FACILITATING THE INTERNAL ADOPTION OF RADICAL INNOVATION CONCEPTS

A strategic design approach to facilitating the decision-making process behind the internal adoption of radical innovation concepts for further development

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Delft University of Technology
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EXECUTIVE SUMMARY

Radical innovation is a critical source for creating competitive advantage and value for potential customers. However, radical innovation has inherent characteristics that make a radical innovation project difficult to manage, such as: increased generativity—the aspect that describes how radical innovation outcomes are creative and novel, different than other radical innovation outcomes, and fundamental non-probabilistic uncertainty—uncertainty inherent to radical innovation cannot be mitigated using data-driven forecasting techniques. The increased generativity and fundamental non-probabilistic uncertainty characteristics of radical innovation presents challenges especially when a decision regarding the internal adoption for further development of a radical innovation concept needs to be made, as financial tools, such as Return On Investment (ROI) and Net Present Value (NPV) are widely used to evaluate and make a decision regarding the internal adoption of radical innovation concepts.

The aim of this master thesis is taking a strategic design approach to design a tool, that facilitates the decision-making process behind the internal adoption of radical innovation concepts, while addressing the knowledge gap between the challenges of radical innovation, and the decision-making tools and evaluation criteria currently used.

Literature review and field research, consisting of qualitative interviews with experts from academia and experts working in industry, was conducted to understand the context of the decision-making process behind the internal adoption of radical innovation concepts. The research phase revealed the knowledge gap mentioned above and insights that were used towards devising design criteria for developing a tool.

Insights gathered from the literature review and field research led to the development of the Viability Decision Canvas, a tool that facilitates the decision-making process behind the internal adoption of radical innovation concepts. The
Viability Decision Canvas is based on the Viability Model which describes viability as the main decision criteria when a radical innovation concept is evaluated by a company, where viability is modeled by desirability, feasibility and suitability. Viability Decision Canvas facilitates the evaluation and the decision-making process behind the internal adoption of radical innovation concepts by employing abductive reasoning in a Fast-and-Frugal decision tree format, that addresses the non-probabilistic uncertainty inherent to radical innovation. The Viability Decision Canvas, besides the decision-maker, involves other relevant people (e.g. designer, engineer, marketer, senior manager, etc.) in the decision-making process to ensure organizational alignment. Being simple and structured, the Viability Decision Canvas allows and encourages rapid adjustment to suit the specific context of the company and the context created by the radical innovation concept generativity aspect.

Critical assumptions identified during the design of the Viability Decision Canvas were validated through a test in a company context, while the usability of the Viability Decision Canvas was tested in the same company context and in a role-playing test with peers. The feedback gathered was incorporated through iterations towards the final version of the procedure.

The positive results of the Viability Decision Canvas evaluation, regarding the facilitation of the decision-making process behind the internal adoption of radical innovation concepts, show the potential value of the use of the Viability Decision Canvas to be implemented as a company routine.
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1. INTRODUCTION

In this chapter, the topic of this master thesis is introduced, while the general context is described.
The importance of innovation for the sustainable future of the business is well known by companies (Collins & Porras, 1994; Christensen, 1997; De Geus, 1997; Cobbenhagen, 2000; Tidd, Bessant & Pavitt, 2001 as cited by van der Meer, 2007), as investing in innovation processes creates competitive advantage and value for potential customers (Pisano, 2015).

Verganti (2008) divided innovation in: Incremental innovation – improvements within a given frame of solutions, and radical innovation – a change of frame (Verganti, 2008; Norman & Verganti, 2014). Verganti (2008), based on this categorization, and the two dimensions of innovation, technology and meaning, defines four types of innovation presented in figure 1: Market-Pull Innovation, Technology-Push Innovation, Meaning-Driven Innovation and Technology Epiphanies. Both Meaning-Driven Innovation and Technology Epiphanies imply a radical change in meaning, an innovation of meaning. Meaning-Driven Innovation, where there is a radical change in meaning and an incremental change in technology, and Technology Epiphanies, where there is a radical change in meaning and technology, will be the focus of this project. Verganti in his book Overcrowded (2016, p. 6) mentions the importance of innovation of meanings, by pointing out how “innovation of meaning is a key source of value creation”. To be more specific, an innovation of meanings, as purpose (Verganti, 2016, p. 33), is a shift from the current paradigm, to a new one which is more meaningful to people (Verganti, 2016, p. 50). In this thesis, radical innovation concepts are defined based on the Verganti’s definition of radical innovation, a change of frame, with a focus on innovation projects that have an innovation of meanings dimension.

A more popular model of managing innovation processes is Open-Innovation (van der Meer, 2007). This model is characterized by three stages, namely the concept stage, the development stage and the business stage (Chesbrough, 2003 as cited in van der Meer, 2007). The Open-Innovation model allows for a multitude of decisions to be made regarding innovation projects during each phase (i.e. interrupting or continuing a project, spinning in and out, etc). Important roles regarding

![Figure 1. The two dimensions and four types of innovation; Source: Norman & Verganti, 2014, redrawn](image)
the future of innovation projects, especially in the concept stage, is played by managers who often take the roles of project champions (van der Meer, 2007). Another important role in these decisions is played by the innovation strategy which, by setting goals, procedures and structures regarding the process of innovation, should support managers in the allocation (or interruption) of resources to each innovation project (Pisano, 2015).

As radical innovation projects have a greater potential impact for a company (Cooper & Kleinschmidt, 1995), and as companies today are flooded with too many ideas (Verganti, 2016; Dong, Lavallo and Mounarath, 2015), the decisions regarding the future of a radical innovation project are even more important to ensure the proper allocation of resources (Dong et al., 2015; Cooper & Kleinschmidt, 1995). An important factor, part of the decision-making process regarding innovation projects, is the inherent non-probabilistic risk of innovation projects. The non-probabilistic risk, which cannot be modeled or predicted, is exacerbated in the case of radical innovation projects (Derbyshire & Giovannetti, 2017). The importance of decisions regarding innovation projects and the associated non-probabilistic risk of the decisions themselves makes the decision of moving a radical project to the development stage (figure 2), to be defined by Shackle, (1955, 1961 as cited by Derbyshire & Giovannetti 2017) as being a one-off ‘crucial decision’ with major implications for the company. Innovation of meaning presents yet another challenge. The decision regarding new developed meanings, cannot be based on an existent “scale of judgment”, as new meanings imply a new judgment scale (Verganti, 2016 p. 80). This relates to the generativity aspect, specific to design (Hatchuel, 2002) which is enhanced in the case of innovation of meaning. Generativity describes the fact that each innovation of meaning will be different from one another, as the purpose of innovation of meaning is to generate a new paradigm, different from existing ones and different from other paradigms generated in the same way.

This crucial decision of radical concepts being moved to the formal New Product Development (NPD) stage is also underlined by Markham.
(2002), who describes a Valley of Death before the development stage. This metaphor shows the difference in resources, or lack thereof, which can lead to the project's ending, if the project does not cross the Valley of Death. It is not clear from Markham's work, but it can be argued, that in the context of Open-Innovation, the Valley of Death lies within Gate 1 of the process (figure 3).

The decision regarding the adoption of a radical innovation concept in the NPD stage is part of the decisions that strategic design tackles. As mentioned by Calabretta, Gemser and Karpen (2016) in their book Strategic Design, strategic design focuses on the ability to influence the innovation decision making process by keeping paramount the desirability, feasibility and viability of a project. A strategic designer's involvement can be extended to influence more strategic decisions, such as: company's overarching vision, corporate strategy and organizational culture (Calabretta et al., 2016).

The crossing of the Valley of Death of a radical innovation concept, from the concept stage to the successful integration in the formal NPD stage for further development, is what is meant in this project as the internal adoption of a radical concept. However, during this phase, no widely used decision-making tool has been discovered during early research of this project, besides financial tools like Net Present Value (NPV) and Return On Investment (ROI) (Calabretta et al., 2016) which are heavily criticized for their data-driven optimization approach in a non-probabilistic risk context (Derbyshire & Giovannetti, 2017). The misuse of financial tools in a radical innovation context shows the knowledge gap. Therefore, the aim of this master thesis is taking a strategic design approach to design a tool that facilitates the decision-making process behind the internal adoption of radical innovation concepts, while addressing the knowledge gap between the challenges of radical innovation and the decision-making tools and evaluation criteria currently used.
2. AIM & APPROACH

This chapter describes the aim and approach of the thesis while illustrating the structure of the project.
This thesis is aimed at facilitating the decision-making process behind the internal adoption of radical innovation concepts for further development, through the design of a tool. The tool was designed based on insights gathered from literature review and field research regarding the context of the internal adoption of radical innovation concepts. The main research questions the thesis was attempting to answer is the following:

- RQ: How can strategic design facilitate the decision-making process behind the internal adoption of radical innovation concepts?

To answer this question, multiple sub-questions have been devised:

- sRQ1: Who is taking the decision behind the internal adoption of radical innovation concepts?
- sRQ2: What are the tools used in the decision-making process regarding the internal adoption of radical innovation concepts?
- sRQ3: What are the challenges of the decision-making process regarding the internal adoption of radical innovation concepts?

The approach to answer the main question and sub-questions was to find a company client where the research could be conducted, and for which the tool could be designed and developed, based on studying the client’s organizational context. However, after contacting multiple companies of size SME (Small and Medium Enterprises) or larger, from several fields such as FMCG (Fast Moving Consumer Goods), industrial, digital and technological, no company agreed to be the client of this thesis. Thereafter, the thesis project was conducted without a client, being a general design-research thesis project.

The approach was divided in the following phases, illustrated in figure 3:

- research phase: creating a foundation for designing a tool, by understanding and gathering insights regarding the context of the decision-making process behind the internal adoption of radical innovation concepts, following the structure of the sub-
research questions.

- design phase: designing a tool based on the insights gathered from research
- evaluation: validating the critical assumptions behind the tool, testing the usability of the tool and incorporating the feedback obtained through iterations of the tool towards the final version

During the research phase, a literature review as well as field research were conducted. The field research consisted in qualitative interviews with experts from academia and with experts from industry. Both efforts were conducted concomitantly, such that literature resources for the thesis could also be gathered during the interviews with the aforementioned experts from academia.

Taking a strategic design approach, the tool was designed based on the design criteria formulated from the insights gathered from the literature review and field research addressing the identified gap.

The evaluation of the tool was done through a test in a company context to validate the critical assumptions identified of the designed tool. The feedback of the evaluation was incorporated in the final iteration of the tool.
3. LITERATURE REVIEW

In this chapter, the relevant literature regarding the decision-making process behind the internal adoption of radical innovation concepts is reviewed, and insights for the design of a tool that facilitates the decision-making process behind the internal adoption of radical innovation concepts are identified and discussed. The scope and method of the literature review are also presented.
The scope of the literature review was to develop a thorough understanding of the current context of the internal adoption of radical innovation concepts and the decision-making behind them from a theoretical perspective. Understanding the context through the existing literature produced a foundation for the development of the field research and design stages.

As mentioned in Chapter 2, the main research question (RQ) and the sub-research questions (sRQ) of this thesis are the following:

- **RQ**: How can strategic design facilitate the decision-making process behind the internal adoption of radical innovation concepts?
- **sRQ1**: Who is taking the decision behind the internal adoption of radical innovation concepts?
- **sRQ2**: What are the tools used in the decision-making process regarding the internal adoption of radical innovation concepts?
- **sRQ3**: What are the challenges of the decision-making process regarding the internal adoption of radical innovation concepts?

In the attempt to answer the sub-research questions, the context was divided into academic topics and their characteristics for the purpose of literature gathering and selection. However, these academic topics are more extensive, looking more broadly than the sub-research questions at the decision-making process behind the internal adoption of radical innovation concepts context, as the strategic design approach adopts a holistic approach. The following academic topics were identified to be relevant and of critical importance to the context:

- **Innovation**: definition of innovation, types of innovation, radical innovation, their influence on the management of innovation.
- **Innovation management**: innovation management model, innovation strategy, innovation decision making, internal adoption of radical innovation.
- **Strategic Design**: Design model characteristics and their implication towards decision making regarding concepts, strategic design and its implication on decision making and innovation management.
- **Decision Making**: Decision making during the innovation process, decision making under uncertainty.

Initial literature selection was based on the author’s judgement using relevance and reliability as criteria. Reliability was judged based on the publisher and author credibility in the community, number of citations and date of publication. Based on the topics above, the relevance of the literature was further discussed with the chair, mentor and the experts from the faculty that were interviewed, towards final literature selection. The list of the relevant selected literature based on the sources and curation methods previously presented can be read in table 1.

The relevant insights acquired from literature are reviewed in the following subsections of this chapter.
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<tr>
<th>Source</th>
<th>Title</th>
<th>Author</th>
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<td>Overcrowded</td>
<td>Verganti, R.</td>
<td>2016</td>
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<tr>
<td>S1</td>
<td>Change by design</td>
<td>Brown, T.</td>
<td>2009</td>
</tr>
<tr>
<td>S1</td>
<td>Strategic Design</td>
<td>Calabretta, G., Gemser, G., &amp; Karpen, I.</td>
<td>2016</td>
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<td>S2</td>
<td>Incremental and radical innovation: Design research vs. technology and meaning change</td>
<td>Norman, D. A., &amp; Verganti, R.</td>
<td>2014</td>
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<tr>
<td>S2</td>
<td>Design, meanings, and radical innovation: A metamodel and a research agenda</td>
<td>Verganti, R.</td>
<td>2008</td>
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<td>S2</td>
<td>Benchmarking the firm’s critical success factors in new product development</td>
<td>Cooper, R. G., &amp; Kleinschmidt, E. J.</td>
<td>1995</td>
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<tr>
<td>S2</td>
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<td>Van der Meer, H.</td>
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<td>S3</td>
<td>The valley of death as context for role theory in product innovation</td>
<td>Markham, S. K., Ward, S. J., Aiman-Smith, L., &amp; Kingon, A. I.</td>
<td>2010</td>
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<td>S3</td>
<td>The effect of abductive reasoning on concept selection decisions</td>
<td>Dong, A., Lovallo, D., &amp; Mounarath, R.</td>
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<td>Hafenbrädl, S., Waeger, D., Marewski, J. N., &amp; Gigerenzer, G.</td>
<td>2016</td>
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3.2. STRATEGIC DESIGN

In this section the strategic design approach that this thesis is embracing is reviewed from the perspective presented in the Strategic Design book by Calabretta et al. (2016).

Strategic design, as defined by Calabretta et al. (2016) in their book Strategic Design, focuses on the ability to influence the innovation decision making process by using design thinking tools and methods while keeping the desirability, feasibility and viability of a project as paramount (figure 4). Examples of such decisions include a vision, a business decision, or a new product. Callabretta et al. (2016, p. 10, 11) expand the definition of “desirability”, “feasibility” and “viability” from the first description that Brown (2009) provided in Change by Design, to:

- Desirability: a project outcome meets the needs and wishes of people; however, design is about enhancing people’s lives, and more broadly, about creating a better society, not only about their needs and wishes.
- Feasibility: the project outcome can be given a tangible form in the present, or foreseeable future using the available resources (technology, processes, people).
- Viability: the form of the outcome can be sustained by the company and generate value in terms of its relevant Key Performance Indicators (KPI): profit, brand equity, triple bottom line, etc.

Through all the stages of the process (strategy, design and realization, as defined by npk design), the co-creational and human-centeredness nature of strategic design implies the involvement of the relevant stakeholders while keeping the user in the center. This is an outwards-in approach on innovation in which the designer should play more of a moderator role when co-creating with stakeholders. At the same time, a strategic designer’s involvement can be extended to influence more strategic decisions, such as: company’s overarching vision, corporate strategy and organizational culture (Calabretta et al., 2016).

In the context of innovation projects, even if not always possible, managers would like to be able to rationally assess their decisions and better

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**Figure 4. Defining the domain of Strategic Design; Source: Calabretta et al., 2016; Brown, 2009; redrawn**
In this section, the context leading to the decision-making process behind the internal adoption of radical concepts is reviewed. This context lies within the first stage of the Open-Innovation model, and concerns the radical innovation concept itself and its characteristics derived from the design process through which the radical innovation concept has been created.

3.3.1. C-K theory

"C-K theory is describing the operations needed to generate new objects with desired properties" (Hatchuel, Wiel and Le Masson, 2013) based on the assumption that design can be modeled as the interaction between the concept (C) and the knowledge (K) spaces; hence the name C-K theory. The K space contains the available knowledge, or all established true propositions. The C space contains concepts that are defined as undecided propositions by the knowledge existing in K. Modeling Design using C-K theory is based on partitioning the initial concept. Each partitioning has to be tested in K with the following possible outcomes:

- The new partition is either true or false, thus expanding K
- The new partition is undecidable, thus expanding C

Hatchuel, Le Masson, Reich and Weil (2011) present two main properties of design even design theories, that seem radically different, have in common: domain independence - design reasoning not being bound by object definitions or assumptions coming from a particular field, and increased generativity - the intention to produce “novel and creative things” (Hatchuel, 2002). C-K theory introduces the notion of expanding and restricting partitions. While restricting partitions have the role of selecting existing objects from K, expanding partitions have the roles of devising the definition of objects and create new ones, and of guiding the expansion of knowledge that cannot be deduced from existing knowledge.

3.3. DESIGN

predict their outcomes. Currently, from a business financial perspective, examples of quantitative tools helping decision makers are the Net Present Value (NPV) and the key one, Return On Investment (ROI). However, not taking the right factors into consideration, can cause current assumptions regarding future demand to be incorrect, as assumptions are of most importance for any future-oriented business case. The goal is to have very few critical assumptions (3-5) and their uncertainty to be further reduced as the projects develop (Calabretta et al., 2016).
However, these notions introduce the issue of introducing new objects and the preservation of meaning, as introduction of new objects requiring a redefinition of terms may create inconsistencies between new and old objects in K. To address this any design should include a rigorous reordering of names and definitions in K in order to preserve the meaning of things (Hatchuel et al., 2013).

3.3.2. Innovation of Meanings

Verganti (2008) defines four types of innovation (figure 1), categorized using two dimensions: technology and meaning, and the change in these dimensions respectively. Thus, the four types of innovation are Market - Pull Innovation, Technology - Push Innovation, Meaning - Driven Innovation, and Technology Epiphanies. Meaning-Driven Innovation, and Technology Epiphanies will be the focus of this project.

Verganti in his book Overcrowded (2016, p. 6) mentions how “innovation of meanings is a key source of value creation”. An innovation of meanings, as purpose (Verganti, 2016, p. 6, 33), is a shift from the current paradigm, to a new one which is more meaningful to the people (Verganti, 2016, p. 50).

Verganti defines the innovation of meanings process as being more suitable to innovate meanings, rather than design thinking or user-driven innovation processes (Verganti, 2016, p. 19). This is an inside-out process that focuses on the fact that the vision should come from the designer (figure 5). The blurred initial inner vision is developed and refined into a concept through criticism from a number of relevant stakeholders, that grows after each stage of the process built (Verganti, 2016). The vision coming from inside aims at creating new meanings that people love. As people are not just looking for meaning, but new meaning, and they fall in love with things that are more meaningful to them (Verganti, 2016, p. 7).

Figure 5. The process of innovation of meaning;
Source: Verganti, 2016; redrawn
3.4. INNOVATION MANAGEMENT

In this section, the broader context of the management of an innovation project is reviewed, focusing on the challenges and successful criteria of an innovation project that are relevant for the internal adoption of radical innovation concepts.

3.4.1. Valley of Death
Companies struggle through the process of taking an idea to the market. Between the research and the New Product Development (NPD) stage in the process of taking an idea to the market, a Valley of Death is identified (Branscomb & Auerwald, 2001; Markham, 2002; Merrifield, 1995, as cited by Markham, Ward, Aiman-Smith and Kingon, 2010). The metaphor shows mainly the difference in resources of the two sides of the valley, which can lead to a project being underfunded and terminated if the project does not cross the valley. However, this gap could potentially impact other areas of the organization, such as finance, legal, production and supply chain management, meaning that organizational wide variables are influencing the introduction of an idea in the NPD process.

Markham et al. (2010) proposes three major roles that are dynamically interdependent, with the following responsibilities:

- Champion - makes the organization aware of the opportunity and prepares the concept and business case.
- Sponsor - supports the project with resources to demonstrate the viability of the concept.
- Gatekeeper - set criteria and makes a decision.

To improve product innovation, companies should account for activities before the NPD phase, such as:

- Technical viability of the product
- Composing product concepts
- Doing enough market research to validate the product concepts
- Showing enough of a business case that convinces others to support the project

3.4.2. Benchmarking Success in New Product Development
Cooper & Kleinschmidt (1995) recognize the critical element of managing new product development in a company’s overall success. They define the performance of a new product development to be dependent on:

- Process: the firm’s new product development process and the specific activities within this process.
- “Organization: the way the program is organized.”
- “Strategy: the firm’s total new product strategy.”
- “Culture: the firm’s internal culture and climate for innovation.”
- “Commitment: senior management’s involvement with and corporate commitment to new product development.”

More specifically, Cooper & Kleinschmidt (1995), through their study, show how high-performance firms, besides other features, have a high-quality execution, a complete process and a senior management involvement and commitment in critical “Go/Kill” decisions along the process.

In this section, the characteristics of radical innovation projects that cause challenges in the decision-making process behind the internal adoption of radical innovation concepts are reviewed, together with potential approaches to address these challenges.

3.5.1. Risks of Innovation
Innovation is governed by non-probabilistic uncertainty, which is both epistemic and ontic...
3.5. DECISION MAKING

in nature, and is even more pronounced in the case of radical projects. As the risk of innovation is non-probabilistic, it cannot be managed using forecasting techniques or probabilistic inferencing methods using objective and subjective probabilities (Derbyshire & Giovannetti, 2017).

The epistemic nature of the risk associated with innovation comes from a survival bias. All the products that can be seen around are successful projects, but these are not the majority. By far, the majority of new products fail, and this group is unobservable. This is a source of a very high risk of misidentification and bias in estimates, leading to inaccurate modeling.

The ontic nature of the risk of innovation comes from the fact that innovation changes the context, the reality once it happens. This arises from what Shackle (1961, as cited by Derbyshire & Giovannetti, 2017) calls “crucial decisions”, namely a one-off decision that changes the very context in which the decision was made, exacerbating uncertainty by fundamentally altering the strategic landscape. They also lead to responding decisions made by others that increases the indeterminism even higher (Derbyshire & Giovannetti, 2017).

3.5.2. Abductive Reasoning

Besides deductive and inductive reasoning, which rely on knowledge and past data respectively, there is another type of reasoning logic; abductive reasoning, which is the one most used in creative design (Dorst, 2011; Roozenburg, 1993, as cited by Dong et al., 2015). Abductive reasoning is responsible for introducing new ideas (Pierce, 1932, as cited by Dong et al., 2015). During the development stages of a product, different forms of reasoning may be used over others. However, during the early stages of new product development, abductive reasoning can aid design concept selection, as not enough knowledge is available (Dong et al., 2015). Abductive reasoning focuses the discussion on “what might be” instead of “what is”, which Dong et al. (2015) showed it can lead to an increase of concept internal adoption rates.

3.5.3. Fast-and-Frugal Heuristics

Optimization works in contexts where risk exists, it is known and it can be reliably calculated (Knight, 1921, as cited by Hafenbrädl, Waeger, Marewski and Gigerenzer, 2016). Decision making tools, such as Bayesian Decision Theory and maximization of (subjective) expected utility (Arrow, 1966; Edwards 1954; von Neumann & Morgenstern, 1947, as cited by Hafenbrädl et al., 2016) that rely on optimization based on calculated probabilities, work in the context of perfect knowledge, named “small worlds” (Savage, 1954, as cited by Hafenbrädl et al., 2016). Situations where risk is unknown, unknowable, or not probabilistic are named situations of uncertainty. Herbert Simon (1956, as cited by Hafenbrädl et al., 2016) indicated how optimization in the real world is often impossible, as frequently it is a matter of contexts of uncertainty. Simon debated how decision making in these situations should be modeled by “bounded rationality”, targeting satisficing.

Fast-and-Frugal decision trees can be used in situations of high uncertainty. Fast-and-Frugal decision trees are easy to understand, use and communicate, making a complex decision more accessible (Hafenbrädl et al., 2016). A Fast-and-Frugal decision tree is composed of the following:

- Search rule: Look up predictor variables in order of their importance.
- Stopping rule: Stop Search as soon as one predictor allows it.
- Decision rule: Classify according to this predictor variable.
Multiple factors raise challenges in the internal adoption of innovation concepts for further development in the NPD stage, especially in the case of radical innovation concepts. However, the adoption decision has been known to be critical for the success of the company (Cooper & Kleinschmidt, 1995; Derbyshire & Giovannetti, 2017).

It is not clear from Markham’s (2010) work, but it can be argued, that in the context of Open-Innovation, the Valley of Death lies during Gate 1 of the process (figure 2). Challenges presented by the Valley of Death are mostly operational, such as funding and company involvement and support for the project. It can be said that, even though these challenges can be recognized in multiple companies, these challenges are contextual, as each project and each company is different, and a different set of challenges can affect a certain innovation project.

However, some challenges come from the nature of the innovation process itself; the non-probabilistic risk. Firstly, the non-probabilistic risk has an ontic and epistemological nature (Derbyshire & Giovannetti, 2017), and, secondly, the fact that the end goal of innovation resides in the real world, as final products are aimed at being used by people, causes another source of uncertainty (Hafenbrädl et al., 2016). Another challenge specific to radical innovation, is the fact that each project is different. On one hand, as per the definition of “radical innovation”; a change of frame (Norman & Verganti, 2014), and on the other hand, as per the generative nature of design, part of the innovation process, which defines and redefines knowledge and meanings along the process (Hatchuel et al., 2013). These challenges, present in every radical innovation project, are the reasons why optimization or other data-driven techniques are not suitable for decision-making in this context (Derbyshire & Giovannetti, 2017). Furthermore, the change of frame, specific to radical innovation, implies that the same tool might not be adequate to make a decision regarding all radical innovation concepts (Verganti, 2016).

Markham (2010) and Cooper & Kleinschmidt (1995) point at the involvement of multiple people from the company, especially senior management, as a solution to the operational challenges facing the internal adoption of radical innovation concepts.

Desirability, feasibility and desirability, well-known criteria for successful innovation project in the design world (Brown, 2009; Calabretta et al., 2016), can also be found in Markham’s (2010) suggestions for improving product innovation, showcasing the potential of becoming critical evaluation criteria:

- Validating technical viability of the product - Feasibility
- Composing product concepts
- Doing sufficient market research to validate the product concepts - Desirability
- Showing enough of a business case that convinces others to support the project - Viability

Addressing the fundamental uncertainty of radical innovation, Dong et al. (2015) introduces abductive reasoning as an alternative to inductive and deductive reasoning, in such early stages of the innovation process where both data and knowledge are limited. Another appropriate method, different from optimization or other data-driven approaches are Fast-and-Frugal decision trees, that provide a simple and accessible procedure for decision-making.
3.7. CONCLUSION

In this chapter, the context of the decision-making process behind the internal adoption of radical innovation concepts has been described from a theoretical perspective through literature review.

Regarding sRQ1, Markham et al. (2010) mentions how multiple people from the company need to be involved in the decision-making process. However, Markham et al. (2010) describes un-official roles, such as Champion, Sponsor and Gatekeeper, without mentioning the formal position that the people in the roles occupy in the company. Cooper & Kleinschmidt (1995) indicates the importance of senior management involvement in the decision-making process.

Regarding sRQ2, no specific tool or procedure has been discovered, besides financial tools, such as ROI and NPV, which are considered to be unsuitable for the decision-making process behind the internal adoption of radical innovation concepts.

Regarding sRQ3, the non-probabilistic risk of radical innovation projects and the fact that each radical innovation concept is different from one another, are considered to be the critical challenges regarding the decision-making process behind the internal adoption of radical innovation concepts.

sRQ2 and sRQ3 are interrelated, as the misuse of financial tools is caused by the challenges regarding the decision-making process behind the internal adoption of radical innovation. However, abductive reasoning and Fast-and-Frugal decision trees have the potential to address these challenges. This proves the gap in existing literature, where potential ways to facilitate the decision-making process behind the internal adoption of radical concepts are presented but no procedure that incorporates multiple people from the company, including senior management, abductive reasoning and Fast-and-Frugal decision trees is provided.

The gap and the insights discovered through literature review will be taken and addressed in the field research phase to understand how they relate in practice.
4. FIELD RESEARCH

In this chapter, the scope, method and results of the field research conducted in this thesis project are presented. Insights from the field research and the literature view are also compared and discussed, to provide a reliable starting point for the design of the tool that facilitates the decision-making process behind the internal adoption of radical innovation concepts.
4.1. SCOPE & METHOD

The goal of the field research was to understand from experts the process behind internal adoption of radical concept decision (as defined in the introduction chapter), and its context (defined in the literature chapter). The decision-making process behind the internal adoption of radical concepts and its context represents the subject of the research. As the goal relates to understanding holistically the process and its details, leading to theory building, qualitative research was considered to be the most suitable research method (M. Bos-de Vos, Qualitative Research Methods slide deck, February 27, 2018). To answer the main research questions of this thesis, the qualitative research was focused on the following sub-research questions:

- sRQ1: Who is taking the decision behind the internal adoption of radical concepts?
- sRQ2: What are the tools used in the decision-making process regarding the internal adoption of radical concepts?
- sRQ3: What are the challenges of the decision-making process regarding the internal adoption of radical concepts?

The field research consisted in semi-structured one-on-one qualitative interviews with experts, from academia and from the industry, that had first-hand experience regarding the internal adoption of radical concepts. The semi-structured qualitative interviews imply an open formal conversation as the goal is that the participants talk “freely and openly” (Robson, 2012, p. 281, as cited by M. Bos-de Vos, Qualitative Research Methods slide deck, February 27, 2018). To ensure the coverage of the relevant topics, the interviews were done using an interview guide (see Appendix A) containing just the discussion topics and probes which help examine specific detailed parts of the topics, but still keep the discussion open (Robson, 2012, p. 285, as cited by M. Bos-de Vos, Qualitative Research Methods slide deck, February 27, 2018). The interviews took 45-60 minutes and were conducted mainly face-to-face but some, due to distance and the schedule of participants, were conducted over a phone or video call. The interviews were audio recorded and notes have been taken during all interviews.

Participants were experts on the topic of innovation management from the Methodology and Organisation of Design (MOD) research group in the Faculty of Industrial Design Engineering (IDE) at Delft University of Technology (TU Delft) (9 participants) (Appendix B - Table 1) and experts working in industrial and tech product companies (10 participants) (Appendix B - Table 2). The first part of the research was done with experts from academia for two main reasons. First, to obtain a research based general view of the subject. Second, to obtain new literature and validate already collected literature on the subject. The participants from the academia were selected based on how close their expertise is to the subject of the research. The participants from the industry were selected based on how close their expertise is to the subject and how involved is their function in the decision-making process behind the internal adoption of radical concepts.

The literature discussion section was the only topical difference from the interviews conducted with experts from the industry. All interviews were conducted using the same interview guide outlined in Appendix A (with the exception mentioned above).

The audio recordings of the interviews were transcribed, and together with the notes have been processed to gather insights relevant for the research questions above. Nonetheless, as the interviews were semi-structured qualitative interviews, other insights relevant more broadly for the topic of the project have been collected.
4.2. RESULTS

The insights gathered, their respective supporting quotes and the participants cited, are presented below in Table 2. It is important to mention, that while some insights are drawn from multiple interviews, for the purpose of reporting the qualitative research insights, only one quote is presented.

<table>
<thead>
<tr>
<th>Research question</th>
<th>Participant</th>
<th>Quote</th>
<th>Insight</th>
</tr>
</thead>
<tbody>
<tr>
<td>sRQ1</td>
<td>AE 5</td>
<td>“the decision is taken by the portfolio manager but there is often an ‘innovation board’”</td>
<td>The decision regarding the internal adoption is taken by the portfolio manager together with an “innovation board”.</td>
</tr>
<tr>
<td>sRQ1, sRQ2</td>
<td>AE 5</td>
<td>“but there is an ‘innovation board’ with people from multiple departments that participates at the decision-making process as an innovation project will impact multiple parts from the company and getting them on-board is very important”</td>
<td>It is important the innovation board involved in the decision-making process of the internal adoption of radical concepts to be multi-departmental and cross-functional.</td>
</tr>
<tr>
<td>sRQ1, sRQ3</td>
<td>AE 7</td>
<td>“you need someone - doesn’t really matter who – to be in the project from start to end, so the non-explicit knowledge of the project will not be lost”</td>
<td>Somebody should be involved in the innovation project through all stages to ensure the implicit knowledge of the concept is not lost.</td>
</tr>
<tr>
<td>sRQ2</td>
<td>IE 4</td>
<td>“the biggest argument ends to be the financial one”</td>
<td>Financial models are the biggest criteria in decision-making.</td>
</tr>
<tr>
<td>sRQ2, sRQ3</td>
<td>AE 1</td>
<td>“numbers regarding radical innovation projects are not working; numbers always lag behind reality”</td>
<td>Past data cannot be used in modelling radical innovation projects.</td>
</tr>
<tr>
<td>sRQ2</td>
<td>AE 2</td>
<td>“managers want some kind of proof that the concept works”</td>
<td>Decision makers use tests, prototypes, MVPs, studies, etc. as criteria for decision-making.</td>
</tr>
<tr>
<td>sRQ2</td>
<td>IE 1</td>
<td>“yes, desirability, feasibility and viability are part of a successful project”</td>
<td>Desirability, feasibility and viability are recognized as characteristics of successful innovation projects.</td>
</tr>
<tr>
<td>sRQ2</td>
<td>AE 3</td>
<td>“they (desirability, feasibility, and viability) depend on each other; it can’t be viable if it’s not desirable”</td>
<td>There is an interdependence between desirability, feasibility and viability.</td>
</tr>
<tr>
<td>sRQ2, sRQ3</td>
<td>IE 4</td>
<td>“if it’s not viable, the concept is dead”</td>
<td>Viability is the most important decision-making criteria.</td>
</tr>
<tr>
<td>sRQ2</td>
<td>IE 10</td>
<td>“every company has its own way of taking decisions...”</td>
<td>Different companies have different tools and processes for decision making.</td>
</tr>
<tr>
<td>sRQ2, sRQ3</td>
<td>IE 10</td>
<td>“...as their contexts are different: industry, size, age, B22/B2B, etc.; in the end culture”</td>
<td>Some of the factors influencing how decision making is done are: industry, size, age, B2C/ B2B, culture.</td>
</tr>
<tr>
<td>sRQ2</td>
<td>IE 6</td>
<td>“we do Design Thinking workshops only when R&amp;D teams (without design background and experience) are facing complex issues and they are not able to find a solution with current formal procedures”</td>
<td>Designers act as in-house consultants who use design methods as special tools when departments deal with complex problems not fitting to be solved with formal problem-solving techniques.</td>
</tr>
<tr>
<td>sRQ3</td>
<td>IE 4</td>
<td>“our concepts are not ‘very designed’; they should be; we are trying to include Design Thinking, but it’s hard to change the procedures”</td>
<td>Design is recognized as potentially suitable for innovation and decision-making regarding innovation, but not largely used, yet.</td>
</tr>
</tbody>
</table>
4.3. INSIGHTS ANALYSIS & COMPARISON WITH LITERATURE REVIEW

It is important to mention that the job function of the decision maker regarding the internal adoption of radical innovation concepts varies, based on company size, and structure. Together with the fact that in the beginning the job title of the decision maker was unclear, this is the reason why there is such a diversity in the job titles of the research participants. Most commonly, the decision regarding the internal adoption of radical innovation concepts for further development is made by the “Portfolio Manager” (AE5: “the decision is taken by the portfolio manager”). The involvement of multiple people from different departments, including senior management, was widely recognized as important, as the wide effect of internally adopting a radical concept on a company was acknowledged (AE5: “but there is an ‘innovation board’ with people from multiple departments that participates at the decision-making process as an innovation project will impact multiple parts from the company and getting them on-board is very important”). Still, only in some cases the decision is made by a “Portfolio Management Team” or “Innovation Board” composed with people from different departments and headed by the “Portfolio Manager”. These cases show the understanding of the critical nature of the decision behind the internal adoption of radical innovation concepts for the company.

The non-probabilistic risk of the innovation process was not formally known, yet participants felt it. When they were presented with the information, it explained a lot of their experiences. However, the lack of data regarding radical innovation was something clear and definite. Still, it was interesting to see how, even though the participants acknowledged the inadequate use of data-driven decision-making methods, such methods were used on a regular basis. Although, each company has different methods and procedures to take decisions, profitability focused financial tools are the most used. This shows that the literature information is known, accepted as true, however not applied, as financial arguments are still critical.

The financial argument was generally associated with viability, as the most important criteria from the three: “Desirability”, “Feasibility” and “Viability”. Generally, all three criteria were deemed very important criteria for successful radical innovation concepts, but some participants mentioned how they are inter-connected (AE3: “it [the radical innovation concept] cannot be viable if it is not desirable”).
4.4. CONCLUSION

In this chapter, the context of the decision-making process behind the internal adoption of radical innovation concepts has been described from a practical perspective through field research insights, gathered from academia and industry experts during qualitative interviews.

The field research insights have been discussed and compared with insights gathered from the literature review, with the following conclusions: Regarding sRQ1, the decision-maker regarding the internal adoption of radical innovation concepts is widely associated with the portfolio manager position. However, the position can still vary from one company to another, and the importance of an innovation board, or involving people from multiple departments with different areas of expertise in the decision-making process is recognized as preferable.

Regarding sRQ2 and sRQ3, the gap seen through literature review is recognized in the field, where financial tools are acknowledged to be overused or misused in the case of making a decision regarding the internal adoption of radical innovation concepts, however without having a viable alternative.

The discussion regarding the field research and literature review insights is used as a starting point for defining the design criteria for the design of a tool to facilitate the decision-making process behind the internal adoption of radical innovation concepts.
5. DESIGN

In this chapter, the design process of a tool that facilitates the decision-making process behind the internal adoption of radical innovation concepts is presented, following characteristics and functionalities derived from the insights gathered from the literature review and field research.
5.1. SCOPE & METHOD

The scope of the design and development part of the project is to deliver a tool that facilitates the decision-making process behind the internal adoption of radical innovation concepts in alignment with the literature review and field research findings. Based on the literature review and field research findings, critical functionalities and characteristics were established for the design of the tool. During the design process, assumptions critical to the design were underlined to be tested and validated following the design in a validation test and a usability test. Based on the results, iterations on the design of the tool were carried out.

5.2. CRITICAL FUNCTIONALITIES & CHARACTERISTICS

Based on the analysis and discussion regarding insights collected from literature review and field research (see section 4.3) the following characteristics and functionalities have been selected to be the starting point of the tool design:

- Desirability, Feasibility and Viability should be the base criteria for evaluating radical innovation concepts.
- Explicitly discussing the critical assumptions of the concept.
- The decision-making process should not be data-driven, in the early stages of a radical innovation project.
- The use of abductive reasoning to be imposed when knowledge is not available for inductive or deductive reasoning.
- People from different departments and with different expertise, especially senior management should be involved in the decision-making process.
5.3. VIABILITY MODEL

As mentioned above desirability, feasibility and viability were selected as the starting point, as these were found to be considered critical criteria for successful innovation projects from both literature and field research. However, multiple participants in the field research mentioned how the three criteria were influencing each other (AE 3: “they (desirability, feasibility, and viability) depend on each other; it can’t be viable if it’s not desirable”). Another important aspect was the fact that viability was considered to be the most important by research participants (AI 4: “if it’s not viable, the concept is dead”).

5.3.1. Viability: a function of Desirability and Feasibility

Based on this information, first hints that all three criteria do not have the same weight, and that the viability is more important and is dependent on both desirability and feasibility came from looking at a cash flow. A cash flow is the basis from which financial profit-driven tools, such as ROI and NPV, are derived from. These tools are currently associated with viability. In Figure 6 it can be seen how Desirability, Feasibility and Viability can be mapped in the cashflow. The first part, the revenues, can be associated to Desirability, as predictive sales are a measure of how desirable the product is to the people. The second part, the expenses, can be associated to feasibility, as the cost of developing and manufacturing the product are a measure of the feasibility of the product in terms of the capabilities of the company. Finally, the last part, is a calculation result based on the first two sections. These results, in this case NPV, are what the viability of an innovation project, radical or not, are based on. This clearly shows a first evidence of the dependency of the viability on both desirability and feasibility.

Based on this information, a mathematical model, describing the dependency of the three criteria, was attempted to be developed in the form of:

\[ V = f(D, F) \]

Where:
- \( V \) = viability of the radical innovation concept
- \( D \) = desirability of the radical innovation concept
- \( F \) = feasibility of the radical innovation concept

Figure 6. New product cashflow, used for calculating ROI & NPV
However, the attempt to develop a mathematical model proved to be unsuccessful. Despite the dependency of D, F and V being shown in the form described above, the mathematical relation between D, F and V, usually seen translated in the graph of the function, could not be found. In other words, how much, if at all, D and F affect V throughout the domain of the function.

Nonetheless, the dependency of the criteria was further studied using Propositional Logics (referred to as PL). PL is a branch of Logics that studies, among others, the logical relationships between multiple statements. The exploration using PL was done by converting desirability, feasibility and viability into statements (as shown below) and using specific PL notation (as shown below). Truth tables (see tables 3-6) have been carried out to further understand the logical relationship between the three criteria, by taking each criteria as known and revealing what is the truth value for the other criteria. The selected criteria as known in each table is highlighted in green.

PL statements:
V: The radical innovation concept is viable.
D: The radical innovation concept is desirable.
F: The radical innovation concept is feasible.

PL truth value standard notation was transformed for avoid confusion in the following way:

True = T = ✓
False = F = ×
Indeterminate = ?

Looking at the truth table above (table 6), case 4 is considered obvious. If a radical innovation concept is not desirable and not feasible, the radical innovation concept is not viable.

Table 4. Truth table for known feasibility value

<table>
<thead>
<tr>
<th>F</th>
<th>D</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>×</td>
<td>?</td>
<td>×</td>
</tr>
</tbody>
</table>

Table 5. Truth table for known viability value

<table>
<thead>
<tr>
<th>V</th>
<th>F</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>×</td>
<td>?</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 6. Truth table for known desirability and feasibility value

<table>
<thead>
<tr>
<th>Case</th>
<th>D</th>
<th>F</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>×</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>4</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>

An example for case 3, in the truth table above (table 6), is the Microsoft Windows Phone (figure 7). After launching the Microsoft Windows Phone to market in 2010, Microsoft officially terminated the product in 2017 after understanding that people don’t need Windows on their mobile phones (Warren, 2017). In this case, the product was feasible, but not desirable, making it not viable for the company.

An example for case 2, in the truth table above (table 6), is the Samsung Galaxy Fold (figure 8). Samsung sent several Galaxy Fold’s to journalists and influencers for review. Most people were very
excited and happy with the devices, until almost all devices catastrophically failed after only days of normal use. This uncovered critical feasibility problems with the Galaxy Fold, making Samsung to cancel the release date of the highly expected device indeterminately (Welch, 2019). This showcases how feasibility can make a product not viable for a company, even if it is desirable for the people.

Looking at the truth tables above, the following PL statement was devised:

\[(D \& F) \leftarrow V\]

Which is translated:

If the radical innovation concept is viable, then the radical innovation concept is desirable and feasible.

The statement is an implication and not an equivalence, because of case 1 in table 6, highlighted in table 7.

<table>
<thead>
<tr>
<th>case</th>
<th>D</th>
<th>F</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>3</td>
<td>×</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>4</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>

The fact that the truth value for V is indeterminate, when the truth values for D and F are both True, proves that the desirability and feasibility of a radical innovation concept are not enough to assess the viability the concept in question. To further study this case, where a radical innovation concept is both desirable and feasible, but not viable, the example of Kodak’s digital camera was explored.

Figure 7. Windows Phone. From “Windows Central” by Z. Bowden, 2019

Figure 8. Samsung Galaxy Fold. From “The Washington Post” by K. Chan, 2019
5.3.2. Kodak’s Digital Camera Case

Even though Kodak filed for bankruptcy in 2012, for the main reason of not adapting their business to the radical disruption that digital cameras caused to film cameras, Kodak was the first to have a digital camera concept in 1975 (figure 9). The digital camera was never released, but Kodak made billions on the patents from the project, until 2007 when the patents expired, and it was too late for the company to enter the new digital camera market. The reason why the radical innovation concept was not internally adopted for further development was because of the fear of cannibalizing film sales (McAlone, 2015). Cannibalizing sales means that new product that a company releases will draw sales from existing products that the company is offering at that moment, instead of bringing new sales and revenue. This strategic decision implies that the radical innovation concept was evaluated to be both desirable and feasible. The fact that Kodak thought the digital camera would draw sales from film cameras, implies that it will sale, so the product is desirable. The same fact implies that the radical concept is feasible, as it cannot sale if the company cannot produce it and release it to the market.

With this in mind it can be implied that Kodak’s decision to not adopt this radical innovation concept is based on the fact that the radical innovation concept was not suitable for Kodak at that moment in time.

5.3.3. Suitability

The Kodak case demonstrates there is more to viability, than desirability and feasibility, supporting the findings from the PL exploration.

Thus, “suitability” is introduced as an additional criteria for evaluating radical innovation concepts. This, rather broad term refers to the radical concept’s fit with the current context of the company, and encompasses suitability in the following areas:

- Corporate strategy; how is the radical innovation concept aligned with the mission, vision and values of the company
- Innovation strategy; how does the radical innovation concept fit with the areas where the company is investing resources for
innovation

- Business model; how does the radical innovation concept fit the current business model (e.g. B2B/B2C, one-time payment/subscription, etc.)

5.3.4. The Viability Model

When suitability is introduced in the truth tables as a statement (see below), together with desirability, feasibility and viability, the truth below (table 8) is obtained:

S: The radical innovation concept is suitable

Table 8. Truth table for known desirability, feasibility and suitability values

<table>
<thead>
<tr>
<th>D</th>
<th>F</th>
<th>S</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

With the introduction of suitability, in table 8 the truth values for viability in all cases are known. Based on the truth table above (table 8), the implication statement:

\[(D \& F) \leftrightarrow V\]

Becomes the equivalence statement:

\[(D \& F \& S) \leftrightarrow V\]

Which is translated:

The radical innovation concept is viable, if, and only if, the radical innovation concept is desirable, feasible and suitable.

Based on the equivalence statement, the Viability Model (figure 10) has been devised. The Viability Model describes how desirability, feasibility and suitability are the fundamental criteria for evaluating the viability of a radical innovation concept; viability being the critical criteria for the decision-making process behind the internal adoption of radical innovation concepts.
5.4. VIABILITY DECISION CANVAS

Based on the Viability Model and the characteristics discussed earlier (see section 5.2) the Viability Decision Canvas (figure 11) has been designed and developed to facilitate the decision-making process behind the adoption of radical innovation concepts for further development, by providing a simple, structured, but still flexible, method to evaluate and to make an informed decision regarding the internal adoption of a radical innovation concept for further development. The questions in the presented Viability Decision Canvas (figure 11), is a general set of questions, that can be adjusted. For more information please refer to the sections below.

5.4.1. Structure
The structure of the Viability Decision Canvas is structured based on the Viability Model. The Viability Decision Canvas has three evaluation sections for desirability, feasibility and suitability, respectively, and a final decision-making section for viability. Using the Viability Model, by evaluating desirability, feasibility and suitability, a decision can be made regarding the viability in order for the radical innovation concept to be evaluated.

Each of the four sections are structured in a Fast-and-Frugal decision tree format, which, based on literature review insights was considered to be an adequate way of evaluating and making decisions. The decision tree format gives clarity and simplicity that offers both structure and flexibility (for more information regarding flexibility, please refer to the section below). For more information regarding Fast-and-Frugal decision trees, please refer to above section 3.5.3.

Each decision tree contains at least three questions. Each question has “yes” or “no” as possible answers. Depending on the answer, continuation is marked by an arrow or by specific instructions provided by the procedure. Each question, in the evaluation sections (and sets of questions in the case of the suitability section) provides spaces to fill in additional information relevant to the question explicitly. In the decision-making viability section, a single space is provided for information relevant to the made decision. For more information regarding questions and fill in spaces, please refer to the section below.
Figure 11. Viability Decision Canvas
5.4.2. Use

The DFSV procedure is meant to be adjusted depending on the radical innovation concept to be evaluated, and the decision-making context, before being used in a decision-making workshop where people from multiple departments with different knowledge and expertise should participate. During the workshop, abductive reasoning should be used whenever data or knowledge is not available and filling in the appropriate space on the DFSV procedure brings out in the open implicit knowledge and critical assumptions for a transparent informed decision-making process. At the end of the workshop, looking at the DFSV procedure, the challenges and the improvement opportunities can be easily identified. If the radical innovation concept needs to be revisited, the improvement conditions are also easily identifiable.

Preparation

One reason for using a fast-and-frugal decision tree structure is its simplicity. Insights from literature and field research show how different radical innovation concepts can be from one to another and how different the decision-making context can be. The simplicity offered by decision tree structures makes adjusting the decision-making procedure depending on the specific context it will be used in, simple and easy. Relevant questions regarding the radical innovation concept to be evaluated or regarding the specific context of the decision can be added, while irrelevant question can be rephrased or removed. However, the simplicity of the DFSV procedure should not be affected and the goal to evaluate desirability, feasibility and suitability in each section respectively should be maintained. For more information regarding specific information regarding each section of the Viability Decision Canvas, please refer to the sections below.

Depending on the set of questions in the Viability Decision Canvas, relevant materials should be prepared or made available for the DFSV decision-making workshop (e.g. user studies, feasibility studies, trends research, etc.)

Participants

Based on insights from literature review and field research, in the decision-making process people from multiple departments with different knowledge and expertise should be involved. For more information, please refer to section 4.3. Based on the gathered insights, the minimum people involved are the following:

- **Designer**: Someone with implicit and explicit knowledge/experience regarding the radical innovation concept’s meaning to be evaluated and its development
- **Engineer**: Someone with knowledge/experience regarding company’s technical capabilities
- **Marketer**: Someone with knowledge/experience regarding market trends and customer behavior
- **Senior Manager**: Someone with knowledge/experience regarding company’s innovation and corporate strategy
- **Decision Maker**

The list above can be broadened with other stakeholders that are relevant for the project.

Navigating the Viability Decision Canvas

The Viability Decision Canvas is meant to evaluate the desirability, feasibility and suitability, and to make a decision regarding viability, in the stated order. This is done by proceeding through each evaluation section, starting at the top, with question D1 (to be read: “Desirability, question 1”), F1 (to be read: “Feasibility, question 1”), and S1 (to be read: “Suitability, question 1”) respectively, and ending with the decision-making section regarding the adoption of the radical innovation concept for further development.
Depending on the answer to each question from the evaluation sections, an arrow will indicate the next question to proceed to, or specific indication regarding what question to proceed to in the form of “Go to Xn” (where X ∈ {D, F, S, V}; and n ∈ {1, 2, 3}). While answering each question, critical assumption should be acknowledged, discussed and filled-in in the appropriate space. For more information about the importance of critical assumptions, please refer to Section 3.6. After answering a question, the reasoning should also be filled-in in the appropriate space. The fill-in space for critical assumptions and reasoning for each question triggers discussion for communicating implicit knowledge that not everyone involved might possess, and thus encouraging a more transparent communication. Filling-in the spaces appropriately, after the decision was made, the procedure can be reviewed (even by other people, or the same people at a different moment in time) and the relevant information (challenges, opportunities, misjudgment, missing information, etc.) can be easily identified.

If the answer to the question did not lead to an arrow point out at the next question in the same section (with the exception of question F1) the “Change in evaluation result conditions” space should be filled in. “Change in evaluation result conditions” means the conditions that are currently not met but need to be met in order to have a different answer to the respective question. At the end of using the Viability Decision Canvas, if it was decided the concept to be revisited, looking at the “change in evaluation result conditions” provides a simple way to identify measures and devise a plan of action for improving the radical innovation concept, until it is revisited.

By the time the procedure gets to the viability decision-making section, a good understanding of the viability of the radical innovation concept in question should be achieved from the results of the evaluation sections. Based on this information, a decision should be made in regards of the internal adoption of the radical innovation concept, and relevant comments regarding the decision can be filled-in.

Throughout the Viability Decision Canvas, “it” in the questions, refers to the radical innovation concept under evaluation.

5.4.3. Desirability Evaluation Section Details
As defined in Chapter 3, desirability means meeting the needs wished by people (Calabretta et al., 2016). However, when evaluating the viability of radical innovation concept, the number of people that the radical innovation concepts might be desirable for, is equally important, just like the desirability of the radical concept compared to current solutions. This means that evaluating desirability can be also understood as market potential. This is done by questions such as D3:

“D3. Is the radical innovation concept meaningful for enough people?”

As mentioned above, evaluating the desirability of a radical innovation concept, especially one that involves an innovation of meaning, does not necessarily mean that it is more meaningful than the current solution for the people. As people perceive the world slightly differently and might have a different view over the same meaning (Peterson, 2013), it is important to address the fact that other people might not find the radical innovation concept more meaningful than current solutions. This is addressed by questions like D2:

“D2. Is the radical innovation concept more meaningful than existing solutions?”

Insights from both literature review (Verganti, 2016, p. 200) and field research point that the best way to evaluate how meaningful a radical innovation concept is, is by conducting user studies, such as focus groups, ethnography.
studies, etc. If this type of knowledge is available, the question set in the Viability Decision Canvas should be adjusted accordingly, for the knowledge to be used. However, the current set of questions in the Viability Decision Canvas is done in a case where no user testing data is available (which was the case of the validation test). To address this lack of knowledge, a comparison of the meaning of the radical innovation concept with future trends is employed in question D1:

“D1. Is the meaning supported by future trends?”

Trend research has been considered to be useful at detecting early signals of possible changes in the environment (Simonse, 2018). Understanding these potential changes in the environment can help evaluate how the meaning of the radical innovation concept might be viewed by the people. If the company has trend research available, it should be used, if not dependable trend research from top consulting firms (e.g. McKinsey, Deloitte, etc.) is published regularly.

5.4.4. Feasibility Evaluation Section Details

As mentioned in Chapter 3, feasibility is defined as the project outcome can be given a tangible form in the present, or foreseeable future (Calabretta et al., 2016). Based on this information the questions in the feasibility evaluation section were devised to evaluate the time frame needed for the radical innovation concept to be given tangible form and if the necessary change in current operations can be sustained.

The first two questions of the feasibility evaluation section address the timeframe for the radical innovation concept to be given tangible form:

“F1. Can it be done now?”
“F2. Can it be done in 2 years?”

The question F1. aims at the favorable scenario where all the technological knowledge and resources are available to give tangible form to the radical innovation concept. This is why, if the answer to question F1. is “yes”, the procedure directs you to proceed to question F3., skipping question F2, which becomes irrelevant.

For questions F1. and F2., besides critical assumptions, required resources should be filled in the available spaces, as they are critical feasibility evaluation criteria based on gathered literature (Cooper & Kleinschmidt, 1995; Markham et al., 2010) and field research insights.

It is important to mention that the space in question F2. should be filled with a time specific frame depending on the context of the decision. This adjustment should be done in preparation for using the Viability Decision Canvas.

The question F3. addresses an insight gathered from field research, which stated that some for some companies adjusting the operations to allow for the radical innovation concept to be feasible is even a larger challenge than the resources needed, making it a critical aspect when evaluating the feasibility of a radical innovation concept.

“F3. Can we adjust our operations to make it?”

5.4.5. Suitability Evaluation Section Details

The suitability evaluation section, as discussed in the Suitability section of the report above, addresses the fit of the radical innovation concept in question with current strategic context of the company.

Especially large legacy companies have the risk of becoming blind at the changing signals of the environment, when gaining momentum. As presented above, Kodak is one of the many examples. This is why, besides addressing the corporate and innovation strategy and business model, the suitability evaluation section has a set of additional extra questions that raises the
subject of potentially changing the corporate strategy, innovation strategy or business model.

5.4.6. Viability Decision-Making Section Details
As mentioned above, by the time the procedure gets at the viability decision-making section, a good understanding of the viability of the radical innovation concept in question should be achieved from the results of the evaluation sections. Based on this information, a decision should be made with regards of the internal adoption of the radical innovation concept, hence the first question:

“Should the radical innovation concept be internally adopted for further development?”

If the concept is not internally adopted for further development, the next question comes natural from, Open-Innovation, where other ways value can be gained from the radical innovation concept are explored, such as a spin-out.

“Should the radical innovation concept be spun-out?”

If none of the first two questions are answered positively, the revisiting option should be considered. Using the evaluation sections’ fill-in spaces, the challenges and change in evaluation result conditions can be quickly identified and plans of action can be developed to improve the radical innovation concept until revisiting.

“Should the radical innovation concept be revisited?”

If based on the evaluation and analysis of the fill-in spaces, the decision is not to revisit the radical innovation concept, then the radical innovation project should be terminated.
Starting from the first iteration of the Viability Decision Canvas (figure 12), iterations 2 and 3 were developed based on self-reflection and self-criticism.

In iteration 2 (figure 13), the four sections of the Viability Decision Canvas were brought on a single canvas, size A2. The decision trees were simplified by replacing questions regarding critical assumptions with fill-in spaces for critical assumptions and reasoning. The decision trees were also standardized.
In iteration 3 (figure 14), the orientation of the decision trees from the desirability, feasibility and viability sections was changed from horizontal to vertical, to resemble more the image people have in mind regarding decisional or mathematical tree structures. Delimitation elements were also added to mark the four different sections of the procedure. The Viability Decision Canvas was also laid on a larger format, size A1. Content-wise, a decision tree has been added to the viability section.
Figure 14. Viability Decision Canvas - Iteration 3

1. **Feasibility**
   - Can it be done now?
   - Can it be done in 2 years?
   - Can we adjust our operations to make it?

2. **Desirability**
   - Does it fit the corporate strategy?
   - Does it fit the innovation strategy?
   - Does it fit the business model?

3. **Suitability**
   - Why? Critical assumptions
   - Why? Critical assumptions
   - Why? Critical assumptions

4. **Viability**
   - Is the meaning supported by future trends?
   - Is it more meaningful than existing solutions?
   - Is it meaningful for enough people?

5. **Should the radical innovation concept be adopted for further development?**
   - NO
   - YES

6. **Should the radical innovation concept be spin-out?**
   - NO
   - YES

7. **Should the radical innovation concept be revisited?**
   - NO
   - YES

8. **Does the radical innovation concept fit further development?**
   - NO
   - YES
The final version of the Viability Decision Canvas (figure 11 and figure 15) was developed based on feedback gathered from the validation and the usability test. Based on the feedback from the validation test, change in evaluation result condition fill-in space were added. Based on the feedback from the usability test, the navigation of the Viability Decision Canvas instructions were modified with arrows and more explicit instructions. The decision tree in the viability section was also brought vertical and the viability section was explicitly delimited from the rest of the sections to emphasize the relation between the four sections as described by the Viability Model. In the final version, the name of the tool was also changed from the DFSV decision-making procedure to the current name, Viability Decision Canvas.
Figure 15. Viability Decision Canvas - final version

**Radical Innovation Concept:**

**Desirability**

D1. Is the meaning supported by future trends?

Reasoning: Critical assumptions

NO → Go to F1.

Change in evaluation result conditions

YES → Go to F3.

D2. Is it more meaningful than existing solutions?

Reasoning: Critical assumptions

NO → Go to F1.

Change in evaluation result conditions

YES → Go to F3.

D3. Is it meaningful for enough people?

Reasoning: Critical assumptions

NO → Go to F1.

Change in evaluation result conditions

YES → Go to F3.

**Feasibility**

F1. Can it be done now?

Reasoning: Critical assumptions & Required resources

YES → Go to F3.

NO → Go to S1.

F2. Can it be done in X years?

Reasoning: Critical assumptions & Required resources

NO → Go to S1.

Change in evaluation result conditions

YES → Go to F3.

F3. Can we adjust our operations to make it?

Reasoning: Critical assumptions

NO → Go to S1.

Change in evaluation result conditions

YES → Go to S1.

**Suitability**

S1. Does it fit our corporate strategy?

Reasoning: Should we change the corp. strategy?

YES → Go to S2.

NO → Go to V.

Change in evaluation result conditions

S2. Does it fit our innovation strategy?

YES → Go to S2.

NO → Go to V.

Change in evaluation result conditions

S3. Does it fit our business model?

Reasoning: Should we change the bus. model?

NO → Go to V.

YES → Go to V.

Change in evaluation result conditions

**Viability**

Should the radical innovation concept be adopted for further development?

YES → Go to V.

NO → Go to V.

Should the radical innovation concept be spun-out?

YES → Go to V.

NO → Go to V.

Should the radical innovation concept be revisited?

YES → Go to V.

NO → Go to V.

The radical innovation project should be terminated.

Comments
In this chapter the design process of the Viability Model and the Viability Decision Canvas has been presented. The Viability Decision Canvas aims to facilitate the decision-making process behind the adoption of radical innovation concepts for further development, by providing a simple, structured, yet flexible method to evaluate and to make an informed decision regarding the internal adoption of a radical innovation concept for further development.

The Viability Decision Canvas is based on the Viability Model, which recognizes Viability as the most important decision-making criteria for the adoption of radical innovation concepts. The Viability Model describes viability as dependent on desirability, feasibility and suitability. Thus, the Viability Decision Canvas facilitates the assessment of the desirability, feasibility and suitability of a radical innovation concept in a simple structure of a Fast-and-Frugal decision tree, making the procedure simple, yet flexible enough to be adjusted as needed. Employing abductive reasoning, the Viability Decision Canvas addresses the non-probabilistic risk of radical innovation, while involving relevant people from multiple departments with different areas of expertise.

5.6. CONCLUSION
6. EVALUATION

This chapter presents, the evaluation process of the Viability Decision Canvas for validating the critical assumptions behind the Viability Decision Canvas and for testing the usability of the Viability Decision Canvas. The evaluation feedback is discussed at the end of this chapter and it has been already integrated in the final version of the Viability Decision Canvas.
6.1. VALIDATION TEST

The main goal of the validation test was to assess and confirm the critical assumptions behind the DFSV procedure that have been identified during the design process and have been presented below.

6.1.1. Critical Assumptions
During the design phase of the Viability Decision Canvas, the following critical assumptions (CA) have been identified:

• CA1: Viability is the most important criteria for decision-making behind the internal adoption of radical innovation concepts for further development.
• CA2: Viability is successfully modeled by desirability, feasibility and suitability, based on the Viability Model
• CA3: The Viability Decision Canvas is facilitating the decision-making process behind the internal adoption of radical innovation concepts for further development.

6.1.2. Evaluation Context
The validation test was done with PHYSEE, a small company in the clean energy and smart building technology business from Delft, Netherlands. PHYSEE was considered to be a suitable context for running the validation test as the company has a clear and stable strategy, delivering a radical innovation product, while the company is still focusing on radical innovation projects.

The main goal of the validation test was achieved at PHYSEE through evaluating and making a decision regarding the internal adoption of a radical innovation concept using PHYSEE’s current process of decision-making and another radical innovation concept using the Viability Decision Canvas (figure 13 - Viability Decision Canvas, iteration 2), and to obtain feedback that would validate the critical assumptions identified.

6.1.3. Radical Innovation Concepts Used
Two radical innovation concepts were used so the participants would not be biased when evaluating and making a decision regarding the internal adoption of the radical innovation concept by the discussion they just had regarding that concept when evaluating and making a decision regarding

Figure 16. Smart Brick, radical innovation concept prototype
the internal adoption of a radical innovation concept using PHYSEE’s current process of decision-making. The two radical innovation concepts used in the test were developed during GESTE Summer School, and are presented below, based on the information provided to the author.

**Smart Brick – Concept A**

*For building construction companies, the smart brick (figure 16) that produces energy from the indoor-outdoor temperature difference, enables the building beneficiaries to produce and use clean energy, because the building beneficiaries wish to be energy efficient and grid independent.*

The smart brick was considered to be a suitable concept to be used in the test, as a radical innovation concept. Based on the definition of radical innovation (Verganti, 2008) used in this thesis (see section 3.3.2) the smart brick is a radical innovation and more specifically, a technological epiphany. On one hand, the concept proposes a new meaning for a brick, not just as a structural and isolation construction material, but also as a producer of clean energy, which can be described as a paradigm shift. On the other hand, the technology that allows this change in meaning is also a radical shift from the way bricks are currently made. The radical change in meaning and technology that the Smart Brick is proposing, makes it a technology epiphany and subsequently a radical innovation concept.

**Mobile Green Power – Concept B**

*The solar and wind powered mobile charging station (figure 17), enables travellers to recharge their EV and other appliances with clean energy, because travellers wish to have longer and safer sustainable travels.*

The Mobile Green Power was considered to be a suitable concept to be used in the test, as a radical innovation concept. Based on the aforementioned definition of radical innovation (Verganti, 2008) used in this thesis (see section 3.3.2) the Mobile Green Power is a radical innovation and more specifically, a meaning-driven innovation. The concept proposes a new meaning for a mobile charging station, one of a source of sustainable energy, compared to current mobile charging...
stations that use fossil fuel, as batteries are yet not as energy efficient. This can be described as a paradigm shift, for people who value sustainability and travel in electric vehicles. The paradigm shift, together with the fact that the technology used, solar and wind energy producing technologies, already exist, the Mobile EV charging station can be defined as a meaning-driven innovation and subsequently, a radical innovation concept.

6.1.4. Setting
The test was run as a one hour long workshop (see workshop structure in Appendix C) with 10 PHYSEE employees (figure 18), that were divided in two groups (Group 1 and Group 2) making sure that each group contained at least one of the required participants (see section 5.4.2 - Participants). The groups decided to not have a decision maker and make a unanimous decision. Even though the author moderated the general evaluation workshop, the author did not moderate the parts of the workshop where the groups evaluated and made a decision regarding the radical innovation concepts. The author only gave instructions regarding the use of the DFSV decision-making tool and was available to answer questions raised regarding the use of the Viability Decision Canvas. The decision to not moderate the evaluation and decision-making parts of the workshop was taken because the author had been given little to no information regarding the participants, standard PHYSEE procedures and the radical innovation concepts. This decision was also made to observe how the participants use the Viability Decision Canvas without the risk of being biased by the author of the Viability Decision Canvas.

The groups evaluated and made a decision regarding the internal adoption for further development of two radical innovation concepts: the Smart Brick and the Mobile Charging Station (Concept A and Concept B). Each group started with a radical innovation concept that they evaluated and made a decision regarding the radical innovation concept's internal adoption using PHYSEE’s current decision-making process (Group 1 – Concept A; Group 2 – Concept B). The two groups swapped concepts and they evaluated and made a decision regarding the radical innovation concept's internal adoption using
the Viability Decision Canvas (Group 1 – Concept B; Group 2 – Concept A). The reason the groups swapped the concepts was so they would not be biased by the discussion they just had regarding that concept. It is important to mention that only very few participants had prior information about the concepts.

PHYSEE didn’t have a formal decision-making procedure for the internal adoption of radical innovation concepts. Nonetheless, a procedure (see Appendix D) that was used as a baseline in a similar study (Dong et al., 2015) regarding the internal adoption of radical concepts was provided. However, the groups were instructed to use whatever decision-making procedure they desired.

The workshop ended with a Feedback and Q&A discussion, where a Feedback form with the goal of validating the critical assumptions of the Viability Decision Canvas was given to the participants (See Appendix E).

6.1.5. Results

Feedback Form

The feedback form provided was filled by 5 test participants. In the feedback form, the participants were asked to rate statements from 1 – I strongly disagree to 5 – I strongly agree. The results of the form are presented below:
The DFS Viability procedure facilitates the decision making process behind the internal adoption of radical innovation concepts.

Figure 19. Results of Feedback form - statement 1

Viability is the most important criteria for the decision making process behind the internal adoption of radical innovation concepts.

Figure 20. Results of Feedback form - statement 2
The DFSViability procedure is useful at evaluating the viability of radical innovation concepts.

Figure 21. Results of Feedback form - statement 3

Viability is successfully modeled by Desirability, Feasibility and Suitability.

Figure 22. Results of Feedback form - statement 4
The following are relevant for evaluating the viability of radical innovation concepts.

**Figure 23. Results of Feedback form - statement 5**

The following sections of the DFSViability procedure are successful at evaluating that particular section’s goal.

**Figure 24. Results of Feedback form - statement 6**
The overall DFSViability procedure is clear and easy to use.

5 responses

Figure 25. Results of Feedback form - statement 7

The following sections of the DFSViability procedure are clear and easy to use.

Figure 26. Results of Feedback form - statement 8
Desirability Section
In the desirability section of the Viability Decision Canvas, the discussion was focused around potential use case scenarios of the radical innovation concepts in question, while mentioning how the radical innovation concept could be more meaningful to the people compared to existing solutions:

P1: “so, you can actually bring it to places where are lots of people”
P2: “being mobile is more meaningful because you can use the same unit in different places, compared with fixed charging stations…”
P3: “…and is non-polluting, comparing to generators.”

Feasibility Section
In the feasibility section of the Viability Decision Canvas, the discussion was focused around the capabilities and expertise of the company regarding the technologies used by the radical innovation concept in question:

P1: “we don’t have to invent anything, it combines multiple things”
P2: “it doesn’t require deep research”

Suitability Section
In the suitability section of the Viability Decision Canvas, the discussion was focused around how the radical innovation concept in question fits the current strategy of the company, and what would mean a potential shift in the strategy of the company:

P1: “let’s look at it. If we take xxxxxx xxxxxx it might work…”
P2: “…I would say no. To change the innovation strategy means going xxxxxx xxxxxx…”
P1: “…It’s xxxxxx. We are already out of xxxxxx xxxxxx…”
P3: “…the difference is, we really need to add xxxxxx…”
P2: “…yes, but going to xxxxxx, would we be going to this? [the radical innovation concept in question] or we are going to start making xxxxxx xxxxxx?”

6.1.6. Analysis and Discussion
Validating critical assumptions and evaluation form results
The identified critical assumptions of the Viability Decision Canvas were validated using statements 1, 2, 3 and 4, with results showing in figure 19, figure 20, figure 21 and figure 22 respectively. Critical assumption 1 was validated through statement 2. Critical assumption 2 was validated through statement 4. Critical assumption 3 was validated through statement 1. Statement 3 was more broad and validated both critical assumption 2 and 3. Based on all the responses being I agree or I strongly agree, it can be said that the test at PHYSEE successfully validated the critical assumptions of the Viability Decision Canvas. Statements 5, 6, 7 and 8, with results showing in figure 23, figure 24 figure 25 and figure 26, addressed other assumptions of the Viability Decision Canvas, such as the capacity in which the question in each section are relevant for evaluating that particular section, how clear and easy to use each section is, and the overall usability. The results show a positive feedback regarding these topics.

Feedback Session
The feedback during the Feedback session at the end of the workshop was also positive. An interesting point was made about the very structured and some argued to be radical, that only “yes” and “no” answers available. Some people said that “it is too black or white”. This started a conversation where people in management and decision-making position said that this feature is actually a positive characteristic of the tool as it forces them to make a decision and not waiver.

P1: “When making a decision, what you notice is that decisions are not always black or white, it can
be more fluid. So, by having to make a decision to continue or stop continuing, this will be difficult. Just having to make a decision between yes and no, to me, it’s too black or white.”

P2: “I would actually like that more...this one (the Viability Decision Canvas) really forces you to cancel the noise...it makes it much more critical to do new things.”

This difference in opinion was judged as normal, but it was taken as positive feedback.

Another feedback point was regarding the addition of a fill-in space for things that need to happen, so the answer to the result can change.

P3: “I think it’s nice to have the yes or no, but then add a separate column - what would determine a change in answer; because over time, the yes can become a no, or the other way around”

This feedback was incorporated in the forms of “change in evaluation result conditions” (see section 5.4.2)

The last comment was regarding evaluating multiple concepts.

P1: “If you would be evaluating multiple concepts, then it would be easy to score between 1 to 5, so in the end you would have a total score, but when you are using this (the Viability Decision Canvas) it’s just GO/NO-GO decisions”

Evaluating multiple concepts is not in the scope of this project, nor it is the context for the Viability Decision Canvas to be applied. For more information about regarding improving decision-making, please refer to the section 7.1.

The Use of the Canvases

It is important to mention that the actual decisions that the groups made, either when evaluating and answering questions, or when making the final decision regarding adoption, were not evaluated, as no empirical way was found to validate these types of decisions, in the timeframe of this project. Another reason for not discussing the reasoning of the groups when answering questions and making decision is, as mentioned above, the fact that the author had little to no information available regarding the participants, the concepts and insider information concerning PHYSEE as an organization and their resources. However, the canvases used by the two groups when using the Viability Decision Canvas (see Appendix F) introduce some discussion points.

Some of the fill-in spaces remained blank and some were filled very little. Furthermore, Group 1 filed more of the canvas than Group 2. Unfortunately, a clear reason for this is unknown, as the feedback session was stopped before schedule for logistical reasons, and an additional feedback session could not be arranged with PHYSEE. However, the following can be inferred:

First of all, the main goal of the fill-in space about reasoning and critical assumption was to trigger discussion in the group and bring out implicit knowledge to everyone. The fact that Group 2, which filled-in less than Group 1, took more time to finalize the procedure than Group 1, proves that discussion indeed happened, and the main goal was achieved, even though the spaces were not filled.

Second of all, the fact that the fill-in spaces were found valuable by the participants was proven by the fact that, not only the participants did not say that in the feedback session, but they suggested the addition of other spaces. This feedback was incorporated in the final version as spaces for “change in evaluation result conditions”, as discussed above.

Other potential reasons for the low extent of filled-in space could be the relative short amount of time
allocated to the decision-making procedure and the low fidelity of the concepts, meaning a low amount of knowledge and information available to be discussed regarding the concepts. However, a more probable reason could be the lack of a moderator for the decision-making procedure. A moderator, could push for filling in appropriate spaces, aiding recording purposes for future use. The moderator role could be possibly taken by the decision maker or the designer.

6.2. USABILITY TEST

6.2.1. Setting
The usability test was done in a 1h decision-making workshop (see workshop structure in Appendix G) where 4 participants (peers from the Industrial Design Engineering) role-played the required participants (see section 5.4.2 - Participants). The participants used the third iteration of the Viability Decision Canvas (figure 12) to evaluate and make a decision regarding the internal adoption of radical innovation concept that was provided. The concept used in this test, was a real radical innovation concept that was adopted by a real company. The participants were instructed to assume the roles that were given to them, in the real company. However, the fact that the concept was internally adopted was not known by the participants.

The participants were shown the Viability Model. The participants were minimally instructed in using the Viability Decision Canvas, with only the goal of the procedure being: Evaluate the viability of the concept by discussing the possible development of the concept in the future and make a decision regarding its internal adoption for further development.

At the end of the Viability Decision Canvas, a feedback session around the following topics has been held:

- The Viability Decision Canvas is clear and easy to use – how can it be improved?
- The DFSV decision-making sections are clear and easy to use – how can it be improved?
- The questions in the DFSV decision-making sections are clear – how can it be improved?

6.2.2. Radical Innovation Concept Used
Reon Pocket
The Reon Pocket (figure 27) is a small cooling device that you can wear like a portable air conditioner, enabling people that need to go through unfavorable temperatures, to do so, while being comfortable.
The Reon Pocket works using the “Peltier effect”; a small electrical current that allows it to either absorb or give out heat. The device is capable of cooling you by 13 degrees Celsius, or heating you by 8 degrees Celsius, for 24 hours out of a single charge via USB Type-C (Porter, 2019).

The Reon Pocket was considered to be a suitable concept to be used in the test, as a radical innovation concept. Based on the definition of radical innovation (Verganti, 2008) used in this thesis (see section 3.3.2) the Reon Pocket is a radical innovation and more specifically, a technological epiphany. On one hand, the concept proposes a new meaning for a personal cooling device, not just as separate air circulating device, but also as a compact wearable cooling agent, which can be described as a paradigm shift. On the other hand, the technology that allows this change in meaning is also a radical shift. Even though the Peltier Effect is known, the integration in such a small and mobile device is different from the current use. The radical change in meaning and technology that the Reon Pocket is proposing, makes it a technology epiphany and subsequently a radical innovation concept.

6.2.3. Results and Discussion

The main feedback received was regarding the visual cues for navigating through the Viability Decision Canvas. This feedback was incorporated in the form of arrows or specific instruction at each possible answer, regarding the next step in the procedure (see fig. 15 – final iteration and section 5.5.2).

P1: “this (if the answer in the middle of the line, you proceed, if it is at the end of the line you stop, no matter if it is a yes or no) confuses me. Just with some other graphic aids, will be better. Some arrows maybe”

P2: “now you don’t have numbers for the questions...usually if you have some parentheses you can put some test ‘go to 9’, and 9 is this one, and people can refer to it without putting a lot of arrows”

Other feedback received was regarding some of the questions and the wording of the questions that was unclear. This highlights the importance of explaining the Viability Decision Canvas to the participants before its use or having a moderator.
6.3. CONCLUSION

In this chapter, the evaluation process of the Viability Decision Canvas has been described. One evaluation test was done to validate the critical assumptions behind the Viability Decision Canvas, and one test was done to assess the usability of the Viability Decision Canvas. The feedback gathered, such as better navigation instructions and extra fill-in spaces in the procedure, has been discussed and incorporated in the final version of the Viability Decision Canvas.

Despite the validation test being done with only one company, the overall positive results regarding the validation of the Viability Decision Canvas facilitating the decision-making procedure behind the internal adoption of radical innovation concepts, show the potential of the Viability Decision Canvas being implemented in a valuable way for a company.

for the procedure.

P1-design role: “the question regarding corporate strategy is bugging me. It’s confusing”
P2-engineering role: “meaningful, this word might be complicated”

With participants from different backgrounds, and with different knowledge and expertise, it is impossible to use words that are ordinary for everyone, without losing the specificity of the words. Thus, it is important to align everyone with the goals and usage of each section of the Viability Decision Canvas, of the before the actual use of the Viability Decision Canvas.
7. DISCUSSION

In this chapter, the limitations of this thesis project and the Viability Decision Canvas are discussed, while implications for future work are presented.
7.1. LIMITATIONS

The main limitation of the Viability Decision Canvas is the fact that it is general. This limitation is caused by the fact that the thesis project was not done for a client, as mentioned in the beginning, and the procedure was designed based on literature review and field research. The generality of the Viability Decision Canvas is seen as a limitation since the field research showed how differently companies act when faced with the decision-making process regarding the internal adoption of radical innovation concepts, together with the fact that radical innovation concepts are very specific in nature, meaning that each radical innovation concept creates its own new context; making the use of the Viability Decision Canvas difficult without proper adjustments. However, the clear and simple structure of the Viability Decision Canvas aids, and even encourages the fine-tuning of the procedure. Still, it is an extra step that needs to be done.

The fact that the Viability Decision Canvas is used to evaluate and make a decision regarding one radical innovation concept at a time can also be seen as a limitation. However, as mentioned before, radical innovation concepts should not be compared to one another. In the case of multiple versions of the same radical innovation concepts that need to be evaluated and made a decision about, tools such as the Harris Profile can be used to choose one version. Afterwards, the chosen version can be evaluated using the Viability Decision Canvas. The Viability Decision Canvas was designed to facilitate the evaluation and decision-making process regarding the adoption of a radical innovation concept independently from the start.

As mentioned before, the field research showed that companies can approach innovation differently, for a variety of reasons. Depending on the company context and how the innovation process is set-up, the Viability Decision Canvas can be more or less valuable. A case (case X) where the Viability Decision Canvas was considered to be less valuable, was encountered when the author was contacting companies that would be available to test the Viability Decision Canvas. In case X, the company had set-up the innovation process in an agile way, where the same multidisciplinary team was working on a project from the very beginning, to the last implementation stage. Moreover, the process was gated differently than the Open-Innovation model that was used as a context defining starting point for this project. In case X, most of the evaluation and decision-making topics, that are covered in the Viability Decision Canvas, are being distributed along multiple gates already, causing the Viability Decision Canvas to be less valuable in the particular context of case X.

Another limitation can be the fact that the Viability Decision Canvas was validated by only one test, with only one company. Multiple companies were contacted for testing the Viability Decision Canvas with; however, PHYSEE, was the only one available. As mentioned in the beginning (chapter 2), a client company search was conductor, but unsuccessfully, making the choice of a company willing to test the Viability Decision Canvas as hard of a challenge. The timing of the project could also be identified as a reason, as the search for the company to test with took place throughout July and August, when many people are on holidays and communication with them becomes a challenge. However, the positive results of the validation test done with PHYSEE proves the potential of the Viability Decision Canvas for future work and development.
The field research showcased how companies each have a different internal context which means a different approach to the innovation process, as well as a different perspective regarding the management and the decision making concerning radical innovation concepts. Future work can be done on how the Viability Decision Canvas can be sustainably integrated within the routines of a company, and its specific internal context. Topics such as the specific people that need to be involved and their needs and expectations from the Viability Decision Canvas, how the Viability Decision Canvas should be adjusted before each use, and what specific information should be prepared before the Viability Decision Canvas, are considered to be worth studying further.

Another topic that is company contextual is the moderator role. Questions that can be addressed could be the following: Who, if anyone, should be moderating the use of the Viability Decision Canvas? Should there be different moderator for each section of the Viability Decision Canvas? What are their exact duties?

The Viability Decision Canvas was designed to be used when a decision for adopting a radical innovation concept in the NPD stage needs to be made. However, this moment is hard to define, in terms of the definition level of the radical innovation concepts in question, meaning the information and knowledge available. Field research pointed out the fact that a concept is never perfect, more information would be preferable, but a decision needs to be made anyway:

IE 4: “the concept that we are talking about is never perfect. There is always something missing...some market or user information, we are not sure about something from operation, the proof of concept is still in the works...there is always something. But we have to make a decision, now.”

This is also known in academia. During the Strategic Product Design Master’s courses at Delft University of Technology, dr. ir. Smulders said that, if you have 100% of the information, the answer should be there, but you never have 100% of the information. The fact that all the information is never available, could point out the fact that the Viability Decision Canvas, might be valuable to be used in more moments during the early stages of radical innovation projects. More work could be done to study the value the Viability Decision Canvas could bring throughout the radical innovation process. During the feedback session of the validation test, a senior manager of the company made the following comment:

P1: “with other tools [that have novelty as a criteria] we will score a lot of innovation very high, because we are very positive towards innovation, we will say yes in many cases. This one [the Viability Decision Canvas] is forcing you to be thorough. It makes it much more critical to do new things.”

In the case of PHYSEE, a company that is open and even focused on innovation, the Viability Decision Canvas raises critical discussion points that show the real value of a radical innovation concept, beyond just the fact that it is a radical innovation concept. It can be argued that the Viability Decision Canvas, that digs deeper in regards to radical innovation concepts, could be also used in the opposite case. A case of a company that is more conservative and less interested in radical innovation, where again, the Viability Decision Canvas goes deeper and shows the importance of radical innovation. During the field research, this case was described by an industry expert:

IE 4: “especially large companies, as they become successful, they gain momentum, which makes them less likely to see and understand how the world is changing, and even less likely to adapt. They will just keep optimizing what they do,
because they know that what they do worked. Nokia would be an example.”

The Viability Decision Canvas could be used to sensitize companies that already gained momentum by raising a deeper discussion regarding radical innovation. However, this way of using the Viability Decision Canvas should be studied further.

In this chapter, the limitations regarding the Viability Decision Canvas and this thesis project as a whole have been discussed. The main limitation is the generality of the Viability Decision Canvas. However, with radical innovation concepts being different from one another and with companies addressing radical innovation differently, the Viability Decision Canvas can be a starting point for developing a solution tailored for the specific context.

Implications for future work regarding the Viability Decision Canvas have been also presented. The main future work direction is related to the generality of the Viability Decision Canvas, where with a specific context available, the Viability Decision Canvas can be adjusted for that specific context. Another similar direction is related to the use of the Viability Decision Canvas in contexts where the innovation process is not structured by the Open-Innovation model, and could be, for example, more agile. A different direction for future work should be the sensitizing capabilities of the Viability Decision Canvas. In other words, how the Viability Decision Canvas could be used to raise critical discussion points regarding the strategy of a company concerning radical innovation.
8. FINAL CONCLUSION
The main research question of this thesis has been the following:

How can strategic design facilitate the decision-making process behind the internal adoption of radical innovation concepts?

Sub-research questions were devised to structure and support the literature review and field research, which consisted of qualitative interviews with experts from academia, as well as experts working in the industry. Based on the literature review and field research, the following gap has been identified:

Data-driven financial tools used for the decision-making process behind the internal adoption of radical innovation concepts are unsuitable to tackle the non-probabilistic risk and generativity associated with radical innovation.

Literature review also show how abductive reasoning and Fast-and-Frugal decision trees are advisable methods to be used in the attempt to address the challenges radical innovation raises during the decision-making process behind the internal adoption of radical innovation concepts.

Field research showed that the inadequate use of data-driven decision-making methods regarding radical innovation is acknowledged, however, still used on a regular basis. Although, each company has different methods and procedures to take decisions, profitability focused financial tools are the most used. The non-probabilistic risk of the innovation process was not formally known, yet participants in the field research perceived it.

Based, on the insights gathered from the literature review and field research, design criteria were devised for a tool that would facilitate the decision-making process behind the internal adoption of radical innovation concepts while addressing the identified gap.

From the design criteria, the Viability Model was constructed to better describe viability, as the main decision criteria when a radical innovation concept is evaluated by a company; where viability is modeled by desirability, feasibility and suitability.

The Viability Decision Canvas, a tool that aims to facilitate the decision-making process behind the internal adoption of radical innovation concepts, was designed based on the Viability model taking a strategic design approach. The Viability Decision Canvas facilitates the evaluation and the decision-making process behind the internal adoption of radical innovation concepts by employing abductive reasoning in a Fast-and-Frugal decision tree format, that addresses the non-probabilistic risk inherent to radical innovation. Being simple and structured, the Viability Decision Canvas allows for rapid adjustment to suit the specific context of the company and the context created by the radical innovation concept.

The positive results of the Viability Decision Canvas evaluation, during the validation test with the company PHYSEE, regarding its capability to facilitate the decision-making process behind the internal adoption of radical innovation concepts show that the Viability Decision Canvas can potentially represent the answer to the main research question of this thesis. In other words, the Viability Decision Canvas, being a context appropriate alternative tool for decision-makers, has the potential to facilitate the decision-making process behind the internal adoption of radical innovation concepts, when integrated as a company routine.

While answering the main research question of this thesis, the Viability Decision Canvas addresses the knowledge gap identified through research. The Viability Model, used in a Fast-and-Frugal decision tree structure while employing abductive reasoning, provides, through the DFSV
decision making procedure, the main contribution of this thesis.

Future work should be directed towards, the implementation of the Viability Decision Canvas in company as a routine, and how it can be adapted to be valuable in different types of innovation management models and in different moments along the innovation process. Another direction for future work consists in studying other potential uses of the Viability Decision Canvas, such as sensitizing companies that gained a momentum and became less interested to radically innovate.
REFERENCES


APPENDIX A

Interview guide used in the interviews conducted during the field research phase.

INTERVIEW GUIDE

Introduction: Thank you, recording consent, my background, topic of research

Topic 1: Innovation
Probes:
• Definition of innovation
• Definition of radical innovation
• Current innovation process
• Innovation of meanings

Topic 2: Design
Probes:
• Usage of design in the innovation process
• Strategic design
• Desirability, Feasibility, Viability

Topic 3: Internal adoption of radical concepts
Probes:
• Current process
• Actors
• Decision making/evaluating tools
• Challenges
• Improvement points

Closing: Miss anything? Have any questions? Reaching out again? Thank you


APPENDIX B

List of the experts that were interviewed during the field research phase.

Table 1. List of experts from academia that were interviewed

<table>
<thead>
<tr>
<th>Academic Expert</th>
<th>Expertise</th>
<th>Background</th>
<th>Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 1</td>
<td>Digital innovation, Entrepreneurship, Agile and lean innovation methods, Lean research</td>
<td>MSc. Strategic Product Design, BSc. Industrial Design</td>
<td>6 yrs.</td>
</tr>
<tr>
<td>AE 3</td>
<td>Turning an idea into a startup, Persuasive presentation and pitch-craft</td>
<td>MSc. Integrated Product Design, Mechanical Engineering (Dipl.-Ing)</td>
<td>7 yrs.</td>
</tr>
<tr>
<td>AE 5</td>
<td>New Product Economics and Quantitative Research Methods</td>
<td>PhD. Marketing, MSc. Marketing and Accounting, BSc. Business Administration</td>
<td>7 yrs.</td>
</tr>
<tr>
<td>AE 8</td>
<td>Creative Facilitation, Education/Learning, Co-design, Co-creation</td>
<td>MSc. Strategic Product Design, BSc. Industrial Design Engineering</td>
<td>8 yrs.</td>
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Table 2. List of experts from industry that were interviewed

<table>
<thead>
<tr>
<th>Industry Expert</th>
<th>Company</th>
<th>Position</th>
<th>Background</th>
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<tbody>
<tr>
<td>IE 1</td>
<td>Global biotechnology company</td>
<td>Global Marketing Manager</td>
<td>MSc Economics</td>
</tr>
<tr>
<td>IE 2</td>
<td>Global biotechnology company</td>
<td>Vice President Product Category - Marketing</td>
<td>MSc Biology-Biotechnology</td>
</tr>
<tr>
<td>IE 3</td>
<td>Multinational conglomerate industrial company</td>
<td>Product Manager - Technical</td>
<td>MBA, MSc Applied Physics</td>
</tr>
<tr>
<td>IE 4</td>
<td>Multinational conglomerate industrial company</td>
<td>Global Portfolio Manager Product Category</td>
<td>MSc Engineering Sustainability, Management of Technology and innovation</td>
</tr>
<tr>
<td>IE 5</td>
<td>Multinational conglomerate industrial company</td>
<td>Business developer - Innovation, Design Thinking and UX</td>
<td>MSc Industrial and Product Design</td>
</tr>
<tr>
<td>IE 6</td>
<td>Multinational food and drink company</td>
<td>Innovation &amp; Design Thinking Specialist</td>
<td>BSc International Design Management</td>
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<tr>
<td>IE 7</td>
<td>Industrial manufacturing company</td>
<td>Portfolio Developer</td>
<td>MSc Strategic Product Design</td>
</tr>
<tr>
<td>IE 8</td>
<td>Service start-up</td>
<td>Senior Product Owner</td>
<td>PhD Industrial Design Engineering, MSc Mechanical Engineering</td>
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<tr>
<td>IE 9</td>
<td>Industrial manufacturing company</td>
<td>International Business Developer</td>
<td>PhD Chemical Engineering, MSc Mechanical Engineering</td>
</tr>
<tr>
<td>IE 10</td>
<td>Multinational professional services network</td>
<td>Senior Strategy Consultant</td>
<td>MSc Strategic Product Design</td>
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APPENDIX C

Structure of the workshop used for validating the tool.

Introduction – 5 min
- The project was presented
- The workshop agenda was presented
- The groups were formed
- Instructions about evaluating and making a decision using the current process or the provided process ware given

Evaluate the radical concept and make a decision using the current procedure – 20min
- Group 1 evaluated and made a decision regarding Concept A
- Group 2 evaluated and made a decision regarding Concept B

Introduce and explain the Viability Decision Canvas – 5min
- The Viability Decision Canvas has been presented and use instructions had been given

Evaluate the radical concept and make a decision using the Viability Decision Canvas -20min
- Group 1 evaluated and made a decision regarding Concept B
- Group 2 evaluated and made a decision regarding Concept A

Feedback session and Q&A
- General discussion regarding the differences of between the two procedures
- Guided discussion towards usability of the Viability Decision Canvas when evaluating and making a decision regarding the internal adoption of a radical innovation concept
- Guided discussion towards validity of the critical assumptions of the Viability Decision Canvas when evaluating and making a decision regarding the internal adoption of a radical innovation concept
- Presenting feedback form
APPENDIX D

Proposed baseline decision-making procedure used in the validation test (Dong et. al, 2015).

I think the concept is novel

The concept is creative

The consumers will accept this product

The concept has market potential

The concept is technically feasible

The concept should be accepted

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yes | no
APPENDIX E

Feedback form used to gather results of the validation test.

Decision making workshop for internal adoption of radical innovation concepts

Thank you for participating in the workshop. I hope you found it useful and interesting.

I would appreciate to hear your feedback. Please fill this quick survey and let me know your thoughts (your answers will be kept anonymous).

*Required

1. The DFSViability procedure facilitates the decision making process behind the internal adoption of radical innovation concepts. *
   
   Mark only one oval.
   
   1  2  3  4  5
   
   I strongly disagree       I strongly agree

2. Please provide more details.

   
   

3. Viability is the most important criteria for the decision making process behind the internal adoption of radical innovation concepts. *
   
   Mark only one oval.
   
   1  2  3  4  5
   
   I strongly disagree       I strongly agree

4. Please provide more details.

   
   

5. The DFSViability procedure is useful at evaluating the viability of radical innovation concepts. *
   
   Mark only one oval.
   
   1  2  3  4  5
   
   I strongly disagree       I strongly agree

6. Please provide more details.
7. Viability is successfully modeled by Desirability, Feasibility and Suitability. *  
    Mark only one oval.

    1  2  3  4  5

    I strongly disagree  □  □  □  □  □  I strongly agree

8. Please provide more details.  
   _______________________________________

9. The following are relevant for evaluating the viability of radical innovation concep
    Mark only one oval per row.

    I strongly disagree  I disagree   Neutral  I agree   I strongly ag

    Desirability  □  □  □  □  □
    Feasibility  □  □  □  □  □
    Suitability  □  □  □  □  □

10. Please provide more details.  
    _______________________________________

11. The following sections of the DFSViability procedure are successful at evaluating
    particular section's goal. *  
    Mark only one oval per row.

    I strongly disagree  I disagree   Neutral  I agree   I strongly ag

    Desirability  □  □  □  □  □
    Feasibility  □  □  □  □  □
    Suitability  □  □  □  □  □

12. Please provide more details.  
    _______________________________________

13. The overall DFSViability procedure is clear and easy to use. *  
    Mark only one oval.

    1  2  3  4  5

    I strongly disagree  □  □  □  □  □  I strongly agree

14. Please provide more details.  
    _______________________________________

82
15. The following sections of the DFSViability procedure are clear and easy to use. *
   Mark only one oval per row.

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<tr>
<th></th>
<th>I strongly disagree</th>
<th>I disagree</th>
<th>Neutral</th>
<th>I agree</th>
<th>I strongly agree</th>
</tr>
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<td>Desirability</td>
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<td>Feasibility</td>
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<td>Suitability</td>
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16. Please provide more details.

______________________________________________________________________________________

17. How could the DFSViability procedure be further improved?

______________________________________________________________________________________

18. Name
APPENDIX F

Canvas used by Group 1 to evaluate and make a decision regarding the internal adoption of Concept B:

Canvas used by Group 1 to evaluate and make a decision regarding the internal adoption of Concept B:
APPENDIX G

Structure of the workshop used for the usability test.

Introduction
• The project was presented
• The workshop agenda was presented
• The roles have been presented and assigned
• The company was introduced
• The radical innovation concept has been introduced

Introduce the Viability Model and Viability Decision Canvas
• The Viability Model was presented and explained
• The Viability Decision Canvas was minimally presented

Evaluate the radical concept and make a decision using the Viability Decision Canvas

Feedback session and Q&A
PROJECT BRIEF:

This document contains the agreements made between student and supervisory team about the student’s IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&S&A (Shared Service Center, Education & Student Affairs) reports on the student’s registration and study progress.
- IDE’s Board of Examiners confirms if the student is allowed to start the Graduation Project.


STUDENT DATA & MASTER PROGRAMME

Save this form according the format “IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy”. Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1!

** family name: Floreanu **
initials: DF
given name: Dan-Stefan
student number: 4740653
street & no.: Jacob Catsstraat 12
zipcode & city: 2613 HB Delft
country: Netherlands
phone: +31640740617
email: ds.floreanu@gmail.com

** Your master programme (only select the options that apply to you): **
IDE master(s):
- PD
- DH
2nd non-IDE master:
- 
individual programme:
- 
(give date of approval)
honours programme:
- Honours Programme Master
- Medesign
- Tech. in Sustainable Design
specialisation / annotation:
- Entrepreneurship

** SUPERVISORY TEAM **

** Chair: prof. dr. Han van der Meer, dept. / section: MOD **
** Mentor: ir. Eline Baxa **
2nd Mentor: TBD
organisation: TBD
city: TBD
country: TBD

** comments (optional): **

Additional mentor from external organisation might be added later in the project.

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v.

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.
Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF
To be filled in by the chair of the supervisory team.

Chair: prof. dr. Han van der Meer  Date: 3 - 6 - 2019  Signature: [Signature]

CHECK STUDY PROGRESS
To be filled in by the CSS, E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair.
This study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: EC
Of which, taking the conditional requirements into account, can be part of the exam programme: EC
List of electives obtained before the third semester without approval of the BoE:

Yes  all 1st year master courses passed
No  missing 1st year master courses are

Name:  Date:  Signature: [Signature]

FORMAL APPROVAL GRADUATION PROJECT
To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, either approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the MSc4-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be deployable within 100 working days/20 weeks?
- Does the composition of the supervisory team comply with the regulations and fit the assignment?

Content: APPROVED  NOT APPROVED
Procedure: APPROVED  NOT APPROVED

Comments:

Name:  Date:  Signature: [Signature]
Facilitating the internal adoption of radical innovation concepts

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

**INTRODUCTION**
Please describe the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are they? What do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural, social norms, resources, time, money, … technology, …)?

This project is a research based graduation project with then main stakeholder being the MOD research group. The research will consist of literature and field research. The field research will consist of qualitative interviews with experts from the MOD department and experts working in the industry (working in industrial and tech product companies). The area of interest hasn’t been studied while explicitly taking design into account, leaving an opportunity for radical innovation. Limitations lie in the fact that the solution is not developed in its context of use, yet insight collection and testing will be done in industry context, making the solution generic rather than specific.

The importance of innovation, for the sustainable future of the business, is well known by companies, (Collins & Porras, 1994; Christensen, 1997; De Geus, 1997; Cobbenhagen, 2000; Tidd, Bessant & Pavitt, 2001 as cited by van der Meer, 2007), as investing in innovation processes creates value for potential customers and competitive advantage (Pisano, 2013). Norman and Verganti (2014) define four types of innovation (Fig. 1), categorized using two dimensions: technology and meaning, and the change in these dimensions respectively. Thus, the four types of innovation are Marriot-Pull Innovation, Technology - Push Innovation, Meaning-Driven Innovation, and Technology Epiphanies.

Meaning-Driven Innovation, and Technology Epiphanies will be the focus of this project as Verganti in his book Overcrowded (2016, p.6) mentions how “innovation of meanings is a key source of value creation”. To be more specific, an innovation of meanings, as purpose (Verganti, 2016, p.33), is a shift from the current paradigm, to a new one which is more meaningful to the people (Verganti, 2016, p.58).

Verganti defines the design-driven innovation process as being more suitable to innovate meanings. This is an inside-out process that focuses on the fact that the vision built should come from inside (Fig. 2). The blurred initial initial inner vision is developed and refined into a concept through criticism from a number of relevant stakeholders, that grows after each stage of the process (Verganti, 2016).

A more popular model of managing innovation processes is open innovation (van der Meer, 2007). This model is characterized by three stages: the concept stage, the development stage and the business stage (Fig.3) (Chesborough, 2003 as cited in van der Meer, 2007). The open innovation model allows for a multitude of decisions to be made regarding innovation projects during each phase (i.e. interrupting or continuing a project, spinning in and out, etc).

Important roles regarding the future of innovation projects, especially in the concept stage, is played by managers, who often take the roles of project champions (van der Meer, 2007). Another important role in these decisions is played by the innovation strategy; which, by setting goals, procedures and structures regarding the process of innovation, should support managers in the allocation (or interruption) of resources to each innovation project (Pisano, 2013).

As radical innovation projects have a greater potential impact for a company, and as companies today are flooded with too many ideas, the decisions regarding the future of a radical innovation project are even more important to ensure the proper allocation of resources (Dong, 2006; Cooper, 1995). Strategic design tackles these types of decisions. As mentioned by Giulia Calabretta in her 2016 book Strategic Design, strategic design focuses on the ability to influence the innovation decision making process by keeping paramount the desirability - a project outcome meets the needs and wishes of people, the feasibility - the project outcome can be given a tangible form in the present, and the viability - the form of the outcome can be sustained by the company and generate value in terms of relevant Key Performance Indicators (KPI’s). A strategic designer’s involvement can be extended to influence more strategic decisions, such as company’s overarching vision, corporate strategy and organizational culture (Calabretta 2016).
Personal Project Brief - IDE Master Graduation

PROBLEM DEFINITION **
Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (~20 full time weeks or 100 working days) and clearly indicate what issues should be addressed in this project.

An important factor part of the decision making process regarding innovation projects is that the risk of innovation projects is inherently non-probabilistic, and is most pronounced in radical projects (Derbyshire, 2017). This factor and the importance discussed above of the decisions themselves regarding innovation projects, makes the decision of moving a radical project to the development stage (Fig.3), to be defined by Shackley, (1995, 1961 as cited by Derbyshire 2016) as a being a one-off crucial decision with major implications for the company. Innovation of meanings, presents yet another challenge. The decision regarding new developed meanings, cannot be based on an existent "scale of judgment", as new meanings imply a new scale (Verganti, 2016 p.80).

This crucial decision of radical concepts being adopted and further advanced in the development stage is also underlined by Markham (2010), who describes a Valley of Death before the development stage. This metaphor shows the difference in resources, or lack thereof, which can lead to the project's ending, if the project does not cross the Valley of Death.

It is not clear from Markham's work, but it can be argued, that in the context of Open-Innovation, the Valley of Death lies during Gate 1 of the process (Fig. 4). The crossing of the Valley of Death of a radical innovation project, from concept to the development stage, is what is meant in this project as the internal adoption of a radical concept.

In the context of innovation projects, even if not always possible, managers would like to be able to rationally assess their decisions and better predict their outcomes. Currently, from a business financial perspective, examples of quantitative tools helping decision makers are the Net Present Value (NPV) and the Return On Investment (ROI) of the innovation project (Calabretta, 2016). However, not taking the right factors in consideration, can cause current assumptions regarding future demand to be incorrect. In the same time, designers that work in the concept phase usually have more intuitive attitude towards innovation. (Calabretta, 2017).

ASSIGNMENT **
State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s)/pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, .... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

In this project the decision making process behind the selection of radical innovation concepts for internal adoption and further development is studied through the design and evaluation of a tool.

I would like to design a tool to facilitate the manager's decision making process regarding the internal adoption of a radical innovation concept explicitly taking into account innovation of meanings and the relevant stakeholders (i.e. designers, engineers, researchers, marketers).

I want to take a strategic design perspective. In strategic design, desirability, feasibility and viability are fundamental criteria in innovation decision-making. I would also want to focus on addressing the assumptions underlying radical concepts and using them more effectively.

Previous work on this topic that I would like to study and base my project upon would be the "The Interplay between Intuition and Rationality in Strategic Decision Making: A Paradox Perspective" by Calabretta, Gerenser and Wörsberg (2017) which proposes a three step process to embed paradoxical thinking in the organization, and "The effect of abductive reasoning on concept selection decisions" by Dong, Lovallo & Mounarath (2015) which proposes that under an abductive frame manipulation, individuals are more likely to accept concepts.
**PLANNING AND APPROACH**

Include a Gantt Chart (please see the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Start Date</th>
<th>End Date</th>
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<tbody>
<tr>
<td>Research and analysis</td>
<td>29.4.2019</td>
<td>20.9.2019</td>
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<td>Literature review/analyses</td>
<td>30.4.2019</td>
<td>21.5.2019</td>
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<tr>
<td>Interviews experts from the industry</td>
<td>22.5.2019</td>
<td>23.5.2019</td>
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<tr>
<td>Literature review</td>
<td>24.5.2019</td>
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<td>Initial model</td>
<td>26.5.2019</td>
<td>27.5.2019</td>
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<td>Create a hypothetical context for the tool</td>
<td>28.5.2019</td>
<td>29.5.2019</td>
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<tr>
<td>User and get feedback in the theoretical design</td>
<td>30.5.2019</td>
<td>1.6.2019</td>
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<tr>
<td>User feedback</td>
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<td>30.6.2019</td>
<td>1.7.2019</td>
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The project will start with literature research and qualitative interviews with experts on the topic from the MOD department. The two activities will run concomitantly and influence each other, one of the objectives of the interviews being finding and addressing relevant literature.

After the interviews with TU Delft experts, qualitative interviews with experts from the field will be conducted.

The interviews and literature will be analyzed and findings will be drawn.

Based on the findings from the interviews and literature, directions for the design of the tool will be made:
- creating a hypothetical context for the tool
- creating the directions
- sparing and getting feedback on the directions from Chair and Mentor.

The design phase will consist of:
- creating vision based on direction
- designing the first version of the tool & while looking for a client to test the tool with
- testing, evaluating (with client/Chair and Mentor) and iterating the design

Writing the report will be done in different stages during the process, at the end of each important stage.

Present the results and graduate in time

IDE TU Delft - E&SA Department // Graduation project brief & study overview // 2018.01 v30

Initials & Name: D.S.F. Floresco

Title of Project: Facilitating the internal adoption of radical innovation concepts
My goal is to have a positive impact in society through my professional activities. I would like to improve someone's experience by bringing new technological developments to people through meaningful products and services. Being a mechanical engineer, I saw too many good engineered products on the market, that nobody needed, which I was perceiving as a waste of resources. I think that poor decision making from management is one of the reasons for the launch of many products that fail in the market. In other words, great and poor innovations need to be adopted or rejected, respectively, by the company first before reaching the user. This is why I want to study how managers make decisions regarding innovation projects.

Innovation should be the core of any business and the focus of its strategy, and I would like to better my knowledge and understanding of innovation decision making through the strategic design perspective, that I mentioned above. I think it is a great way to manage the innovation process of a business, and it can improve value proposition creation and overall sustainable business development.

I am also very interested in the innovation of meanings. From my experience, it's much harder to go deeper than understanding the needs of people, to what is actually meaningful to them. Yet, successfully understanding what is truly meaningful and innovating based on it creates better results. Thus, I would like to better understand innovation of meanings and Design-Driven Innovation (which is argued the best way of developing meanings) and how they can be adopted by a company in order to have a positive impact on the company's decision making and overall strategy regarding innovation.

I read and hear a lot about two teams: innovators/designers and management. And strategic design should be in the middle, or in both, or in one but close to the other one. I think that strategic designers should at least understand both. On one hand, I would like to better understand design, in terms of its ontological and epistemological nature. This is important to me as all of my formal education was very scientifically rooted. On the other hand, would like to better understand traditional business decision-making and strategy.

**FINAL COMMENTS**

In case your project brief needs final comments, please add any information you think is relevant.