. Secondly, the core of Design Thinking will be explained by looking into the key reasoning patterns in design. Thirdly, the core of design practice will be explained.

2.1.1 The concept of Design Thinking

Design Thinking can be described as team based, user centered process, powered by a thorough understanding of what users want and need (Brown, 2008). It is used for finding a solution for an often ill-defined problem in any organizational or social context. The problem solving process includes a complex inquiry phase and a suspension of decisions and even suspension of the problem definition itself (Kuiper & Kolsteeg, 2012). It originated in the last decade of the 1900's, where researchers studied the essential mental strategies of designers (Cross et al., 1992). More recently (2001 – 2012), the concept of design thinking has been stretched, and has broken free from its domain limits. Today, Design Thinking is understood as a complex thinking process of conceiving new realities, expressing the introduction of design culture and its methods into fields such as business innovation (Tschimmel, 2012). It is not a predefined series of orderly steps, but "a human-centered, creative iterative and practical approach to finding innovative ideas and solutions (Brown, 2008).

2.1.2 Problem solving

In his article "The core of "design thinking" and it's application, Dorst (2011), explains the core of Design Thinking and what it could bring to practitioners and organizations in other fields. He uses a model from formal logic to describe the key reasoning patterns in design and explains how this type of reasoning is very different from other fields. He then explains how designers adopt and create "a frame" to deal with a problem at hand.

In problem solving humans adopt different kinds of reasoning patterns. In the sciences two types of reasoning are distinguished: Deduction an Induction. The difference between the two is the different setting of the knowns and unknowns in this equation:

WHAT (thing) + HOW (working principle) leads to RESULT (observed)

In Deduction, because the "what" and the "how" are known, the result can be predicted and informs "justification". In Induction, the "what" and the "result" are known, the proposing of a "working principle" that could explain the observed result is a creative act and a "discovery".

In design however, the result is not a statement or a fact, but the creation of value for others.

WHAT (thing) + HOW (working principle) leads to VALUE (aspired)

This basic reasoning pattern is called Abduction. Dorst (2011) explains two forms of Abduction, one of which most closely represents the open, complex problems for which organizations are seeking new approaches:

??? (thing) + ??? (working principle) leads to VALUE (aspired)

The challenge in this form of Abduction is to figure out "what" to create, while there is no known "working principle" that can be trusted to lead to the aspired value. Designers resolve this type of problem by framing and frame creation.

2.1.2 Design Reasoning

A "frame" is the general implication that by applying a certain working principle a specific value will be created (Dorst, 2011). This means that he "thing" and the "working principle" are created together:

WHAT + HOW leads to VALUE
--------frame-----------

In design literature (since Schön (1988)) "framing" is the term used to describe the creation of a (novel) standpoint from which a problematic situation can be tackled. The "frame" is a complex set of statements that include a specific perception of a problem statement. The reasoning is as follows: IF we look at the problem situation from this viewpoint, and adopt the working principle associated with that position, THEN we will create the value we are striving for. This type of reasoning requires

an iterative process of reasoning "backwards" (starting with the value) and then "forward", to see whether the "thing" that has been created, together with the working principle, actually creates the aspired value.

The uniqueness of design reasoning is found with various authors on the subject. Different terms are used, but they all seek to explain how designers think differently. Tschimmel (2012) calls it: "thinking in new and different perspectives and about future possibilities". Tim Brown, CEO of IDEO, a company specialized in organizational change from the perspective of Design Thinking speaks about "a fundamental way of thinking" (Brown, 2009) . The most important aspect of Design Thinking in his view is "insight". Insight in a problem is obtained by observation and empathy, as opposed to relying on quantitative data. "Insight" and "aspired value" both represent design reasoning as a "methodology that imbues the full spectrum of innovation activities with a human-centered design ethos" (Brown, 2008).

2.1.3 Design practice: frame creation and changing frames

The ability to create frames and " to reframe a problematic situation in new and interesting ways is widely seen as one of the key characteristics of design thinking" (Paton & Dorst, 2011). So how are frames created? In creating new frames, what expert designers are engaging in is a subtle process of analysis that has much in common with phenomenological methods of analysis, through which a complex situation is read in terms of "themes" (Manen, 1990). In this method, a "theme" is the experience of focus, of meaning. Themes are not clearly positioned in either the problem space or the solution space. These "themes" become triggers for creation of new frames that allow the central problem to be approached in a new and interesting way. This gathering of clues is a deliberate strategy with designers. To an outsider it may look like an informal activity, and the terms designers use are sometimes vague: they talk about "getting close to a situation", the importance of "richness" of the problem area, they stress the importance of "getting first-hand-experience" of the problem situation.

By reframing a problem, based on emerging themes from their investigation, designers develop new solutions. The original frame limits the solution space: if, for example, a City Centre entertainment area is framed by the local government as a law-and-order problem, only measures that fit into the law-and-order paradigm are taken. By reframing it as a music festival, and defining the value to be achieved as: "young people wanting to have a good time", a different solution space can be tapped into.

In design practice, as well as in organizational change in general, the problem situation as is first presented to the designer – the change manager or project manager – is often implicitly framed by the client organization. Designers actively uncover this implicit frame and develop new frames in close cooperation with their client. In the next section this process is explained.

2.1.4 Design practice: briefing and the role of the designer

A design project usually starts with a brief, formulated by the client. The designer and the client engage in a series of interactions, in order to develop a mutual understanding of the project. The end-result is an accepted brief that is understood and agreed upon, in which the designer's and the client's frame have come to align or align to a certain extent (Dorst, 2011). Designers describe this process as a process of negotiation to define a "vision" of what the project should be, and what the shared appreciation is of the value to be achieved.

In their research, Dorst and Patton (2011), describe the particular roles that designers perceive themselves to play in this process:
- Technician: the designer is given a solidly defined brief and is expected to carry this out.
- Facilitator: the client knows what he wants, but not what is required to achieve it completely. The designer gives expert advice.
- Expert/Artist: the client knows what he needs, and the designer is responsible for framing the project with the client to a workable outcome

- Collaborator: both client and designer work mutually on framing the project in terms of both problem and solutions space.

The designers interviewed in the research identified the expert/artist role and the collaborator role as being the most desirable mode for briefing. The interviewees describe the reason for negotiating to change a client-given brief to be: to make the project more successful.

In the table below (**Table 1**), the four roles identified are shown in relation to topics involved in the process of briefing: point of entry of the designer to the project, involvement in problem space formulation, involvement in solution space formulation and amount of iterations.

So how do designers negotiate new frames? An important aim for designers is to shift clients away from a problem-solving approach. First, the conversation should be about the exploration of the aspired value. To do this, designers use abstractions in the form of visual abstractions or analogies. Another way to negotiate new frames is identified as contextual engagement: designers create interaction and activities with the client, that facilitate reframing the project with the client. This can take the form of workshops in which client and designer co-explore the problem space, often in playful, "fun" –type meetings where a variety of ideas are played with in order to "loosen" fixation on a particular outcome.

2.2 Design Thinking in Project Management Literature

In this section, an overview is given of the occurrence of (related) concepts of Design Thinking in Project Management research literature. And although there are a great number of articles relating to General Management in relation to Design Thinking, specific mention of Design Thinking in Project Management academic literature is rare. Related terms that have been found, will be described in this section: Agile, problem-setting, uncertainty and change/innovation.

2.2.1 Agile

In software development, the term design is used in relation to software design management. The 12 Principles of Agile Software have influenced the Project Management practice since the Manifesto for Agile Software Development was published in 2001 (Beck & Beedle, 2001). Characteristics of Design Thinking are echoed in some of the terminology used in Agile: customer collaboration, iterative development cycles, welcome change. Nerur and Balijepally (2007) corroborate this view, but provide a critical note by observing a lack of academic foundation of Agile methods. The authors argue that Agile has the same theoretical basis as conceptual shifts in patterns of thought in other disciplines (Design and Strategy), but the rich perspectives that these other disciplines could provide for the emerging Agile philosophy is conspicuously absent in research. They argue that the metaphor of design offers a strong theoretical basis for the conceptual foundation of Agile methods. The authors urge the Agile community to examine it's theoretical roots. This call has not been answered, since no academic articles on the subject can be found.

2.2.2 Problem setting

De Blois and De Coninck (2008) elaborate on the relationship between project management and design. The authors introduce the notion of the "organizing project". A project is seen as an organizing process, in which all actors and stakeholders play a predominant role as opposed to the traditional perspective on projects as "the organized project". A project is not an object itself, independent of its context. Rather, the trilogy action, stakeholder, transformation defines the project: the project links the ideas, the intentions, the aims, the stakeholders, it produces the project and the objects. The concept of the organizing project is explained by the notion of thinking by design, highlighting the role of actors' and stakeholder participation through the design process. The authors stress that knowledge of design as an activity needs to be developed further, because what is usually NOT taken into account is the "iterative" nature of the design activity. Designing serves the purpose of establishing and conceiving the problem space, while keeping it open to welcome potential emerging solutions. In Project Management theory, the problem-setting activity seems often ignored and is usually referred to as the feasibility phase (Macmillan, 2001). The authors recognize the

MODE	POINT OF ENTRY TO PROJECT	INVOLVEMENT IN PROBLEM SPACE FORMULATION	INVOLVEMENT IN SOLUTION SPACE FORMULATION	AMOUNT OF LITERATION
Technician	End of planning	No	No	Low
Facilitator	Near end of planning	No	Partial	Low
Expert/Artist	Mid-planning	Partial	Yes	Med
Collaborator	Beginning of planning	Yes	Yes	High

TABLE 01. *Briefing modes an ability to reframe during briefing*

need for the Project Management community to develop tools for defining the problem space, rather than devising the solution of a given problem.

In his paper that builds on discussions that took place over a series of meetings in the UK of the Rethinking Project Management Network, Atkinson et al. (2006) also conclude that in professional Project Management guidelines the role of conception at the front end of the project life cycle is minimized. The assumption is that project objectives are clear, or clarified in the feasibility phase. But in practice objectives are often unclear, contradictory, or impossible. Many projects that are managed in this way, experience problems for this reason. The Rethinking PM Network regards management of uncertainty as a necessary condition of effective PM. What is needed, however, is the development of project uncertainty management as ambiguity management. The next section of this literature review will focus on that subject.

2.2.3 Uncertainty

In traditional PM uncertainty is approached as management of risk and opportunity. The solutions to tackle these uncertainties originate in the "control" space: control of performance and results of execution (de Blois & De Coninck, 2008). The measures that Cochrane and Turner (1993) propose, milestone planning and configurations management, are examples of solutions that originate in the "control space". This type of uncertainty can be anticipated, planned and managed. It leaves no room for identifying unknown spaces (de Blois & De Coninck, 2008). Sources of uncertainty are wide-ranging (Atkinson et al., 2006). They are not confined to potential events, but include lack of information, ambiguity, varying agendas in different stages of the project life cycle. The Rethinking PM Network concludes that common PM does not address these uncertainties.

The result is that project management is commonly regarded as concerned with ensuring things get done right, assuming that there is a well-defined idea of what needs to get done. With this view, project management is not concerned with thinking about whether the right things are done, why the project should proceed, or what performance criteria would be appropriate.

In their article, Atkinson et al. (2006) make a clear distinction between uncertainty and ambiguity. Uncertainty is defined by the difference between the data required and the data already possessed: it is "lack of information". Ambiguity means the existence of multiple and conflicting interpretations: it is linked to confusion and lack of understanding. Uncertainty warrants the acquisition of objective information and answering of specific questions. Ambiguity warrants sense-making, the exchange of views and the definitions of situations/problems. This sense-making is especially important in the concept stage of the project life-cycle, and during preliminary design and planning activities. He concludes by giving directions for development of project uncertainty management: what is needed is to formulate qualitative success measures to assist managing projects, instead of just quantitative success measures.

2.2.4 Change/Innovation

Project management in academic studies tends to be regarded as an adequate solution to the problems raised by innovation (Lenfle, 2008).The authors argue that in the literature, there is a missing link between project management and innovation management. Justification for Project Management lies in the fact that something "new" is created, but the divers situations of "newness" are not addressed. Also, the rational view of PM in which the accomplishment of clearly defined goals within budget, quality requirements and time is dominant, does not address the fact that innovation is first and foremost characterized by divergence and unforeseeable uncertainties that render the rational approach irrelevant. (Lenfle, 2008). To deal with these issues, they propose the following managing principles:
1. The central role of experimentation and concurrent exploration: making a plan of action to tackle unforeseeable uncertainties in order to allow problems and solutions to be discovered.
2. The dual nature of performance and goal reformulation: the management process must take into account the two different dimensions of performance: the value of the product AND the accumulation of

knowledge. The accumulation of knowledge during the project is not the same as "lessons learned" after the project is completed. Knowledge accumulated must allow for reformulation of the objectives along the way.

2.3 Summary

In summary, one might observe that in academic literature on Project Management a few references are made to Design Thinking or related terms. Various authors (Nerur & Balijepally, 2007; Lenfle, 2008) observe a lack of theoretical connection to modern general management concepts. All authors argue that dealing with uncertainty, ambiguity and creating value for customers are key issues around which Project Management theory should evolve. De Blois (2008) explicitly argues that knowledge about design as an activity needs to be developed further. Project Management should be more focused on the problem space, instead of the solution space. Where the goal of projects are unclear, more time should be dedicated to sense-making and reformulating objectives along the way (Lenfle, 2008) Ambiguity warrants sense-making, the exchange of views and the definitions of situations/problems. This sense-making is especially important in the concept stage of the project life-cycle, and during preliminary design and planning activities.(Atkinson et al., 2006). Design Thinking can contribute to just these type of issues.

3. Methodology
3.1 Conceptual model

The literature presented in the previous sections has shown that the core of design practice lies in the ability of designers to frame and reframe a given problem. Designers use a systematic human-centered approach to explore the definition of a problem and synthesize solutions (Buchanan, 2010). In order to create a paradigm shift in Project Management towards applying Design Thinking, the Project Manager needs to reassess his/her mode of thinking. Applying Design Thinking implies a different approach to a project than the Rational Analytic approach that is dominant in Project Management theory and practices.

In a previous publication, we developed a conceptual framework that compares the Rational Analytic approach with the Design Thinking approach on the following set of aspects: problem formulation, criteria used in problem solving, method used, information processing emphasis, solution process, rationale and outcome (The authors, 2016). This framework, presented in **Table 2**, is based on the works of Tschimmel (2012) and Glen et al. (2014), that both compare the Design Thinking approach to problem solving to a traditional, Rational Analytical, approach. To direct the characterization of the two contrasting approaches towards project management, descriptions were added by the authors of this article, using the literature on Design Thinking and definitions from the IPMA Competence

Baseline version 3 (International Project Management Association, 2006).

3.2 Research design

The conceptual model shown as **Table 2** provides a characterization of the Rational Analytic project manager, versus the Design Thinking project manager, as well as a set of indicators with which to research the concept. From the characterizations of **Table 2**, it shows that the 'Design Thinking Project Manager' may differ on many aspects in his/her approach to a project from the Rational Analytic Project Manager. In order to explore these differences empirically, we followed Wright, Wrigley and Morehen (2013) and deployed an experiment based research design.

The sub question of our empirical study were therefore specified as:

- How does a Design Thinking approach affect the working methods of non-design Project Management students? (method)
- Does the application of Design Thinking skills have a positive effect on exploring the definition of a problem and synthesizing solutions (framing and reframing)?
- Based on their experience in the design workshop for non-designers, how do the participants experience the value of Design Thinking for the Project Management profession? (contribution)

The experiment undertaken was a two and a half hour intensive design workshop for two groups of non-design students following a project management program. The students were from various background, such as business, health, social sciences and technology. One of the two groups consisted of full-time non-experienced undergraduate students (10 participants), whereas the other group consisted of part-time graduate students with a minimum of five years of work experience in projects (15 participants). Both groups had, as part of their courses on project management, worked on a fictitious project case called "Blood test Optimization". For this case, they had performed various learning exercises, such as developing a Project Brief, a stakeholder analysis, a risk analysis and a work breakdown structure. The aim of the design-thinking workshop was to assess the impact of a Design Thinking approach on the students perception of this project task and its context.

For practical reasons, the research was designed as a quasi-experiment. A control group was not included in the experiment, but internal validity was strengthened by two research design features: (1) the same test was done in two separate groups (undergraduate students and graduate project management professionals and (2) both groups received a control treatment and an experimental treatment. The control treatment is the study activity using a traditional project management approach; the experimental treatment is the Design Thinking approach in the same activity. The dependent variable is measured by asking the participants to reflect on previous experience, and describe the difference using a set of open-type questions. According to Bryman and Bell (2011) internal validity is ensured sufficiently in this way.

	Rational Analytic approach	**Design Thinking approach**
Problem formulation	Well-defined goal and constraints. Immediate perception and quick interpretation of a situation. Result oriented. Views the start of a project as receiving an assignment to achieve a "job" in the form of a project. Receives orders from the client. (International Project Management Association, 2006)	Goals and constraints uncovered during the design thinking process. Intensive observation and wondering, challenging stereotypical perception, asking questions and postponing decisions/ problem definition. Views the start of a project as the start of a dialogue with decision-makers and users. Interacts with the client.
Criteria	Objective definition of criteria, established before generation of alternatives. Project sponsor and stakeholder- driven. Focused on a well-defined project result. Meeting commitments and fulfilling expectations. (International Project Management Association, 2006)	Both objective and subjective criteria used to define design objectives, since the end user is the ultimate judge of efficacy. Empathic and human-driven, deep understanding of peoples' needs and dreams. Focused on the wants and needs of the user.
Method	Mainly rational and objective. Planning and analysis—thought precedes action. Sequential process. Analytical, deductive and inductive. Technician and facilitator. A method is a linear process	Iterative exploration of the design "space," where thinking and doing are intertwined. Emotional and rational at the same time, subjective. Adductive and inventive, thinking about future possibilities. Expert and collaborator. A method is an Iterative process.
Information processing emphasis	Preference for objective formulations, especially verbal and quantitative. Emphasis on project documents, use of waterfall planning sheets, Product/Work Breakdown Structures, diagrams and tables. (International Project Management Association, 2006)	Preference for visual and spatial representations, which evoke both objective and subjective insights. Use of sketching and prototyping tools.
Solution process	Ideally based on conscious, rational-logical reasoning process, which, over time, becomes formalized into a set of rules. Lead by organizing, planning and control	Solutions evolve as the result of interaction with users and the ongoing creation and refinement of possible solutions. Incorporates experience-based insights, judgment, and intuition. Comfortable with ambiguity and uncertainty.
Rationale	"Get it right." Reduce chances of failure though careful prior analysis	Use rapid experimentation and prototyping to learn from early, inexpensive "failures".
Outcome	Solution optimizes predefined criteria to arrive at "best" answer. Looking for 'correct' answers "analyze, come up with the solution and implement the solution" (International Project Management Association, 2006, p. 107). Concerned with ensuring things get done right (Atkinson et al., 2006)	Obtain "better" answer. Process may expose additional problems and solutions. Failure is a part of the process. Concerned with thinking about whether the right things are done (Atkinson et al., 2006).

TABLE 02. *Comparison of Rational Analytic and Design Thinking approaches (The authors, 2016)*

All materials required for the workshop were provided by the researcher. The workshop commenced with a group activity (activity 1), followed by an introduction into design thinking, prior to undertaking the main activity (activity 2) , which was then reflected upon individually at the end of the workshop. Following the research design of Wright et al. (2013), activity 1 was the "Marshmallow Challenge", an activity in which the participants are required to collaborate in building a standing structure from supplied materials (spaghetti sticks, thread and tape), while under time pressure. The
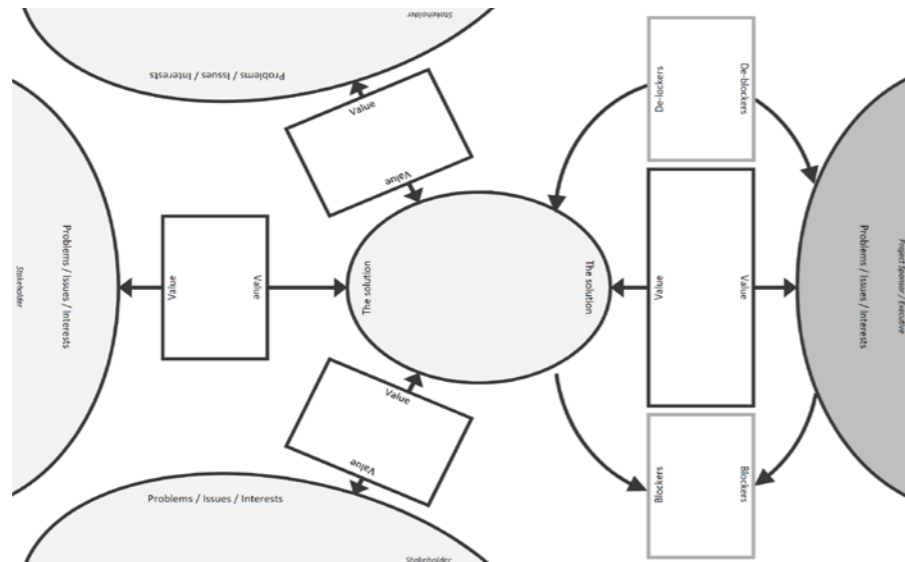

FIGURA 01. *The Design Integration Framework poster (Developed by the authors).*

activity was used as a hands-on introduction aimed at experiencing the difference between a rational analytical project management approach, and a design thinking approach. In activity 2, the participants were asked to work together in order to reframe the project Blood Test Optimization. Participants were issued with a "Design Integration Framework" poster (see **Figure 1**).

With the aid of the poster and a handful of cards containing questions, they were encouraged to further define the project, discussing and formulating responses as a group.

3.3 Data collection

The participants were split into multidisciplinary teams of 3-4 persons. Each participant was given a reflection journal with which they provided written feedback on the learnings and challenges of the workshop. The journal consisted of open-type questions based on the categories of the conceptual model. To provide focus and structure to the questions, a threefold division was made:

- Method: questions dealing with the way of working/ way of thinking of the participant.
- Framing and reframing: questions relating the impact of the exercise on the content of the project's problem definition and objectives.
- Contribution: questions about the perceived value of Design Thinking for Project Management.

Table 3 shows the relationship between the research sub-questions, the categories of the conceptual model and reflective questions of the experiment.

The participants were asked to individually write their answers to each of the 12 questions on sticky-notes, using one sticky-note per question. The sticky notes were assembled on three large posters, representing the three categories.

3.4 Data analysis

The collected answers were transcribed in a document. The arrangement of the answers in the document, was based on the threefold division (1 method, 2 framing/reframing, 3 contribution) and the two groups. Subsequently, this document was imported in Maxqda 10, and thematically analyzed using grounded theory-type activities: coding, categorizing, recognizing relationships and developing categories (Myers, 2009) in order to identify emergent patterns.

4. Findings

This paragraph discusses the findings from the experiment for both groups together. Only when a striking difference between the two groups occurred, will the two groups be discussed separately.

4.1 Data from the experiment

Table 4 presents an overview the data of the experiment.

Category		Reflective question
Method	All	Q1: Has this exercise changed the way you normally work/think? How? What is the difference?
	Criteria	Q2: What was the effect of focusing on the wants and needs of the user on your working-method?
	All	Q3: Which card has influenced the outcome the most, has created the best insights?
	Information-processing emphasis	Q4: How has the use of visual aids (the poster) contributed to the creation of new insights?
Framing and reframing	Problem formulation	Q5: During the previous classes, you have formulated objectives and goals for the project. How has this exercise influenced your view of the problem of the Sacred Heart Hospital?
	Solution	Q6: How has this exercise contributed to the formulation of a
	process	solution for the Sacred Heart Hospital?
	Criteria	Q7: What is the advantage/disadvantage for the executive?
	Criteria	Q8: What is the advantage/disadvantage for the other stakeholders?
	All	Q9: Has this exercised contributed to reframing the project? How?
Contribution	Problem formulation	Q10: In your experience as a project manager, does your executive involve you in the problem-formulating process? Expound on the answer.
	Problem formulation	Q11: Based on the experience in this exercise, what possible role do you see for the project manager in the problem-formulation process of a project?
	All	Q12: What new knowledge and skills have you gained from this exercise that could be useful to your work as a project manager?

FIGURA 03. *Reflective questions of the experiment related to the categories of the conceptual model.*

Category	Codes comments	Subtotal	Total
METHOD\ way of working	More a team effort	2	5
	More playful brainstorming	3	
METHOD\ way of thinking	Focusing on wants and needs of users	9	14
	Challenging project outcome	5	
METHOD\ focusing on wants and needs of user	Looking for possible solutions	15	21
	Rethinking problem definition	4	
	More subjective than objective	2	
METHOD\ use of visual aids	Oversight and structure	15	21
	Shows connectedness	6	
FRAMING AND REFRAMING\ project objectives and goals	Different problem and/or solution	8	17
	Unchanged	9	
FRAMING AND REFRAMING\ solution process	Reformulation of solution is necessary	14	16
	Unchanged	2	
FRAMING AND REFRAMING\ stakeholder perspective	Advantage	16	28
	Disadvantage	5	
	Neither	7	
FRAMING AND REFRAMING\ executive perspective	Advantage	14	30
	Disadvantage	13	
	Neither	3	
CONTRIBUTION\ current role in relation to defining the problem and solution space in a project	Yes	9	20
	No	7	
	A little	4	
CONTRIBUTION\ future role in relation to defining the problem and solution space in a project	Facilitate dialogue with users	5	23
	Stress importance early dialogue with users to steering group	1	
	Reformulate problem definition with executive	4	
	Facilitate process/connector/bringing together points of view	13	

FIGURA 04. *Data from the experiment*

4.2 Findings
4.2.1 Method

The reflective question started off with a general question about how the exercise changed the way the participants normally work/think. The table shows that most reactions were recorded around the topic way of thinking (14). Focusing on wants and needs of users also shows high scores. One of the participants wrote "to feel empathy for the stakeholder is rare". In the exercise, after all, the participants were asked to reflect on the main issues and problems the users face in their daily lives, and involve this insight in defining the problem and solution of the project. These reactions refer to the category criteria in the conceptual model.

Another high score can be seen in challenging project outcome. In their initial reaction to the exercise participants recorded the fact that they began to wonder whether the problem definition and the solution process should be more than "the wish of the executive". The related criteria are: problem formulation solution process.

Six participants noted that the exercise had not changed the way they normally work. As will be shown in the discussion in the Contribution section, the score in the undergraduate group can be explained by the fact that their working experience is limited, and sometimes primarily based on assignments in internships. One experienced graduate student wrote: "my approach to projects is probably too traditional, I need more practice to change my way of working and thinking".

The reactions around the topic way of working relate to the category information-processing emphasis: playful, informal brainstorming and more a team effort.

The next question zoomed in on the effect the participants experienced of focusing on the wants and needs of the user. The most striking result on this topic is: looking for possible solutions. Participants mentioned the fact that they had looked at the solution of the problem from different perspectives. The more experienced graduate students were most specific in what that resulted in: "we have come up with an alternative solution" , "we've debated the original solution, since that solution did not have a direct value for the users", "different perspective leads to different (sometimes impossible) solution". These answers refer to the categories solution process and outcome of the conceptual model.

The category problem formulation is present in the code rethinking problem definition. With four scores, this category is also noteworthy. Striking in the answers is the connection made with the term value: "what is the real value of the project that needs to be addressed for the users?" More subjective than objective refers to the criteria with which the success of the project is measured.

The participants were led through the exercise by means of six cards, each focusing on a different aspect. The problem card focused on the executive's perspective, the empathy card was aimed at imaging what the day-to-day problems of the users (in their relationship to the case) would be. The solution card focused on possible solutions, the blocker card focused on the impossibilities of new found solutions. Asked which card influenced the outcome most, the solution card scored highest. Ranking second are the problem card and the empathy card. This outcome resembles the outcome of the previous topic.

The last topic in the method section is the contribution of visual aids in the experience of the participants. Participants were issued with a Design Integration Framework poster. With the aid of the poster and a handful of cards containing questions, they were encouraged to further define the project, discussing and formulating responses as a group. The poster, together with the sticky-notes that were used to formulate the answers to the questions on the cards, provided a visual conversation framework.

The majority of the participants mentioned oversight and structure as the main contribution in obtaining new insights through the visual aids. Some of the comments: :"it works like a flow chart", "one visually works from different corners of the poster to a result", "you keep track of all the insights", "it provides a structure for the meeting". Six participants also mentioned the result of having oversight, namely that it shows connectedness: "it centralizes the thoughts, differences and similarities can be spotted at the same time, instead of read in different parts in a project report". One of the graduate students wrote: " the shape of the poster takes away the hierarchy in the different perspectives" . This topic, and the answers retrieved from the data, all refer to the category information-processing emphasis.

4.2.2 Framing and reframing

The questions in this next section all reflected on the ability of the participants to frame and reframe the given content of the project brief. The participants were asked whether the exercise had changed their opinion on the goals and objectives of the project, as well as the solution of the project.

Nine participants responded that the projects objectives and goals remained unchanged. Different reasons were mentioned: "the change plan gave us the same insights" , "the objectives were clear from

the start", "it's difficult to re-think, executive perspective is dominant", "I was too involved in the original to be able to change".

Eight participants observed that they had come up with a different problem, and/or a different solution. They reported: "the solution introduced by the executive is no longer valid" , "there are many more ideas that could contribute to the solution", "the real problem is different, when observed from the point of view of the stakeholder".

Zooming in on the solution process, the necessity to rethink the solution became more visible in the answers, and more concrete in what this actually means. Participants responded that they had obtained a better answer: "we've made a connection between the values of the different stakeholders and possible solutions", "we've enriched the goals and objectives", "there's a new link between project goal and stakeholders that may need attention in the realization of the project". One participant was quite clear: "we need to go back to the executive and reformulate the solution". Other participants also gave responses that hint at the necessity of reformulation of the solution, making more general remarks about incorporating chances, new insights and exploring possible solutions. Only two participants reported an unchanged solution.

The answers to these question refer to the categories problem formulation, criteria, method, solution process and outcome in the conceptual model.

In the next set of questions, the participants were asked to reflect on the advantage or disadvantage of the (re)formulated solution in the perspective of the stakeholders and that of the executive.

Observed from the perspective of the stakeholders, seven participants responded there is no advantage and no disadvantage (neither). The reason they gave is that there was no change in the solution. Five participants saw a disadvantage for the stakeholder: "users get the impression they can participate in formulating a solution, but it is uncertain whether that can be realized". A different perspective on the disadvantage was given by two participants: "more problems are identified, it becomes more complex, other problems might be overlooked".

The majority, however, responded they saw advantages for the stakeholders. Focusing on the wants and needs of the user is the code most often retrieved from the answers. A few reactions: "the solution is better suited to their problem" and "stakeholders feel more secure because they feel that their voice has been heard". These answers refer to the categories criteria and outcome in the conceptual model.

From the perspective of the executive, however, the disadvantages and advantages are in balance: disadvantage 13, advantage 14. In the disadvantages, two perspectives emerged: the executive will run out of time and budget and he will have to let go of his own perspective and revise his ambition. In the words of one of the graduate students: "he really has to deal with this". The time/budget responses focused both on the process

of consulting the stakeholders as time-consuming, as well as on the extra goals or solutions that were formulated that will take time to incorporate in the realization of the project. These answers refer to the categories criteria and outcome of the conceptual model.

The advantages for the executive were mostly seen in stakeholder satisfaction/commitment: "involving stakeholders may lead to quicker acceptance and less resistance". Other participants concluded that the advantage lies in the fact that it leads to a sustainable/better solution. These answers refer to the category outcome. The code more creation of value also falls into this category.

4.2.3 Contribution

In this section the findings about the perceived value of Design Thinking for Project Management are presented. Participants were asked to reflect on their current role in relation to defining the problem and solution space in a project.

Seven participants, six of them graduate students, responded they are not involved in this process. The main reason that was given is: the assignment is fixed. A variation is: "what" is given, "how" is up to PM. Note that this code was also used in the "yes" section: these participants value their contribution in the "how" in a different way.

Nine participants responded that they are involved in the process. Of these responses, seven were given by the unexperienced students. The fact that in their answers some refered to their internship, might mean that an internship assignment differs from a professional assignment. In the graduate group two participants responded with a "yes": "I usually receive a problem or a wish without a solution, my job is to make this concrete". The other participant made a distinction between an internal and an external executive, saying that it is more common to be involved in the process with an internal executive. Four participants responded that they are a little involved in this process, sometimes because there is no executive, sometimes depending on the personal approach of the executive.

Participants were also asked to reflect on their future role in relation to defining the problem and solution space in a project.

Eighteen participants saw a role as facilitator of the process: "the PM can help the executive fill in the poster, together we can look at the stakeholders perspectives on the project", "lead a brainstorm session to reformulate the problem from different perspectives". This included an active role in relation to the users: "ask stakeholders what they want", "be the linking pin between executive and stakeholders". Some participants formulated this role as: "connector", "bringing together points of view".

Five participants stressed the importance of their role in this process in relation to their executive and steering group (stress importance early dialogue with users to steering group, reformulate problem definition with executive): "urge the executive to reformulate the problem, if this creates value".

The last question asked the participants to reflect on what they have learned in the exercise that is of use to their work as project manager.

The results showed a recap of the findings discussed above. All participants responded that they have learned something that is of use to their work as project manager. Some participants experienced the exercise as a reminder to keep listening to stakeholders, others reported more concrete eye-openers, for example: "so it can be a good thing, not to do exactly as the executive asks!"

4.3 Difference between the groups

Throughout the description of the findings, the differences between the inexperienced undergraduate group and the more experienced graduate group were highlighted where relevant. Overall, both groups have responded in quite similar fashion. In the research design, no specific questions were asked to try and explain occurring differences. Based on the written data, most differences could be explained by lack of experience in the role of project

manager of the undergraduate group participants. One could also argue that the data reveals that too much experience as a traditional project manager, hinders the willingness or ability to adopt a different reasoning pattern.

4.4 Discussion

In his chapter, the findings of the experiment have been discussed. All participants report they have learned valuable new knowledge and skills that are of use to their work as project manager. Among the advantages recorded in the data, both for the executive and the stakeholders, participants mention the following themes:

- Focus on wants and needs of the user
- Discover chances
- Stakeholder satisfaction/commitment
- Better solution.

The participants also record disadvantages, both for the executive and the stakeholders: The executive may have to revise his ambition and let go of his own perspective. Moreover, additional goals and solution may result in running out of time and/or budget. The stakeholder, on the other hand, may feel his wants and needs are noticed, but implementation of better solutions could be uncertain.

In the experience of the participants, the experiment has encouraged them to adopt a Design Thinking approach. Their responses show a great resemblance to the characteristics in the Design Thinking project manager as was described in the conceptual model.

The characteristics described through the criterion "information-processing emphasis", relate to the use of the visual aid in the experiment: the Design Integration Framework poster. The participants all mention the strength of this tool: they mention oversight and structure as the main contribution in obtaining new insights through the visual aids. The result of having oversight for the participants is that it shows connectedness: "the shape of the poster takes away the hierarchy in the different perspectives" .

Not all characteristics come to the fore. Among them are the following: "intensive observation", "a method is an iterative process", "use of sketching", "incorporates experience-based insights", "use rapid experimentation and prototyping". The nature of the experiment didn't allow for direct observation of users, nor asked for sketching or prototyping. This also explains the absence of responses in the Rationale category. The iterative process was not mentioned by the participants, although in the experiment, they were asked to rethink the work they had previously done with their project. In a way, this process mirrored the iterative process that is characteristic of Design Thinking.

The possible contributions of a Design Thinking project manager, as described by the participants, fall in the categories Problem formulation and Method. This is remarkable, because in the findings, the category that was most referred to, was the category Solution process. The question about which card influenced the outcome of the experiment most, corroborates this: the solution card was mentioned most. An explanation could be that exploring possible solutions, starts with asking questions about the problem definition and applying a method that focuses on the wants and needs of users in order to obtain a "better answer". This is precisely the role the participants in their final reflection define for themselves: stress the importance of early dialogue with users, talk about the problem definition with the executive, facilitate dialogue with the users. The exercise has given them insight in the possible benefits of challenging the perspective of the executive by asking questions and viewing the start of a project as the start of a dialogue with decision-makers and users. The project manager is the facilitator of this dialogue, the connector who brings together different points of view.

5 Conclusions and implications

5.1 Answering the research question.

This study set out to explore the question What aspects of the Design Thinking approach should be integrated into Project Management in order to contribute to the successful management of projects? Our literature review found that Design Thinking is understood as a complex thinking process of conceiving new realities, expressing the introduction of design culture and its methods into fields such as business innovation. Design Thinking can be described as team based, user centered process, powered by a thorough understanding of what users want and need. It is used for finding a solution for an often ill-defined problem in any organizational or social context. The core of design practice lies in the ability of designers to frame and reframe a given problem, thereby creating a novel standpoint from which a problematic situation can be tackled.

In academic literature on project management only few references are made to Design Thinking or related terms. However, where a reference was made, it was concluded that project management should be more focused on the problem space, instead of the solution space. Where the goal of projects is unclear, more time should be dedicated to sense-making and reformulating objectives along the way. This sense-making is especially important in the concept stage of the project life-cycle, and during preliminary design and planning activities. A project assignment - as it is first presented to a project manager – could be implicitly framed by the executive. Actively uncovering this implicit frame and developing new frames, in close cooperation with the executive and users, could be a valuable addition to the role of the project manager.

Applying Design Thinking implies a different approach to a project than the Rational Analytic approach that is dominant in project management theories and practices. The conceptual model that was introduced in this research, proposes a list of characteristics for a Design Thinking project manager, versus a Rational Analytic project manager. In order to be able to apply the Design Thinking approach, project managers need to develop skills to think more like a designer.

The experiment conducted in this study showed that the participants were able to adopt a Design Thinking approach with the aid of a Design Thinking tool: the Design Integration Framework. This tool enabled them to actively uncover the implicit frame of the executive, and develop new frames. It also encouraged them to gather new insights about the wants and needs of the users, and incorporate these insights in order to create a better solution . The visual aspect of the poster, combined with a more team-based, playful way of working that is triggered by the tool, played an important part in the outcome of the experiment. The visual aid invoked both objective and subjective insights and helped the participants to understand each other, to see connections that were otherwise lost, to visualize dreams and aspired value and to create an open conversation about the project.

Based on this study, we propose that the following three aspects of Design Thinking should be integrated into Project Management:

1. Framing and reframing: more focus on the problem space by actively uncovering the implicit frame of the executive and developing new frames.
2. Focus on the wants and needs of users, through empathy, paying attention to personal insights of stakeholders, observation and interacting with the users in their own environment.
3. Use of visual aids: use the power of visualization in order to stimulate the imagination and uncover new connections.

5.2 Implications for theory

Project management theory could benefit from incorporating the theoretical concepts of Design Thinking. De Blois (2008) explicitly argues that knowledge about design as an activity needs to be developed further. Project Management should be more focused on the problem space, instead of the solution space. Where the goal of projects is unclear, more time should be dedicated to sense-making and reformulating objectives along the way (Lenfle, 2008). This sense-making is especially important in the concept stage of the project life-cycle, and during preliminary design and planning activities. (Atkinson et al., 2006). This research corroborates this view and provides insight into the future role the project manager could play in framing and reframing the problem definition.

As this paper reports one of the first studies on the application of Design Thinking in project management, there are many subjects for further research. A more in-depth study could be made to aspects of Design Thinking, especially into models of the Design Thinking process and into specific Design Thinking tools. The use of visual aids to encourage an open dialogue about the project has proved a powerful tool in this research, and is an especially interesting aspect for further research.

Another interesting subject would be to research the possible benefits of project managers collaborating with designers and/or service designers. The research could also focus on the Competence Baseline (IPMA) for project managers: which areas of the baseline are affected if a Design Thinking approach is adopted? Another interesting area for research is the role of the executive in relation to a Design Thinking approach to projects.

5.3 Implications for project management practice

The Design Thinking project manager understands that in order to be more effective in the solution space – the traditional domain of Project Management - he should claim a role in the problem space, because this is the phase in the project life-cycle where sense-making is especially important (Atkinson et al., 2006). The ability to reframe is highest in the Pre-Project phase in which the Project mandate and Business Case are developed. In this phase, a Design Thinking project manager's main objective is not to formulate a well-defined project result in the eyes of the executive, but to start a process in which the project goals are uncovered by starting a dialogue with decision-makers and users.

The Design Thinking project manager makes sure that the wants and needs of users are incorporated in the project objectives. The Design Thinking approach implies that stakeholder management is not only concerned with assessing the help potential and harm potential of stakeholders (Donaldson, 1995). The Design Thinking project manager, on the contrary, takes a profound interest in the needs and dreams of the user. He explores possible solutions that include user's interests and discusses them with the executive, because he is convinced of the fact that ultimately, more value is created through this policy.

Because the use of visual tools is an essential element in the Design Thinking toolbox, project managers should develop their skills in using visual and spatial representations, instead of more analytical forms like diagrams and tables. This step need not be very difficult and complex. Project managers can get to work with practical things, like: encourage teams to be more visual, create impulses to invite people to sketch (free spaces on walls), use visuals to help interdisciplinary teams to understand each other, sketch your innovation process literally as a road map.

A key factor is the persuasiveness of the project manager in relation to the executive. The end-result of the problem formulation process may be, that the executive has to change his ambitions. This policy may meet with resistance from the executive. The research has given some insight into the advantages and disadvantages of the Design Thinking approach. It is important for the Design Thinking project manager to discuss and defend the merits of the approach. And to realize that executives do not always have the answer, and can benefit from the Expert contribution of the Design Thinking project manager.

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