‘Effective visualization of strategy’
Master Thesis

FACULTY OF BEHAVIOURAL MANAGEMENT AND SOCIAL SCIENCES
UNIVERSITY OF TWENTE

UNIVERSITY OF TWENTE.

Name:
Z.I.M. Geuke

Student number:
s1209957

Supervisors:
Dr.ir. E. Hofman
R. Siebelink MSc

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Abstract

Appropriate management of strategy is essential for the survival and success of businesses. Effective communication is key for effective implementation of strategy. The use of visualization in strategy communication has effects on the quality of the communication. Various studies find contradictory results regarding whether these effects are positive or negative. A systematic discourse on how visualization can be successfully implemented in strategy communication does currently not exist. In this study, the first step towards creating such a discourse is made. Requirements for the effective use of strategy visualizations were formulated. The key drivers of these requirements were determined to be *strategic content, strategy communication, functional visuals* and *usability.* An existing strategy visualization method, technology roadmapping, was analyzed using the requirements. Technology roadmaps scored predominantly positive, according to the formulated requirements, but showed some room for improvement. A recommendation is made that addresses the shortcomings that technology roadmaps showed during the analysis. In conclusion, in order to effectively visualize strategy, the main focus during the design phase should be addressing its strategic content, strategic communication value, functional visuals and usability.

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1.Introduction

The world is perpetually changing, becoming increasingly complex. conditions change and uncertainty arises. Businesses have to continuously adapt accordingly, to cope with the changing circumstances (Grant, 2003). The survival and success of businesses is affected by its ability to manage its strategy (Teece, Pisano & Shuen, 1997). A strategy can be defined as a pattern in decisions with regards to the intended approaches to change (Mintzberg, 1978).

Hrebiniak (2006) states that the implementation of a strategy yields several problems. These problems share a common driver, as most relate to the fact that strategy formulation and strategy implementation are interdependent and often executed by different actors. Careful strategy design does not always translate to effective execution of said strategy.

Hrebiniak argues that communication, through transfer of knowledge and achieving coordination across operating units within a business, is vital to strategic success. Communication during strategy execution quickly becomes a challenge, since organizations oftentimes consist of multiple layers, different departments, and various functions, all of which can play different parts in said execution (Hrebiniak, 2006).

The stakeholders of strategy communication are all parties that come into contact with the strategy, its communication, implementation and consequences. The stakeholders can be divided into four categories. Top management (Breene, Nunes & Shill, 2007), middle management (Shi, Markoczy & Dess, 2009), regular employees (Hambrick & Canella, 1989) and shareholders (Kaplan & Norton, 2004; Velasco, 2006). These stakeholders must collectively make sure that the strategy is formulated, designed, communicated, and implemented in such a way that all parties are sufficiently informed about the relevant implications of said strategy.

Lengler & Eppler (2007) emphasize that a communicator should not only be occupied with conveying the message, but also shape the message to the recipient's context, in such a way that this recipient can reconstruct the knowledge, integrate it and put it to meaningful action. Li, Guo-hui & Eppler (2011) found four dominant problem areas of strategy communication: awareness and attention to strategy information, understanding and comprehension of the strategy, agreement and support of the strategy, and retention or recall of the strategic content.

There are multiple methods of communication. Many businesses, due to their size, have no other option than to use mediated communication methods for strategy communication, rather than having all communication take place face-to-face. The benefit of mediated communication methods lies in its multiplicative power and its speed to reach a larger audience (Fidler & Johnson, 1984). The weakness of mediated communication methods could be considered its effectiveness when it comes to higher complexities. The complexity of strategies is variable, as complexity can be described to be the amount of all relevant variables

and interactions (Sommer & Loch, 2004). In order to communicate strategies of larger complexity, communication methods have to be appropriate and of sufficient quality.

The communication methods that businesses use to communicate their strategy are not always of sufficient quality. Cummings & Angwin (2011) found that many employees of organizations are not sure what they are meant to do to enact the company's strategy. In a survey by Hunter & O'Shannassy (2007), 79% of the respondents indicated the need to more effectively communicate strategy internally. This suggests that current communication methods are often lacking in quality.

A solution for this lack of quality in communication methods can be found in the conceptualization and visualization of strategy (Farace, Monge & Russell, 1977; Foos & Goolkasian, 2005; Kernbach, Eppler & Bresciani, 2015). Burkhard (2005a) found evidence that there is a huge potential when complementary visualizations are used during strategy implementation, but a systematic discourse on how to actually implement visualization in strategy communication is currently missing.

The findings of Griffin (1995), Bresciani & Eppler (2009) and Vliegen & van Wijk (2006) suggest that the use of visualization in strategy communication affects communication quality negatively. Visual representations could for example be interpreted differently, and strategy visualizations might not always be fit for use given the specific context.

This study is intended to investigate the use of visualization in the communication of strategy. The findings of various scholars, such as those stated above, suggest that there is a fine line between the effective use of visualization in strategy communication, and making communication of strategy more difficult by (ineffectively) implementing visualization.

The objective of this study is to find how strategy can be effectively visualized, so that it improves the quality of strategy communication between stakeholders. Ultimately, the goal of this study was to make a recommendation regarding the effective implementation of visualization in strategy communication. This recommendation has been constructed by creating a substantiated list of requirements that effective strategy visualizations have to meet in order to be considered effective. The requirements for strategy visualizations were determined using the design cycle from the design science methodology (Wieringa, 2014), after which these requirements have been analysed using the key driver method (Heemels & Somers, 2006).

In order to formulate the recommendation, a strategy visualization method was used as a case. This visualization method has been analysed using the newly constructed list of requirements. Suggestions for improvement of this visualization method were made based on its performance with regards to the requirements.

2. Research Design

2.1 Problem statement

Businesses have to continuously adapt in order to cope with changing circumstances and conditions (Grant, 2003). They do so by implementing new strategies or adapting their current strategy. In order for strategies to work, communication is key (Hrebiniak, 2006). Communication is a complex and time-consuming process. Larger businesses tend to use mediated communication methods, which are characterized by the use of information systems, due to their multiplicative power and its speed to reach a larger audience (Fidler & Johnson, 1984). The use of mediated communication does however pose a weakness, as mediated communication methods have a lower effectiveness when it comes to communication of strategies of higher complexity (Fidler & Johnson, 1984).

A solution for decreasing the complexity through communication could be found in conceptualization and visualization of strategy. Various scholars have found the use of visualization to have positive effects on the quality of strategy communication (Farace, Monge & Russell, 1977; Foos & Goolkasian, 2005; Kernbach, Eppler & Bresciani, 2015). Others have found that the use of visualization can have negative effects on the quality of strategy communication (Griffin, 1995; Bresciani & Eppler, 2009; Vliegen & van Wijk, 2006).

The problem addressed in this study is the contradiction in the results of various scholars regarding the effects of the use of visualization in strategy communication. Their contradicting results suggest that the use of visualization in strategy communication can have positive effects, but only when done properly. How this can actually be done seems not to be clear. Burkhard (2005a) supports this statement, as he states that there is no clear discourse on how to implement visualization in strategy communication. He found evidence that there is a huge potential when visualizations are used for strategy communication.

The goal of this study was to make a recommendation regarding how strategy can be visualized effectively so that it improves the quality of strategy communication between stakeholders. This recommendation was formulated using a case, the strategy visualization method of technology roadmapping. This visualization method was used as the base of the recommendation, it has been analysed and suggestions towards its improvement have been.

2.2 Research objectives and questions

In order to make a recommendation, the needs and requirements of all the different stakeholders regarding strategy communication had to be assessed. The researcher set out to find in literature what research has already been done regarding the use of visualization in communication of business strategies. This lead to the formulation of the following main research objectives and the sub-objectives. For each of these objectives, the research questions that are considered relevant are shown.

Main objective: To make a recommendation on the effective use of strategy visualization to improve strategy communication between stakeholders.

A: How to effectively visualize strategy in order to improve communication of strategy between stakeholders?

Sub-objective 1: Define strategy communication

A: What is strategy communication?

Sub-objective 2: Determination of effectiveness in strategy communication

A: What determines effective strategy communication?

B: What obstacles are there that hinder effective strategy communication?

Sub-objective 3: Defining strategy visualization and its use

A: How can strategy be visualized?

B: What determines effective strategy visualization?

C: How does the use of visualization affect strategy communication?

Sub-objective 4: Determination of the role of stakeholders in strategy communication

A: Who are the stakeholders in strategy communication?

B: How is communication of strategy different for the different stakeholders?

C: What requirements do the different stakeholders have for strategy visualization?

2.3 Research model

A research model has been developed to give an overview of the course of this study. This research model is based on the theory by Doorewaard & Verschuren (2007) and is shown in Figure 1. The essence is: Visualization theory has been consulted to look into effective visualization methods, and requirements for effective strategy visualization have been formulated. Communication theory was consulted to determine when strategy communication can be considered effective, and requirements for effective strategy communication have been formulated. Stakeholders of strategy communication were identified, and requirements that they have for the effective use of strategy visualization in strategy communication have been formulated, also, a strategy executive has been interviewed. The four sources of requirements were combined by performing the key driver method. The results of this key driver method have been applied to a case, the strategy visualization method of technology roadmapping, in order to formulate a recommendation regarding the use of strategy visualization in strategy communication.

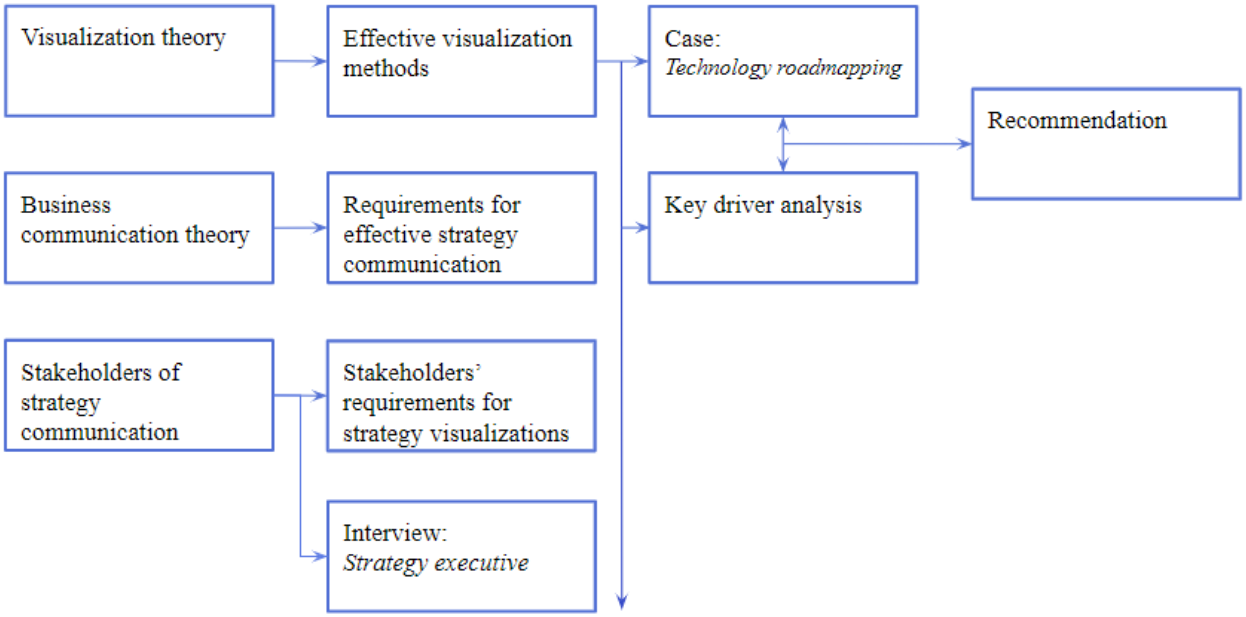


Figure 1: Research model, based on theory by Doorewaard & Verschuren (2007)

2.4 Methodology

2.4.1 Design cycle

2.4.1.1 Description

Assuming that a new, effective strategy visualization is to be created, it has to be designed systematically. Design can be done using different techniques, but in this study the design cycle from the design science methodology has been (partially) used (Wieringa, 2014). This method has been selected due to the fact that it is a rational process meant for designing treatment, that incorporates the requirements from different stakeholders. Wieringa states that treatment is a better term to use here than solutions, as there is a possibility that the designed 'solution' may solve a problem only partially or not at all, it could also introduce new problems.

According to Wieringa (2014), the design cycle is decomposed into three tasks, namely, problem investigation, treatment design, treatment validation, described more thoroughly in the next section. The design cycle is part of a larger cycle, the engineering cycle, which also incorporates treatment implementation and implementation evaluation, shown in Figure 2 below.

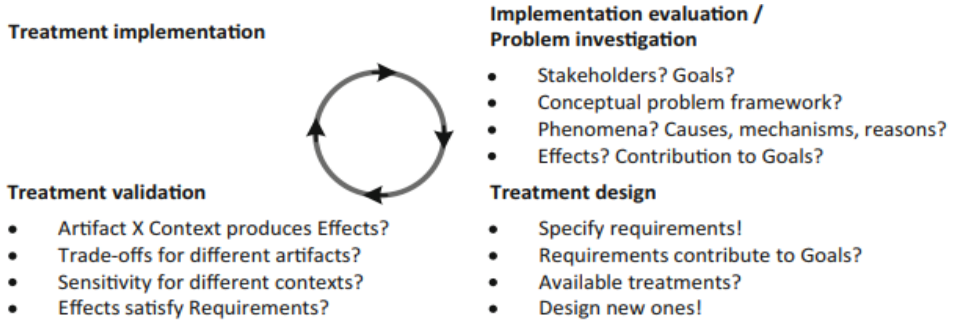


Figure 2: Design cycle (Wieringa, 2014)

The scope of this study limits itself to parts of the first three steps of the design cycle. The problem was investigated and put into perspective, and a set of requirements for a treatment to this problem was constructed. This set of requirements was then be used to assess an already existing treatment. After analysing the existing treatment, a recommendation has been written for the design of a more effective treatment for the problem at hand. This recommendation was then be validated by performing an expert review.

2.4.1.2 Design cycle steps

Problem investigation: The researcher sets out to describe what phenomena must be improved, and why, by doing so, the problem will be identified, described, explained and evaluated. The stakeholders of the problem have to be determined, and their role with regards to the problem described. A conceptual framework is to be created so that the research problem can be framed, putting it into the right perspective.

Treatment design: The researcher must specify requirements for a treatment to the problem, and must note assumptions that are made due to the context of the problem. Also requirements that stakeholders have for the treatment have to be considered. If there are any treatments already available, these can be looked into, to find strengths and weak spots. Ultimately, a new treatment is to be designed.

Treatment validation: The researcher sets out to validate the designed treatment. Does the designed treatment satisfy the requirements that have been listed for it. Does the treatment produce the effects that it was designed to do?

The next section will describe how and to what extent the three steps of the design cycle will be followed through with in this study.

2.4.1.3 Problem investigation

During the first step of the design cycle, literature research has been done in order to create a baseline of understanding regarding the problem at hand. Next, the researcher set out to find out what research has already been done.

The topics that are relevant to this research are *strategy communication, effective communication, visualization of strategy* and *stakeholders of strategy communication.* The goal here is to answer the research sub-questions that have been formulated for these topics.

First, a literature review has been done to elaborate on strategy communication, this was done to figure out what content is communicated exactly, and what techniques or methods are currently used in order to communicate said strategy. Subsequently, literature has been consulted to determine when strategy communication is considered to be effective, and what obstacles one can run into while trying to communicate strategy effectively. Next, visualization literature was reviewed to see how strategy can be visualized, how visualization can be incorporated into strategy communication, and how this affects said strategy communication. Last, the stakeholders of strategy communication have been identified using literature. The role of each stakeholder towards the problem has been be described, and put into context.

2.4.1.4 Treatment design

Now that the specific problem has been defined, it can be addressed. In order to address the problem with a treatment, a list of requirements for said treatment has to be constructed. These requirements can be stakeholder requirements, system requirements or organizational requirements. These requirements also have to be weighed appropriately to the context.

In order to be able to create a requirements list that provides a structured overview, rather than just an unordered list of requirements, the key driver method was used. The key driver method is a structured approach to obtain system requirements in a systematic way and provide an structured overview of said requirements (Heemels & Somers, 2006). For this reason, the key driver method fits well in the overall structure of the design cycle.

The key driver method fits in the broader framework of the CAFCR methodology, which is a decomposition of a system architectural description into five views, as shown in Figure 3 below.

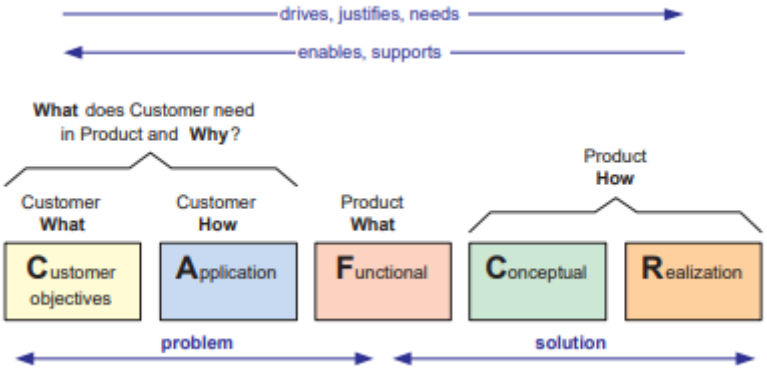


Figure 3: The CAFCR Methodology (Heemels & Somers, 2006)

The key driver method can considered to be a 'CAF submethod' of CAFCR. The key drivers represent the main customer objectives (C view), the key driver method helps to derive the more detailed and quantified system requirements (F view). A bridge between key drivers and requirements is a layer of application drivers, as represented in the A view (Heemels & Somers, 2006). The key and application drivers in the customer views (C&A) can be linked via requirements (F) to design choices in the other views (C&R).

A more thorough explanation of the key driver method, how it is used to gather the relevant requirements, and its application within this study will follow in chapter 2.4.2.

The results of the application of the key driver method have been used to formulate a recommendation regarding the use of strategy visualization in strategy communication. An elaboration on how this recommendation has been constructed will follow in chapter 2.4.3.

2.4.1.5 Treatment validation

After the recommendation has been constructed, the components of this recommendation must be validated. This validation must be done to justify that the treatment contributes to the stakeholder goals, if it were to be implemented (Wieringa, 2014). The goal of validation is to build a theory of the implemented treatment in a real world context.

One way to validate is by expert opinion (Wieringa, 2014). This method has been used to validate the findings of this study. The findings, analysis, and recommendation that were constructed during this study have been submitted to an expert in the field. This expert imagines how the proposed recommendations would interact with the problem context, were they to be applied. The expert predicts whether the effects satisfy the stakeholder requirements. If the anticipated effects of implementation do not satisfy the predetermined requirements sufficiently, this is a reason to redesign the treatment.

Validation by expert opinion only works if the expert understands the proposed treatment, is able to imagine realistic problem contexts, and makes reliable predictions about the effects of the treatment in this context. Within expert opinions, negative opinions are more useful than positive opinions, as negative opinions give early indications of improvement opportunities, as well as indications of conditions of practice that have not been thought of by the researcher.

The researcher set out to find an expert that is knowledgeable within the fields that are relevant to this study, business strategy, (effective) strategy communication, strategy visualization, and strategy stakeholders. This expert was used as instrument to observe, by imagining, how the recommendations made would interact with the actual problem context.

2.4.2 Key driver method

2.4.2.1 Description

This method is generally used for the design of complex products, where different parties have (possibly contradicting) requirements and needs regarding the actual design. During this study, a visualization that is used for strategy communication was considered to be the 'product', also, the stakeholders of strategy communication (strategy executives, top- and middle-management as well as their subordinates) were considered to be the 'customer'. The functional viewpoint used within this study is the viewpoint of those that formulate and wish to implement the strategy.

The goal of using the key driver method is to construct a detailed overview of the key drivers of an effective strategy visualization, along with the requirements that follow through from these drivers. These requirements in turn were used to propose a recommendation regarding the use of visualization in strategy communication. The key driver method involves four steps, which are meant to be iterated, shown on the next page (Muller, 2011; Heemels & Somers, 2006):

2.4.2.2 Key driver method steps

1. Define the scope specific

- Who are considered to be the stakeholders in this situation, and what is considered relevant to them? How are the stakeholders interconnected, and how does this translate to certain requirements? Does the context of strategy communication and the use of visualization within said communication create any new requirements that are not directly related to the stakeholders?

2. Acquire and analyze facts

- Extract facts from product specifications and ask why questions about the specification of existing products. Literature was reviewed to find whether strategy communication in itself introduces requirements for a strategy visualization. A stakeholder analysis was done to construct the stakeholder requirements for strategy visualizations.

3. Build a graph of relations between drivers and requirements

- List all requirements from all stakeholders, and find the key drivers by comparing similarities of requirements, also look for contradicting requirements, build a graph of the relations between drivers and requirements. One requirement can serve multiple key-drivers, and one key-driver results in many different requirements.

4. Obtain feedback

- In order to put the graph of requirements and drivers to the test, it can be discussed with different stakeholders. This could result in new insights or requirements that had previously not been considered.

2.4.2.3 Requirements gathering

To be able to make a valid list of requirements, a set of steps has to be followed through with (Muller, 2011):

1. Stakeholders and their wishes, wants, and needs

- It has to be clear who the stakeholders are, what they want to achieve with the product, and why. This can be done by, for example, doing a stakeholder analysis (Harrison & St John, 1998). The stakeholders' requirements were formulated by reviewing literature, and performing use cases. Cockburn (2000) argues that use cases are the norm for writing functional requirements for object-oriented information systems, which makes this method The use cases are based on a template by Cockburn (2000), shown in Figure 4 on the next page.

USE CASE #	< the name is the goal as a short active verb phrase>	
Goal in Context	<a longer statement of the goal in context if needed>	
Scope & Level	<what system is being considered black box under design> <one of : Summary, Primary Task, Subfunction>	
Preconditions	<what we expect is already the state of the world>	
Success End Condition	<the state of the world upon successful completion>	
Failed End Condition	<the state of the world if goal abandoned>	
Primary, Secondary Actors	<a role name or description for the primary actor>. <other systems relied upon to accomplish use case>	
Trigger	<the action upon the system that starts the use case>	
DESCRIPTION	**Step**	**Action**
	1	<put here the steps of the scenario from trigger to goal delivery,and any cleanup afte>
	2	<...>
	3	
EXTENSIONS	**Step**	**Branching Action**
	1a	<condition causing branching> : <action or name of sub.use case>
SUB-VARIATIONS		**Branching Action**

Figure 4: Usecase template (Cockburn, 2000)

2. Mandatory and non-mandatory requirements

- A distinction has to be made between requirements that must be fulfilled, and requirements that are optional, such as customer wishes.

3. Consider the product to be a black box

- One of the main characteristics of a requirement is that they describe *what* has to be achieved by the product, rather than *how* it has to be achieved.

4. Requirements for requirements

- There are several requirements for the requirements themselves:
    - **Specific**, what exactly is needed?
    - **Unambiguous**, so that there can be no different expectations of the outcome
    - **Verifiable**, requirements must be able to be verified after realization
    - **Quantifiable**, a quantifiable requirement makes it able to verify the requirement
    - **Measureable**, also to support verification of the requirement
    - **Complete**, requirements must be as complete as possible, completeness is a dangerous criterion however, as in practice, requirements are never complete.
    - **Traceable**, all requirements must be able to be traced back to their origin
- Next to the requirements for requirements listed above, there are three requirements that are also relevant, as the product involves human activity, with human capabilities and constraints. All requirements for human stakeholders must be **Accessible,**

Understandable, and have a **Low threshold.** These three requirements may be conflicting with requirements prescribed in the requirement management process. Many problems in practice can be traced back to violation of the human-imposed requirements(Muller, 2011).

2.4.3 Recommendation: Case study

2.4.3.1 Preparation of the recommendation

After determining the key drivers of effective use of strategy visualization in strategy communication, these key drivers can be used to formulate a recommendation. This recommendation is made using an existing strategy visualization method as base. This strategy visualization method was analysed using the key drivers that have been formulated during the earlier phase. Ultimately, it is argued how the visualization method can be improved, why it should be improved, and how this can be done.

2.4.3.2 Technology roadmapping

In this study, the case of *technology roadmapping* has been used as base for the recommendation. The choice for this strategy visualization method has been made due to its presence in the industry and its flexibility in application (Phaal et al., 2004). Phaal et al. (2004) describes technology roadmapping to be a flexible visualization method that supports strategic and long-range planning. Technology roadmaps provide a structured, often graphical means for exploring and communicating between evolving and developing markets, products and technologies over time. Roadmaps can be considered to be dynamic business or system frameworks, that enable the evolution of a complex system to be explored and mapped, supporting innovation and strategy development and deployment at all levels (Phaal, Farrukh & Probert, 2009). Often, hierarchies of roadmaps are used, to enable information at different levels of granularity to be displayed

Within technology roadmaps, there are many different types of specific roadmaps, depending on the purpose of the roadmap, and the type of format used (Phaal et al., 2001). Examples of types of purposes are: Product planning, service/capability planning, strategic planning, long-range planning, knowledge asset planning, programme planning, process planning and integration planning. The different formats that can be used are the following: Multiple layers, bars, tables, graphs, pictorial representations, flow charts, single layer and text. The generic template of the roadmap can be viewed in Figure 5 on the next page:

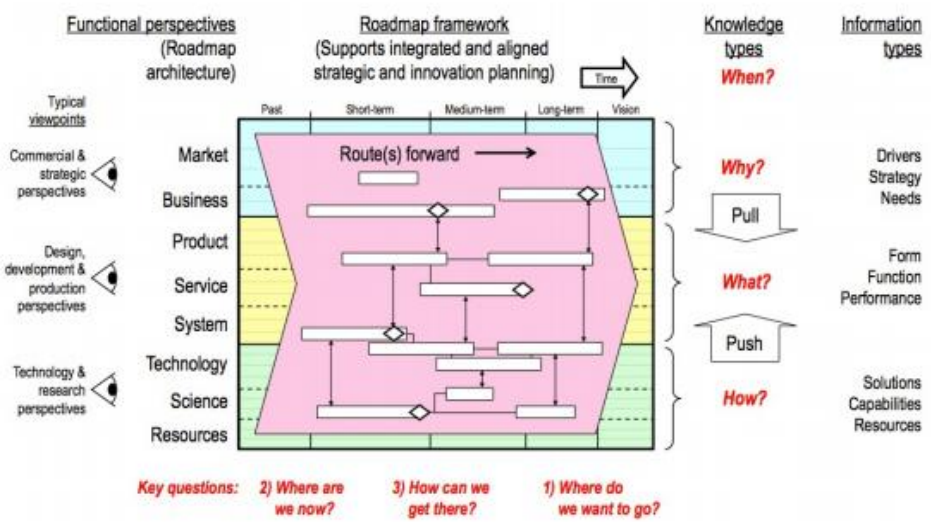


Figure 5: Roadmap template (Phaal, Farrukh & Probert, 2015)

2.4.3.3 Technology roadmapping design

Phaal, Farrukh & Probert (2015) designed the generic technology roadmap template, they claim this is the most flexible and powerful framework for the creation of roadmaps. It comprises a multilayered time-based chart, bringing together various perspectives into a single visual diagram. This type of roadmap enables both *'demand'* and *'supply'* side views to be represented, balancing *'market pull'* and *'technology push'*. The roadmap framework links to the fundamental questions that apply in any strategic context:

1: Where do we want to go? Where are we now? How can we get there?

2: Why do we need to act? What should we do? How should we do it? By When?

Phaal, Farrukh & Probert (2015) state that roadmaps are simple, adaptable *'strategic lenses'*, through which the evolution of complex systems can be viewed, supporting dialogue, alignment and consensus. They state that, although the generic format is helpful for developing strategy, it might not always be the best way to communicate said strategy, depending on context, purpose and audience. This already suggests that there is room for improvement in the current design.

3. Problem investigation:

In this literature review, the researcher showcases previous research regarding the relevant topics: *strategy communication, effective communication, visualization of strategy* and *stakeholders of strategy communication.* The goal here is to answer the research sub-questions that have been formulated for these topics.

3.1 Strategy: definition and description

A strategy can be defined as a pattern in a stream of decisions with regards to the intended changes (Mintzberg, 1978). More specifically, business strategy can be summarized as the set of plans designed to achieve a business' goals, and strategic management is the set of decisions and actions that result in the formulation and implementation of mentioned plans (Koskei, 2003). Strategic management guides the aspects of general management that have effects on the survival and success of businesses (Teece, Pisano & Shuen, 1997) Strategic management can be divided in three interdependent steps, strategy formulation, strategy implementation and strategy evaluation (David, 2011).

Strategy formulation consists multiple tasks, one is gathering and specifying the objectives and goals of the business, and another task consists of planning actions for actors within the business, these actions should be in accordance with the formulated objectives and goals (David, 2011).

According to Hrebiniak and Joyce (1984), strategy implementation is a set of actions regarding organizational structures, key personnel activities, and control systems designed to control performance with respect to the desired ends. Similarly, Floyd and Wooldridge (1992) state that implementation is the managerial interventions that align organizational actions with strategic intention. In order to be able to communicate strategy implementation, all departments of the business are required to be appropriately aligned (Beer, 1980; Venkatraman & Camillus, 1984). Noble (1999) combined several perspectives on strategy implementation, with a focus on the processes involved, this resulted in strategy implementation being defined as the communication, interpretation, adoption and enactment of strategic plans.

Strategy evaluation is the third step of strategic management, where the process of strategy implementation is evaluated. During this third step, the business' actions, as carried out during the implementation stage, are monitored, to verify whether they are in line with the business objectives or goals as described during the strategy formulation stage (David, 2011). If evaluation is properly carried out, this creates a closed loop, feedback from the implementation can be used in the next formulation stage.

Alternatively, strategies can form gradually, rather than being a set of the three steps mentioned above. Strategy makers can choose to make strategic decisions one by one, forming and adjusting the overarching strategy over time. Mintzberg (1978) refers to this as strategy formation.

3.2 Strategy communication: definition and description

It is clear that there is a need for effective and sound inter-organizational communication, in order to formulate, implement and evaluate strategies. The survival and success of a business is partly dependent on the effectiveness of its strategic management (Teece, Pisano & Shuen, 1997), therefore it is of importance that communication is of sufficient quality. It could be argued that the implementation stage of a strategy consists mostly of the communication of said strategy to all actors involved. Kaplan & Norton (2005) define strategy communication as "*Communicating and educating employees about the strategy of the organization" (p. 18)*. They also state that effective communication to employees about strategy, targets, and initiatives is vital if employees are to contribute to the strategy (Kaplan & Norton, 2005).

Hrebiniak (2006) states that the implementation stage always involves more people than the formulation stage. In addition to this, strategy implementation is usually played out over longer periods of time. Communication down the organization, or across different functions or departments, over a longer time span, becomes more of a challenge. Especially when the number of people involved is large, the challenge of effective strategy communication becomes greater. Hrebiniak (2006) also argues that communication through transferring knowledge and achieving coordination across operating units within a business are vital to strategic success.

Beer & Eisenstat (2000) state that one of the major barriers in strategy implementation is poor vertical communication, this is in resemblance with what Hrebiniak (2006) argued. When strategies are formulated, this is usually done in the upper side of the chain of command. In order to implement said strategy, it has to be communicated vertically down the organization, involving a larger amount of people.

Farace, Monge & Russell (1977) state that communication also plays a key role in overcoming resistance to innovations and in the reduction of uncertainty. Strategy being an innovation that has to be adopted by the entirety of the business, suggests that proper communication is vital to successful implementation of said strategy.

Hambrick and Cannella (1989) argue that employees are the people who will make a strategy work, requiring them to be fully informed about the intended changes to the current course of events and underlying intentions of these changes. Employees have to be 'sold' a strategy in order for it to work, requiring full understanding of said strategy. If the quality of the executed communication is not sufficient, thus not having 'sold' the strategy to employees, this will result in insufficiently informed employees, limiting adoption of changes, and therefore making the implementation of a strategy less successful.

Fidler & Johnson (1984) state that an increase in communication is linked to a decrease in uncertainty, therefore lowering resistance to adoption of new strategies. Communication can be used as tool to counter to the problems that arise when strategies become more complex, however, the proper execution of communication itself introduces new obstacles too.

3.3 Strategy communication: managing change

Hrebiniak (2006) argues that there are two different approaches to managing large changes due to implementation of new strategies; sequential or complex change. A sequential intervention consist of smaller, more manageable pieces or proportions of the large change, over a longer period of time, whereas a complex change consists of all changes to be implemented simultaneously during a usually shorter implementation horizon. Depending on the objectives of the implementation of a new strategy, and the anticipated time-horizon in which these objectives are to be achieved, different approaches are appropriate. Hrebiniak (2006) suggests that an organization that faces a large strategic change should always rely on sequential change, when there a sufficient time span to do so. It could however be the case that there simply is not enough time to perform all portions of the change step-by-step, where complex change becomes the favourable choice. Below, the benefits and disadvantages of the two types of change are listed.

Sequential change benefits from its step-by-step process, as this allows managers to reduce resistance to change, as the success of the first stages in the change process can be used to win over doubters who were originally against the entire intervention. Step-by-step sequential change also allows cause-effect analysis of the independent steps, since the degree of success during certain stages can be attributed to specific steps. Lastly, sequential change allows for incremental investment of time, money and effort. There is no need to "bet the entire house" on a new strategy, as small portions of an investment can be done with minimal risk, lowering the overall risk profile and uncertainty for the organization (Hrebiniak, 2006).

Sequential change has several disadvantages that can be attributed to one characteristic. Sequential change takes time. Different parts of the change are spread over the course of months or even years. One disadvantage that results from this is that people lose sight of the ultimate goals of the change. Another disadvantage of the long implementation horizon of sequential change is the volatility of external factors, over the course of several months to years, competitors' actions or plans could change, consumers could change in spending behaviour, rules and legislations presented by the government could change. Sequential change must always be ready to adapt to any of these external sources of change.

Complex change, in contrast to sequential change, benefits most from its implementation horizon, as complex change can be done over much shorter periods of time. This shorter time span allows for quick adaptability to changes from external sources. Complex change allows large problems to be confronted faster, and simultaneously.

It is however difficult to coordinate and control complex change, as too much is going on at once. Secondly, cause-effect analysis is next-to impossible, as the effects of independent steps of the larger change are almost not analysable. Third, learning suffers, resulting from the inability to do cause-effect analysis, organizations are almost unable to learn from mistakes, as it is unclear what portion of the overall change caused a certain outcome. Fourth, it is necessary to relax the performance criteria against which people are held accountable. The only way to make a complex change work, is to reduce its complexity.

Sommer & Loch (2004) describe complexity as the amount of variables and interactions, they however also state that the use of the term complexity is not consistent in literature. Using the definition of complexity of Sommer & Loch (2004), when there is a high amount of variables and interaction, this leads to increased difficulty in assessing optimal actions beforehand.

Fidler & Johnson (1984) define complexity as the number of dimensions along which an innovation can be evaluated by a potential receiver, which makes it an inherent characteristic of said innovation, innovation here being the business strategy. They argue that a greater complexity leads to higher resistance to adopting a new strategy within the organization. They also found greater complexities to be linked to a lower likelihood of successful strategy implementation.

In the context of strategy, the variables or dimensions that are most relevant for businesses are industry characteristics, environment, size, time span of change, and objectives. Larger businesses, those that operate in uncertain industries and/or environments and businesses with more complex objectives over shorter time spans, and all possible combinations, are required to implement strategies of larger complexity to be able to cope with its conditions. This higher complexity might result in added risk, higher inter-organizational adoption resistance, uncertainty and a lower likelihood of successful implementation (Fidler & Johnson, 1984).

The sequential change process as defined above, offers a method of reducing complexity, it does this by spreading the objectives of a strategic change over a longer period of time, this enables the business to account for changes in the industry or environment, while taking its time to follow through with the steps required to make the larger overall change.

In turbulent, highly competitive and/or changing industries however, there could simply be insufficient time to apply the sequential change process. A business might not have the ability to timely react to external forces, and has to stay ahead. In order to be able to do so, the business must find other methods of reducing complexity, enabling complex change

Summarizing the relevance of the change approaches and strategy complexity, time spans of objectives are of great importance, change has to be made in an appropriate fashion, accounting for all relevant (both internal and external) factors.

3.4 Strategy communication: obstacles

Next to the varying complexities of strategies, there are more obstacles that prevent strategies to be communicated properly, e.g. Lengler & Eppler (2007) emphasize that the communicator should not only be occupied with conveying the message, but also shape the message to the recipient's context, in such a way that this recipient can reconstruct the knowledge, integrate it and put it to meaningful action.

Kaplan & Norton (2008) emphasize that strategies that are not communicated well are very difficult to execute well. Executives would prefer a decent strategy that is executable by their organization to a brilliant strategy that the organization does not understand and therefore cannot deliver. In other words, a strategy that is clearly communicated enables better strategy implementation. In a 2005 study, more than 90% of a company's employees were found not to be aware of its strategy, or not to comprehend it (Kaplan & Norton, 2005).

Kaplan & Norton (2008) state that employees can't implement a strategy that they are not aware of, and employees who do not understand the strategy are unable to link their daily actions to its successful execution, management should therefore align employees with the strategy. All employees have to understand the strategy and are motivated to achieve it, in order for it to be successfully executed.

Cummings & Angwin (2011) found it not to be a surprise that many people in organizations are not sure what to do to enact the company's strategy, as a result of the fact that company strategies are generally being captured in and communicated by documents and generic PowerPoint presentations, that are packed with text and numbers. In a study by Hunter & O'Shannassy (2007), 79% of respondents to a survey indicated the need to more effectively communicate their strategy internally. This suggests that communication as it is carried out now leans towards being of insufficient quality.

According to Hrebiniak (2006), one basic problem is that managers know more about strategy formulation than implementation. They've been trained to plan, not implement plans. A large difference can be distinguished between planning a strategy and executing implementing strategy, since planning a strategy involves little communication, while implementation consists largely of communication. Another problem Hrebiniak (2006) found is that some top-level managers believe strategy implementation is 'below them' - something best left to lower-level employees, while improper informed lower-level employees, as result of insufficient communication, are unable to execute plans accordingly. This inability of managers in execution or implementation of strategies is a result of most MBA programs being focussed on strategy formulation and functional planning. Core courses are typically about competitive strategy, marketing strategy, financial strategy etc. These core courses do however lack the emphasis on the actual 'doing' (Hrebiniak, 2006).

Li, Guo-hui & Eppler (2011) did a literature review, reviewing 60 studies regarding strategy implementation, and found four main problem areas that hinder said implementation: *attention, comprehension, agreement* and *retention.*

Attention:

Consensus can not be achieved if lower-level management and nonmanagement are not aware of the same information as those that are trying to implement the strategy, therefore, proper attention to the strategic information needs to be stimulated. Kaplan & Norton (2008) found that *"employees cannot help implement a strategy that they are not aware of"*(p. 12)

Comprehension:

Employees who do not understand the strategy are unable to adjust their daily actions to its successful implementation, it is deemed important that employees really understand the strategy rather than just seeing or hearing about it. A shared understanding of management and those at the operational level with the strategic goals is of critical importance for effective implementation.

Agreement:

Management should align employees with the strategy, as the majority of employees is required to agree with and be committed and motivated to implementing the strategy, in order for it to work. Schaap (2006) concluded that *"when employees do not understand and agree with the company's strategic plan, there will be a much higher likelihood that the implementation process of that plan will fail"* (p. 23).

Retention:

The strategy needs to be communicated in a memorable way, to stimulate retention in employees. An employee that can not remember the key elements of the strategy is an employee who cannot participate to the successful execution of the strategy. Collis & Rukstad (2008) state that few executives can remember the companies' strategy enough to be able to summarize it in such a way that colleagues would put it the same way. This suggests that said executives have not been instructed about the strategy in a memorable way.

3.5 Strategy communication: effectiveness

Communication can be executed in various ways, but for communication to be effectively executed, the problems summed above have to be overcome.

Fidler & Johnson (1984) found one of the primary structural features associated with the diffusion of innovation within organizations to be the number and arrangement of communication channels. Each channel has its own capacities with regard to the type and volume of information that is to be shared among parties. The efficacy of communication channels is important, as it partially determines the cost effectiveness of the process of strategy implementation.

Rogers & Shoemaker (1971) state that there are two possible channels of communication that have been focused on in innovation research: Interpersonal, involving primarily face-to-face modalities; and mediated channels, which are usually a method that lies between source and receiver (often referred to as mass media).

Carr & Kaynak (2007), state that there are multiple methods of communication, traditional communication methods are those that involve the use of telephone, fax, email, written and face-to-face contact. More advanced methods of communication are computer-to-computer links, electronic data interchange and enterprise resource planning.

Interpersonal channels can often provide the social support and enhanced confidence in the outcomes of the innovation that is crucial to the implementation of this innovation (Katz, 1957; Katz, 1961). Mediated channels, usually written ones, provide information in a more general way. The strength of mediated channels lies in its multiplicative power and its speed to reach a larger audience (Fidler & Johnson, 1984). "*For increasingly risky innovations, interpersonal channels will become increasingly effective in innovation implementation; conversely, with decreases in perceived risk, mediated channels become more efficacious in innovation implementation*" (Fidler & Johnson 1984, p. 708).

Communication costs that are linked to the use of interpersonal communication channels are usually higher than those linked to mediated channels. Therefore, when risk and complexity are low, mediated channels can widely distribute all essential information

regarding the intervention not only with a minimum of effort, but also costs (Rogers & Shoemaker, 1971). It could be beneficial to find a method or mean of communication that both benefits from the low effort and costs of a mediated channel, but also addresses potential complexity issues.

One key for the better execution of strategies is thus to engage employees through a better way of communicating the strategy. Many researchers have mentioned the importance of communication for the strategy implementation process (Mazzola & Kellermanns, 2010) and "communication is mentioned more frequently than any other single item promoting successful strategy implementation" (Li, Guo-hui & Eppler, 2011, p. 18).

Yet, little empirical research has so far looked at what really constitutes effective managerial communication of business strategies (Kernbach, Eppler & Bresciani, 2015). Kernbach et al. (2015) state that strategy communication could benefit from the use of visualization, as there are extensively documented benefits of graphic representations for complex communication.

3.6 Visualization: definition and description

Visualization is a very broad concept, it includes everything that involves some kind of graphical or visual display. MacEachren (1994) defines visualization as *"to bring something as picture before the mind"* (p. 53). Usage of visualization can range from simple, for example a euro-symbol (€) instead of 'euro' in plain text, to more complex, for example an interactive map of air pressure over time, such as used in the weather report in the news. A visualization can replace one word, but can also tell an entire story with one figure. When the weather reporter shows a map such as described in the example, this carries a relatively large message, one view of a weather map can explain the forecasted weather of a day or even week to even those that are uninstructed.

3.7 Visualization in communication: benefits & disadvantages

In psychology literature, Foos & Goolkasian (2005) state that people can receive and understand instructions with higher complexities far more readily when they are presented graphically, rather than textually. Further, individuals have better recall of pictures, while printed words receive less attention. This suggests that adding visuals in the form of graphs or pictures to mediated channel communication could make the use of mediated channels for communication a more viable method when complexities are higher, while keeping effort and costs low.

Farace, Monge & Russell (1997) argue that communication through mediated communication channels benefits from the use of symbol systems, as these reduce uncertainty, making the contents of the message more clear to readers. The reduction of uncertainty subsequently contributes to the reduction of complexity. Symbol systems, when properly implemented, are collections of symbols that evoke similar symbol-referent

relationships for both the sender and receiver of messages. This in turn makes it possible for communication to be less filled with text.

Similarly, Rode (2000) has shown that processing information through the visual system rather than through language can substantially increase the degree to which complexity can be handled successfully. *"Representing connected information visually rather than verbally serves as an important tool to support knowledge capturing by reducing working memory capacity demands and thus enhance our ability to perceive complex relationships"* (p. 7).

Tory & Möller (2004) state that visualization can support cognition of data or information in various ways. visualization can increase resources through *parallel processing, offloading work to the perceptual system, reduce demands on human memory, and increase storage and accessibility of information*. Next to that, visualization can help *group related information, represent a large quantity of data in a small space,* and *impose structure on data and tasks in such a way that it reduces task complexity*. Visualization can also enhance recognition, as *visualizations of information are easier to be recognised than recalling said information,* and *higher level patterns can be recognised if data is aggregated more selectively.* Visualization can also support cognition through *perceptual monitoring* and being a *manipulable medium, since using preattentive visual characteristics allows monitoring of a large number of potential events,* and *manipulation of the structural organization of data may allow different patterns to be recognised* (Tory & Möller, 2004).

Kernbach, Eppler & Bresciani (2015) did an experiment to gather evidence regarding whether the use of visualization is better than text in communication of a business strategy. Subjects were found to pay significantly more attention to, agree more with and better recall the strategy when they had seen a graphic representation of the strategy rather than a textually identical bulleted list version. However, no significant difference could be found regarding the comprehension of the strategy. Subjects that were shown graphic representations of strategies perceived the presentation and presenter significantly more positively than those that were shown bulleted lists.

Contrarily, Griffin (1995) found the use of visuals in business communication through symbols to be more complicated. The use of symbols could be an aid in lowering complexity when communicating. The meaning and message that symbols carry are however largely dependent on how they are interpreted. "*When considering the importance of business communication and the fragile nature of the message, business people must recognize that symbols mean different things to different people" (p. 186).* Griffin (1995) also states that the interpretation of certain symbols is influenced by cultural differences. This brings up the following problem, how must visualization be implemented in communication, to ensuring that said visuals represent the actual message correctly, to all receivers respectively.

Abdallah & Langley (2014) state that this ambiguity in strategic communication is not necessarily bad, as it can offer considerable benefits, such as enabling strategic development and change, and contribution to cyclical patterns of strategy development and reorientation.

Bresciani & Eppler (2009) did a literature review to investigate other potential pitfalls of visualizations used for communication. They did so in order to attempt to deepen and structure the understanding of the possible limitations of visualizations, rather than to

diminish the potential of visualization. A better understanding of the limitations enables the support of designers' decisions on the use or modification of the appropriate visual format. Based on their findings, they distinguish between cognitive, social, and emotional risks of visualizations, that can be viewed from two perspectives, the point of view of the designer of the visual representation, and the point of view of the 'user'. Table 1 below shows an overview of the risks of visualization, where a distinction is made between the three types of risks, and the perspective.

	Designer induced	**User induced**
Cognitive	Ambiguity Breaking conventions Confusion Cost to make explicit Cryptic encoding De-focused Hiding/obscuring Implicit meaning Inconsistency Low accuracy Misleading Misuse of figure-ground Not respected gestalt principles Over determinism Over/under reliability appearance Over-complexity/simplification Redundancy technology/template driven Time consuming to produce Unclear Unevenness	Change blindness Channel thinking Depending on perceptual skills Difficult to understand High requirement on training and resources Misuse Overload Reification Wrong salience
Emotional	Disturbing Boring Ugly/ unappealing Wrong use of colour	Visual stress Personal preferences Prior knowledge and experience
Social	Affordance conflict Hierarchy, exercise of power Inhibit conversation Rhythm of freezing and unfreezing Turn taking alteration Unequal participation	Altered behavior Cultural and cross-cultural differences Defocused from non-verbal interaction Framing effect Different perspectives Hiding differences of opinion Time consuming to agree upon

Table 1: Risks of visualization (Bresciani & Eppler, 2009)

Another distinction that can be made in the designer induced risks is whether the problem is intentional or unintentional. Bresciani & Eppler (2009) state that their review of the literature resulted mostly in unintentional problems, mistakes made by the designer, but after a careful analysis they considered the possibility that risks may be intentionally induced by a designer, for example for manipulative purposes.

3.8 Visualization methods

There are many visualization methods. *"A visualization method is a systematic, rule-based, external, permanent, and graphic representation that depicts information in a way that is conducive to acquiring insights, developing an elaborate understanding, or communicating experiences" (Lengler & Eppler, 2007, p. 1).* In their paper, Lengler & Eppler (2007) attempted to create visual overview of all visualization methods that are fit for use in management. It is called the periodic table of visualization methods, and within this table they categorized the visualization methods based on five dimensions. These five dimensions were based on previous (meta-)taxonomies as proposed by previous studies, and are chosen specifically because they should address challenges related to managerial thinking(cognitive challenges), managerial communication(social challenges) and the managers' ability to motivate and engage their peers and employees(emotional challenges). The five dimensions are described below:

Complexity of visualization

Low to *high*, referring to the number of rules applied for use and/or the number of interdependencies of the elements to be visualized. As it is with strategy, visualizations can vary largely, as a lot of variables could be accounted for.

Main application or Content area

Visualizations tend to differ according to what kind of information they are representing, these kinds of information can be categorised under: *Data*, *Information*, *Concept*, *Metaphor*, *Strategy*, *Compound Knowledge.* It is important that it is clearly visible what kind of information is being shown.

Point of view

This dimension describes the extent to which detail is shown, also categorised: *Detail* (individual item highlighting) *Overview* (big picture), and the combination *Detail and Overview* (both at the same time). The point of view immediately shows what detail is meant to be emphasized by the visualization.

Type of Thinking Aid

Is the visualization method trying to reduce complexity, then it is *Convergent*, if it adds complexity, it is *Divergent*. Visualization can be used to simplify information of high complexity, while it could also show the complication of something that seems simple firsthand.

Type of Representation

There is *Process* representation, which is stepwise cyclical in time and/or continuous sequential, and *Structure* representation, for example hierarchy or causal networks. This is also an important dimension, as here again, the visualization should be very clear as to what type of information it is trying to convey.

An example of visualization in business communication can be found in business modelling, where models are becoming increasingly more complex, similarly to business strategies. Visual representations of a business model usually enhance understanding among readers (Osterwalder & Pigneur, 2005). Gordijn & Akkermans (2003) found that using conceptualizations to capture business models enables users to present them graphically, with little additional effort.

3.9 Visualization of strategy

Lengler & Eppler (2007), argue that strategy visualizations are visualizations of concepts, and what sets them apart from other concept visualizations is is their higher degree of complexity of visualization. This higher degree of complexity can be explained by the fact that obtaining an understanding of the visualization may require more management or domain specific knowledge. They found a sizable amount of visualizations that are used for strategy communications: *supply demand chain, performance charting, strategy map, organization chart, house of quality, feedback diagram, failure tree, magic quadrant, stakeholder rating map, porter's five forces, s-cycle, stakeholder map, life-cycle diagram, technology roadmap, edgeworth box, portfolio diagram, strategic game board, mintzberg's organigraph, zwicky's morphological box, affinity diagram, decision discovery diagram, bcg matrix, strategy canvas, value chain, hype-cycle ishikawa diagram, taps and spray diagram.* Even though these visualization methods are all meant to visualize strategies, they differ in degree of complexity, *low to high*, point of view, *detail, overview or both,* type of thinking-aid, *convergent or divergent* and type of representation, *process or structure visualization*.

Burkhard (2005a) introduced Strategy Visualization, which is defined as the systematic use of complementary visual representations to improve the analysis, development, formulation, communication, and implementation of strategies in organizations. Strategy Visualization is more than a mapping of measurements, as it is developed to engage and activate employees. Since a strategy is required to be communicated to the stakeholder's context, it is similar to other knowledge visualizations. The Strategy Visualization is based on the Knowledge Visualization Framework (Burkhard, 2005b; Eppler & Burkhard, 2006), which designates all graphic means that can be used to develop or convey insights, experiences, methods, or skills among individuals. For effective transfer and creation through knowledge through visualizations, four questions should be considered:

What's the goal of using a visualization method?
What type of knowledge needs to be visualized?
Who is being addressed?
What is the best method to visualize this indicator?

In a case study, Burkhard (2005a) revised the Knowledge Visualization Framework and applied it to strategies. Applying the framework opened up a new understanding of how a strategy can be communicated by using complementary visualizations. Two conclusions were drawn, within the implementation of strategies, there is a huge potential when complementary visualizations are used, and currently, a systematic discourse on visualization in strategic

management is missing. The visualizations used in their case study had attracted individuals, presented overview and detail, and fostered the creation of a shared vision among the presenter and addressees. The complementary use of visualizations, illustrating different levels of detail and different aspects of the strategy, lead to more motivation and engagement regarding the strategy implementation.

Cummings & Angwin (2011) argue that individualized visualizations of strategy could enable more effective conceptualization and communication of strategies that are higher in complexity. They refer to this visualization of strategy with the term stratography. Stratography is defined as pictorial abstractions that outline the unique terrains and/or some relationships related to this terrain: competition, internal relationships, or market conditions in which organizations are embedded.

3.10 Visualization of strategy: design criteria

According to surveys conducted by Cummings & Angwin (2011), there are seven good stratography practices. These stratography practices could be called the design criteria for a functional strategic visualization. Four of these criteria are associated with mechanical movements, stopping the eye, spreading the eye across a terrain; enabling the eye to seek out connections; and facilitating the eye to zoom in and out. The latter three are more related to cognitive and sensual principles, mimesis, synaesthesis and mnemonics.

Attracting and focusing the eye

Good stratography requires the eye to be stopped, in order to command a viewer's attention. To do so, the visual representation should be perceived to be interesting, useful and easily comprehensible. Key elements for stopping the eye and encouraging it to pay attention to a visual are:

- *Novelty,* which can go a long way toward earning a second glance, but too much can make a graphic to appear irrelevant;
- *Aesthetics,* clear lines and good use of colours, not too many of either;
- *Purpose,* the first time a graphic is viewed, it should be clear what it seeks to do.
- *Utility,* the graphic should convey a sense that the viewer could acquire interesting information from it.

Spreading the eye

In western cultures, the eye is generally accustomed to scanning graphics hierarchically from the top left corner across and down the page, or clockwise from left to right, down and back around. In business context, good stratography should work with, rather than against, this grain. Enabling the eye to move in a comfortable manner, so that it can quickly more understand the underlying message, is generally more effective.

Encouraging the eye to search

After attracting and focusing the eye, a good graphical representation may do two more things simultaneously. Keeping it engaged to the picture, and begin to loosen up the eye, enabling it to seek new patterns or information.

Facilitating the eye's zooming in and out

The visual representation should enable the eye to see both the big picture and the detail, as both the simple and complex components are important aspects of effective strategic action. Good stratography should support this. Too much detail can turn people off, so the fewest dimensions necessary to aid decision making should be incorporated. Even though three dimensions may be a better representation of reality, two-dimensional graphics or maps allow work to be much easier. Within the two dimensions, no more than seven colours, seven directions or seven value categories should be introduced, as this would become too detailed. Similarly, the amount of different shapes should be kept low, to simplify complexity.

Mimesis: Leading the eye in human direction

Visual representations can mirror the different directions that individuals might take in actual life. Strategy implementation, presented as text, can only go left to right and top to bottom, other directions would lead to confusion, whereas visuals can show mimetic dimensions that help learning and retention by connecting cognition to physiology.

Synaesthesis: uniting different modes of communication, sense and behaviours

An advantage with regards to communication that visualizations have is that it can be multimodal: it can consist of more than just text. Multimodality enhances the ability to communicate meaning (Hull & Nelson, 2005). Effective multimodal visual representations also have a synaesthetic effect, that is, they encourage readers to engage other senses to work together to give the visual a greater meaning. For example, a good map of subway tracks invites you to trace what you see. Synaesthesis supports readers to get a greater mental connection to the meaning of the visual.

Mnemonics: Entering the mind's eye

Subsequently, a good stratography should be mnemonic: easy to remember. It is more likely that a reader will remember a graph and its meaning as opposed to a plain text that covers the same information. This 'stickiness' is most important for strategy communication, as it should be enacted in real time, all the time. It is most helpful if people are able to recall a broad picture of how they are instructed to contribute. This mnemonic quality of visual representations is mostly a sum of the six practices listed above, if performed correctly. If the visualization is able to; arrest the eye; spread the vision across the picture; draw in the eye and lead it in certain ways; aid the viewer in zooming into specific details of the greater picture; bring other senses into play; and help focus the viewer's mind, then the chances are high that it will be remembered. One important additional requirement here is the rule of seven, an interesting eccentricity of the way the human brain works. Humans tend to be more able to remember visuals that have seven or less main elements as opposed to more than seven.

3.11 Stakeholders of strategy communication

There are several stakeholders that are relevant to strategy, its formulation, communication and implementation, listed below:

Top management

This is the team that formulates, designs and wishes to implement the strategy in a business. Some top management teams have a chief strategy officer (CSO)(or equivalent), this is a executive who is responsible for developing, communicating, executing, implementing and sustaining strategic initiatives in businesses (Breene, Nunes & Shill, 2007). Their role in use of the strategy communication is the largest. CSO's articulate a clear definition of the strategy, and explain how each employee can fit into the greater scheme of this strategy by adjusting their daily activities to the overall business objectives. Through the use of the strategy communication, they spread all knowledge required to implement the strategy, down the chain of command to all levels or departments of the business (Breene, Nunes & Shill, 2007).

Middle-management

These are the groups of managers who are located below top-managers and above first-level supervision in the hierarchy, that disseminate and communicate the strategic plans that top-management wishes to implement down the chain of command, to their subordinates (Wooldridge, Schmid & Floyd, 2008). Shi, Markoczy & Dess (2009) argue that middle management plays a brokerage role in businesses, where they mediate the flow of resources or information between other unconnected actors. In this case this means that they communicate strategic information down the chain of command, and if this results in difficulties or other problems, these can be communicated back up the chain of command.

Regular employees

This is essentially all non-management personnel. These are the individuals that have to execute the plans that are described in the strategy. How the strategy relates to their everyday activities is what is relevant to them. Also, how their activities fit into the bigger picture of the business' activities may prove to be important to them. Hambrick and Cannella (1989) argue that all employees need to be sufficiently informed about the strategy and its implications, in order for it to work. Their role can be described as the actor that actually executes the plans described in the strategy.

Shareholders

Shareholders are internal and external individuals or groups that legally hold shares of the company. Shareholders are concerned with the business increasing or at least sustaining its shareholder value, and strategy is how a business intends to create sustainable growth in shareholder value (Kaplan & Norton, 2004). Shareholders are affected by strategy and have power in influencing it to maximise shareholder value for themselves (Velasco, 2006).

3.12 Summary of literature review

In order to give a structured overview of the findings of the literature review, some of the sub questions as formulated in the study design have been answered below.

Sub-objective 1: Define strategy communication

A: What is strategy communication?

Strategy communication can be described as the communication and education of employees regarding the strategic goals of the company. This means that all employees of an organization have to be thoroughly informed of what their daily activities are, and how these activities fit into the greater scheme of the business' objectives. Strategy communication is a substantial component of the process of strategy implementation. Sufficient strategy communication has been found to be a requirement for businesses to successfully implement their strategies. The content that is to be communicated includes but is not limited to all strategic plans that the business

Sub-objective 2: Determination of effectiveness in strategy communication

A: What determines effective strategy communication?

In order for strategy communication to be effective, several main problems have to be overcome. These main problems are: raising attention and awareness amongst those that are communicated to, making sure that the communicated strategy is understood thoroughly enough to be able to put it to use, stimulating support and commitment of the strategy, and communicating in a memorable way, so that it can be clearly remembered.

B: What obstacles are there that hinder effective strategy communication?

There are different sources of obstacles that hinder effective strategy communication, not all of which can be avoided. For example, when businesses grow, this often involves an increase in the amount of employees it has, which in turn makes communication more difficult, as more individuals have to be informed of the course of events. Other obstacles in achieving effective strategy communication are all practices that:

- Do not foster awareness of employees to the strategy
- Communicate the strategy in such a way that it is not understood by those that are enacting the activities it involves
- Do not inspire employees to support and commit to the strategy
- Are not memorable enough for employees to remember

Sub-objective 3: Defining strategy visualization and its use

A: How can strategy be visualized?

Visualization is a broad concept, it includes anything that brings a picture or message to mind through the use of a graphical or visual display. Regarding to strategy, visualizations are usually representations of strategies or elements of said strategy, displayed in such a way that it gives a clear overview. There are numerous methods of visualization that can aid in communicating strategies. Examples are *strategy maps*, *porter's five forces*, *technology roadmaps*, *strategy canvases*, and *value chains*.

B: What determines effective strategy visualization?

Effective strategy visualization takes place when the visualization is able to aid or replaces dialogue regarding strategy communication. Visualization, when implemented correctly, can aid in communication by for example conveying the same message with less text, or by giving a better overview of the entire process for comprehension purposes. Effective use of visualization in strategy communication can lead to an increase in attention, agreement and degree of retention of said communication. The use of complementary visualizations in communication is expected to have great potential in improving said communication

C: How does the use of visualization affect strategy communication?

There is a dichotomy in literature regarding the effects of visualization on communication quality. On the one hand visualization is expected increase communication effectiveness through enhancing attention, agreement and retention levels, but due to ambiguity, the addition of visualization could also lead to confusion, especially when the information that is being communicated could be interpreted differently by different parties.

Sub-objective 4: Determination of the role of stakeholders in strategy communication

A: Who are the stakeholders in strategy communication?

The stakeholders of strategy communication can be categorised in four groups, top management, middle management, regular employees and shareholders.

B: How is communication of strategy different for the different stakeholders?

Each stakeholder has a different role regarding strategy communication, for example, top management is mainly responsible for the formulation of said strategy and communicating it in such a way that their subordinates know what to do or how to communicate the information down the chain of command towards the respective relevant parties. Middle management's role in strategy communication can be summarized as the brokerage role.They manage the flow of strategic resources up and down the command, providing subordinates with the information that is relevant for them, and providing feedback regarding the execution of the strategic plans to their superiors. Regular employees are the individuals that actually execute the strategic plans, their role in the communication of strategy more passive. The are supposed to be 'sold' the plan and its consequences. If their motivation, attention, support, comprehension and retention of the information is not sufficient, they will not be able to execute the plans as effective. Shareholders also hold a more passive role. They wish to be and stay informed about the business and its activities, therefore they are concerned with how the business' strategic plans aims to increase the shareholder value (or at least sustain).

The information gathered during this literature review has given a more in-depth view into problem and its context. A framework was created regarding the research topics strategy, strategy communication, stakeholders of strategy communication, and strategy visualization. Next up is the design of a treatment to the problem. In order to design a treatment, requirements for such a treatment will have to be constructed.

4. Treatment design

4.1 Introduction

Now that the specific problem has been defined and put into perspective, it can be addressed. In order to design a treatment for the problem, a list of requirements for said treatment has to be constructed. These requirements can be stakeholder requirements, system requirements or organizational requirements. These requirements also have to be weighed appropriately to the context.

4.2 Key driver method

In order to create an overview of all the requirements for the design of the strategy visualization, the key driver method is used. In this section the scope will be defined, all stakeholders will be summed up and their requirements for a treatment will be gathered. Using these requirements together with requirements that can be formulated using literature, the key drivers will be formulated. These key drivers in turn will make it possible to do make a grounded recommendation regarding the design of an effective strategy visualization.

4.2.1 Define the scope specific

There are several stakeholders that are relevant to a strategy visualizations meant for use in strategy communication. The stakeholders are listed below, along with a description of how they perceive the problem and its possible treatment.

4.2.1.1 General description of the scope:

A strategy is what businesses use to cope with (external) conditions and circumstances in order to survive. Strategies are most often formulated by top management, and are meant to be communicated towards everyone in the business, to a certain degree. Depending on an employees' individual task description, a component or a larger portion of the strategy can be considered relevant to them. Strategy visualizations are meant to be used to aid in the communication of strategies. They are supposed to facilitate in communicating information effectively, by showcasing relevant information to the right parties in such a way that they are informed sufficiently on when to do what, and why.

4.2.1.2 Top management:

Top management are those that formulate, design and wish to implement the strategy in a business. Through the use of the strategy visualization, they wish to spread all knowledge required to implement the strategy, on all levels or departments of the business. Top managers must be able to graphically show what strategic plans are intended to be implemented, and how these plans link to the business' objectives. A strategy visualization could also aid top management during the formulation stage of the strategy, e.g. by creating a clear overview of the anticipated plans early on, so that shortcomings can be discovered early on in the formulation process.

4.2.1.3 Middle management:

These are the groups of individuals that communicate the strategy further down the chain of command. The strategy visualization should therefore be meant to facilitate said communication. The visualization must be sufficiently informative, so that they can bring their actions in line with the strategy. They need the strategy visualization to inform them on what to communicate, to what extent, to whom and why. Also, if they receive feedback from subordinates regarding the strategy and its execution, or have feedback themselves, they should know how this feedback can be passed back up the chain of command (e.g.who to inform when activity X does not result in the expected outcome).

4.2.1.4 Regular employees:

Regular employees are all personnel that is not considered to be management, they are the individuals that actually execute the strategy. Using a strategy visualization, they must be able to view what the implications of the strategy are for their daily activities. Only if they are informed sufficiently so that they understand what the consequences of the strategy for their individual activities are, they will be able to execute it effectively. They must also be able to view how their daily activities fit in the greater picture of the business and its objectives. Similar to the middle management, regular employees should be informed how to process potential feedback.

4.2.1.5 Shareholders:

These are the groups or individuals that hold shares in the business, they are concerned with what the business is up to, and how this will relate to their returns. Using the strategy visualization, shareholders must be able to view what the business is focussing its efforts on. Shareholders are concerned with shareholder value, and the strategy should reflect how the business is increasing (or at least sustaining) this value. Shareholders should be able to see performance measures so that they know how the business is doing.

4.2.2 Acquire and analyze facts

In order to create a comprehensive overview of all requirements, these requirements first have to be gathered. The requirements were gathered in three ways:

- by doing a stakeholder analysis, in order to obtain stakeholder-specific requirements
- by doing an interview, to obtain requirements from practice
- by reviewing literature regarding strategy visualization in strategy communication, for requirements based on theory.

4.2.2.1 Stakeholder analysis

A stakeholder analysis involves identifying and prioritising stakeholders, assessing their needs, collecting their ideas and integrating this knowledge into the strategic management process (Harrison & St John, 1998). The stakeholders have already been identified, and can be categorised into four groups; top managers, middle managers, regular employees and shareholders. Using use-case scenarios, requirements that these stakeholders have were gathered. These use case scenarios are be based on a template by Cockburn (2000).

Four use cases were constructed, each is based on the perspective of one of the stakeholders. These use cases are shown in Table 2 to 5 on the following pages.

Use case #1	Communication of strategy by a top manager through use of a strategy visualization	
Goal in context	Using a strategy visualization, a top manager wishes to communicate the (new) business strategy down the chain of command, he/she expects subordinates to understand the strategy, its implications, and how they can put the information to use in their daily activities.	
Scope & Level	The scope of the goal is the entire business The strategy visualization is being considered black box	
Preconditions	Top management has formulated a strategy and a visualization of said strategy has been designed.	
Success End Condition	The strategy encapsulated in the visualization is communicated effectively, i.e. subordinates of the top manager are fully aware of, comprehend, agree to, and are able to remember the strategic content of the visualization.	
Failed End Condition	The strategy encapsulated in the visualization is not communicated effectively.	
Primary, Secondary Actors	Primary: Top manager Secondary: Middle management, Regular employees, Strategy visualization	
Trigger	A change is made to the business' objective(s), requiring a change in the existing strategic plans, or the implementation of a new strategy	
Description	*Step*	*Action*
	1	Business objective(s) change(s).
	2	New/adapted business strategy is formulated to account for the changes to the objective.
	3	Top manager instructs for design of a conforming strategy visualization .
	4	Top manager uses the resulting strategy visualization for communication of the encapsulated strategy down the chain of command.
	5	Subordinates of the top manager receive the strategy visualization and interpret its contents.
	6	Subordinates are fully aware of, comprehend, agree to, and are able to remember the strategic content.
Extensions	*Step*	*Branching Action*
	3a	Strategy visualization can not be designed due to unclear formulation - 3a1. Re-formulation of the strategy is required.
	6a	Strategy is not effectively communicated: - 6a1. Feedback can be provided to the top manager

Table 2: Use case 1: Top manager perspective

Use case #2	Communication of Strategy by a middle-manager through use of a Strategy visualization	
Goal in context	Using a strategy visualization, a middle-manager wishes to communicate the (new) business strategy down the chain of command, he/she expects subordinates to understand the strategy, its implications, and how they can put the information to use in their daily activities.	
Scope & Level	The scope of the goal is the subdivision of the business that the middle-manager is responsible for The strategy visualization is being considered black box	
Preconditions	Top management has formulated a strategy and a visualization of said strategy has been designed. The strategy visualization has been communicated to middle management by top management.	
Success End Condition	The strategy encapsulated in the visualization is communicated effectively, i.e. subordinates of the middle manager are fully aware of, comprehend, agree to, and are able to remember the strategic content of the visualization.	
Failed End Condition	The strategy encapsulated in the visualization is not communicated effectively.	
Primary, Secondary Actors	Primary: Middle manager Secondary: Regular employees, Top management, Strategy visualization	
Trigger	Top management has instructed that a change is made to existing strategic plans, or that a new strategy is to be implemented.	
Description	*Step*	*Action*
	1	Middle management is informed of a change of strategic plans
	2	The middle manager aligns his/her activities to the (new) plans
	3	The middle manager communicates the strategic content further down the chain of command, to subordinates that he/she is responsible for, using the strategy visualization
	4	The subordinates receive the strategy visualization and interpret its contents
	5	Subordinates are fully aware of, comprehend, agree to, and are able to remember the strategic content.
Extensions	*Step*	*Branching Action*
	2a	The middle manager can not align his/her activities to the new plan due to unclear formulation or communication - 2a1. Re-formulation of the strategy is required
	5a	Strategy is not effectively communicated: - 5a1. Feedback can be provided to the middle manager

Table 3: Use case 2: MIddle manager perspective

Use case #3	Interpretation of the strategic content of a strategy visualization by a regular employee	
Goal in context	Using a strategy visualization, a regular employee of a business wishes to adapt his/her daily activities in order to align them to the business' objectives	
Scope & Level	The scope of the goal is the subdivision of the business that the employee and his/her objectives are part of. The strategy visualization is being considered black box	
Preconditions	Top management has formulated a strategy and a visualization of said strategy has been designed. The strategy visualization has been communicated to middle management by top management. The strategy visualization has been communicated to regular employees through middle management.	
Success End Condition	The employee is fully aware of, comprehends, agrees to, and is able to remember the strategic content, and is therefore able to align his/her daily activities to the business' (new) objective(s).	
Failed End Condition	The employee is not able to align his/her activities to the business' (new) objective(s).	
Primary, Secondary Actors	Primary: Regular employee Secondary: Middle management, Strategy visualization	
Trigger	Middle management has informed the employee that a change is made to existing strategic plans, or that a new strategy is to be implemented.	
Description	*Step*	*Action*
	1	The regular employee is informed of a change in strategic plans by middle management
	2	The employee receives the strategy visualization
	3	The employee interprets the strategic content of the visualization
	4	The employee is fully aware of, comprehends, agrees to, and is able to remember the contents of the strategy.
	5	The employee aligns his/her daily activities to fit the (new) strategic objectives
Extensions	*Step*	*Branching Action*
	4a	Employee is not fully aware of, comprehends, agrees to, and able to remember the strategic content - 4a1. Feedback can be provided to the middle manager
	5a	Employee is unable to align his/her daily activities - 5a1. Additional information must be gathered by interacting with the middle manager

Table 4: Use case 3: Regular employee perspective

Use case #4	Interpretation of the strategic plans of a business by a shareholder, through the use of a strategy visualization.	
Goal in context	Using a strategy visualization, a shareholder of the business wishes to view how the business plans its activities in order to increase or at least retain its shareholder value.	
Scope & Level	The scope of the goal is the entire business. The strategy visualization is being considered black box	
Preconditions	Top management has formulated a strategy and a visualization of said strategy has been designed. The strategy visualization has been communicated to the entire business. It is assumed that all employees have aligned their activities to the (new) strategic plans. The strategy visualization has been made available to the shareholders.	
Success End Condition	The shareholder is fully informed regarding the business' (new) strategy and if/how this impacts the shareholder value, through viewing the strategy visualization.	
Failed End Condition	The shareholder is unable to be informed sufficiently through use of the strategy visualization.	
Primary, Secondary Actors	Primary: Shareholder Secondary: Top management, Strategy visualization	
Trigger	The shareholder wishes to assess how the business is managing its shareholder value.	
Description	*Step*	*Action*
	1	The shareholder wishes to have insight into the businesses practices
	2	The shareholder views the strategy visualization
	3	The shareholder interprets the strategic content of the visualization
	4	The shareholder is fully informed how the business aims to increase or at least sustain its shareholder value
Extensions	*Step*	*Branching Action*
	4a	The shareholder is insufficiently informed regarding the businesses practices and how these relate to shareholder value - 4a1. The shareholder can contact top management in order to receive additional information or provide feedback

Table 5: Use case 4: Shareholder perspective

4.2.2.2 Stakeholder-specific requirements

The use cases are used to determine requirements for a strategy visualization that is fit for use in strategy communication. Table 6 below shows the stakeholder-specific requirements for a strategy visualization from their respective perspectives. These requirements are based on how the stakeholders fit into the process of strategy communication according to the literature reviewed.

Stakeholder	**Stakeholder-specific requirement**
Top management	The strategy visualization is required to have the following characteristics: - Graphical representation of the business' objectives and strategy - Graphical representation of interconnection between strategy and objectives - Facilitating value during the formulation of strategy - Facilitating value in the communication of the strategy down the chain of command - Facilitating value in processing feedback
Middle management	The strategy visualization is required to have the following characteristics: - Graphical representation of the business' objectives and strategy - Graphical representation of interconnection between strategy and objectives - Facilitating value in the communication of the strategy down the chain of command - Facilitating value in processing feedback - Facilitating value in dispersion of information to respective subordinates - Explanatory value in alignment of individual activities to the strategy
Regular employees	The strategy visualization is required to have the following characteristics: - Graphical representation of the business' objectives and strategy - Graphical representation of interconnection between strategy and objectives - Facilitating value in processing feedback - Explanatory value in alignment of individual activities to the strategy
Shareholders	The strategy visualization is required to have the following characteristics: - Graphical representation of the business' objectives and strategy - Graphical representation of interconnection between strategy and objectives

Table 6: Stakeholder-specific requirements for strategy visualizations

4.2.2.3 Requirements obtained from an interview with a stakeholder

An interview was conducted with a strategy executive of a large company in information services. The interview was semi structured and revolved around the following topics: business strategy, strategy communication, and strategy visualization. The interviewee was also asked what requirements a strategy visualization must satisfy, given the business' specific circumstances, in order for it to be effective for use in strategy communication. The requirements suggested by the interviewee are shown in Table 7 below.

Interviewee	**Requirement proposed**
Strategy executive of a large company (3.000+ employees) in information services	For effective use in strategy communication, the strategy visualization should fulfill the following requirements: - Graphical representation of the business' objectives and strategy - Display of all strategic information required for an employee to align his/her respective everyday activities - Display of linkage between activities, projects and processes - Display of a timeline for the proposed strategy - Display of short-, mid- and long-term planning - Accessibility for all employees - High ease of use and usability - Enabling of accountability, e.g. through implementing display of performance measures - Interactiveness, so that different pieces of information or detail can be shown and hidden respective to the situation - Filtering mechanism for information, so that only the information that is relevant to the party it is shown to is visible. - Use of layering, so that there are different levels of detail that can be opened up or hidden, supporting the filtering mechanism. - Provision of the ability to protect confidential information through its filtering and layering. - Customizability to fit to the needs of the user/viewer

Table 7: Stakeholder-specific requirements for strategy visualizations, obtained in an interview

4.2.2.4 Requirements obtained from literature review

Following the literature review, requirements for a strategy visualization can be formulated. These requirements are summarized in Table 8 below:

Author	**Requirement proposed**
Burkhard (2005a)	The visualization of strategy should complement the analysis, development, formulation, communication and implementation of strategies in organizations

Kaplan & Norton (2005)	The visualization of the strategy should: aid in communicating and educating employees about the strategy of the organization
Hrebiniak (2006)	Depending on the complexity of the conditions and the strategy, but also the anticipated timeline, the strategy visualization should allow for sequential or complex change to be viewed.
Lengler & Eppler (2007)	The communicator should not only be occupied with conveying the message through the visualization, but also shape the message to the recipient's context, in such a way that this recipient can reconstruct the knowledge, integrate it and put it to meaningful action.
Bresciani & Eppler (2009)	In their literature review, a distinction has been made between cognitive, social, and emotional risks of visualizations, amongst these risks, there is a distinction between designer-induced and user-induced, as well as intentional and unintentional risk. The proposed requirement is that these risks have to be accounted for during the design process.
Li, Guo-hui & Eppler (2011)	The visualization of strategy should foster the following four concepts amongst recipients: *attention, comprehension, agreement* and *retention.* These have been determined to be the four main problem areas in strategy implementation, according to a literature review of over 60 studies. '*Communication is mentioned more frequently than any other single item promoting successful strategy implementation'.*
Cummings & Angwin (2011)	The visualization of strategy, in order to be effective, needs to meet the following seven requirements: 1. *Attracting and stopping the eye* The visualization should attract and focus the eye of the reader, this can be done through the use of novelty or aesthetics or by clearly displaying a purpose or utility of the inherent strategy. 2. *Spreading the eye* The visualization should be designed in such a way that it is to be read from left to right and down the page, or clockwise. This is to enable the eye to move in a comfortable manner, which makes the reader understand the underlying message quicker. 3. *Encouraging the eye to search* The visualization should encourage the reader to look search, keeping the reader engaged to the picture. 4. *Facilitating zoom* The visualization should show both the big picture and the detail, as both are important aspects of effective strategies. Too much detail turns people off, so the prefered amount of dimensions should be two. Also the amount of colours, directions, shapes or value categories should be limited to a maximum of seven. 5. *Mimesis* The 'reading route' of the visualization should mirror the directions

	that individuals might take in actual life. This is to aid learning and retention by connection cognition to physiology. 6. *Synaesthesis* The visualization (if possible) should make use of multimodality, incorporation of other senses, to give the visual a greater meaning, this supports readers to get a greater mental connection to the inherent information. 7. *Mnemonics:* The visualization should be constructed in such a way that it is more easily remembered than for example a plain text version of the same information would. This requirement is often more easily fulfilled when the previous six requirements are met. Important here is the rule of seven as shown in requirement 4, humans tend to be more able to remember visuals that have seven or less main elements, as opposed to more than seven.
Phaal, Farrukh & Probert (2015)	The visualization of the strategies should be *'Simple, adaptable 'strategic lenses', through which complex systems* (strategies) *can be viewed, supporting dialogue* (strategy communication), *alignment and consensus* (agreement)*'.* The visualization should show answers to the following questions, in a structured manner: - *Where are we now?* - *Where do we want to go?* - *How do we get there?.* - *Why do we need to act?* - *What should we do?* - *How should we do it?* - *By when?* In order to answer these questions and display the entire strategy in one visual, a set of various information types and perspectives become relevant.

Table 8: Requirements for strategy visualizations, based on literature

4.2.3 Build a graph of relations between drivers and requirements

Requirements for strategy visualizations have been gathered from different sources. All the requirements can now be combined and categorised. Using this list of requirements, the key drivers of said requirements can be described. The key drivers for effective strategy visualization have been determined to be: *strategic content, strategy communication, functional visuals*, and *usability*.

Figure 6 on the next page shows an overview of the final design requirements, along with their respective sources. It also shows how the different requirements relate to the determined key drivers. Some key drivers have similarities in the requirements that they are derived from.

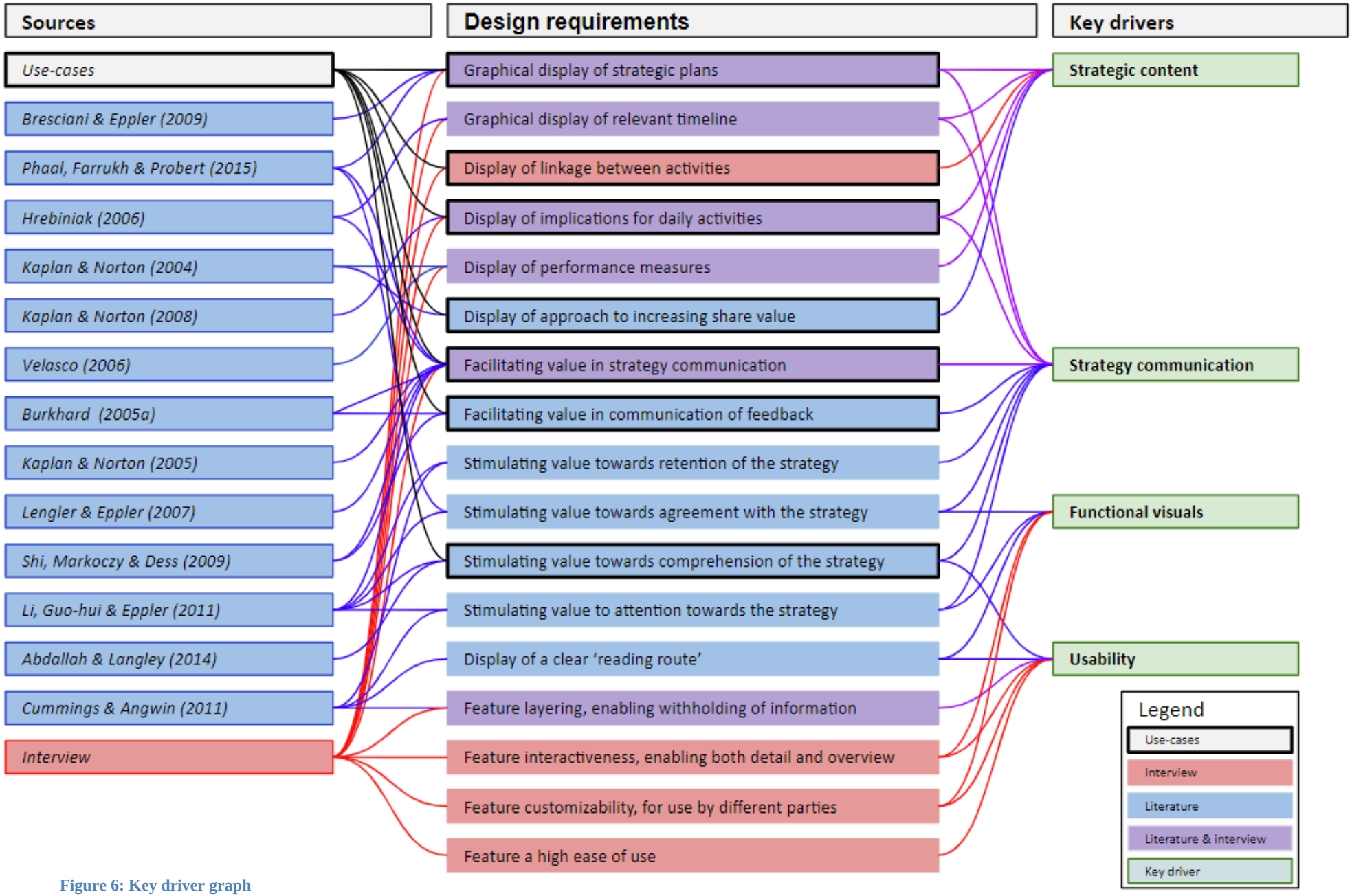


Figure 6: Key driver graph

5. Case: technology roadmapping

5.1 Scoring the technology roadmap

In this chapter, the strategy visualization method of technology roadmapping (Phaal, Farrukh & Probert, 2015) will be analyzed. The generic template, as shown in Figure 7 below, was used for this analysis. The analysis has been done using the requirements for effective use of strategy visualizations, which have been formulated in the previous chapter. These requirements are categorised under the key drivers *strategic content*, *strategy communication*, *functional visuals*, and *usability*.

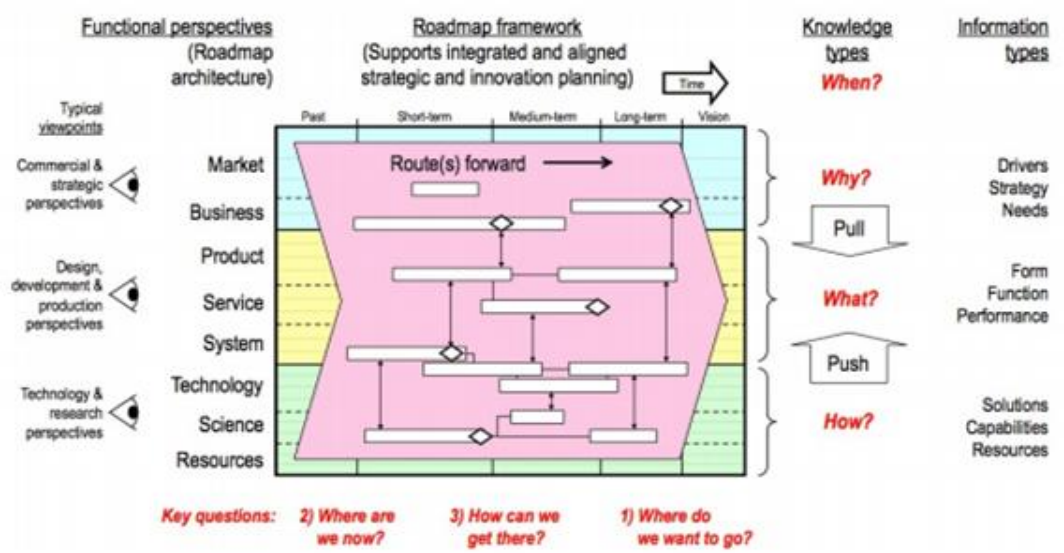
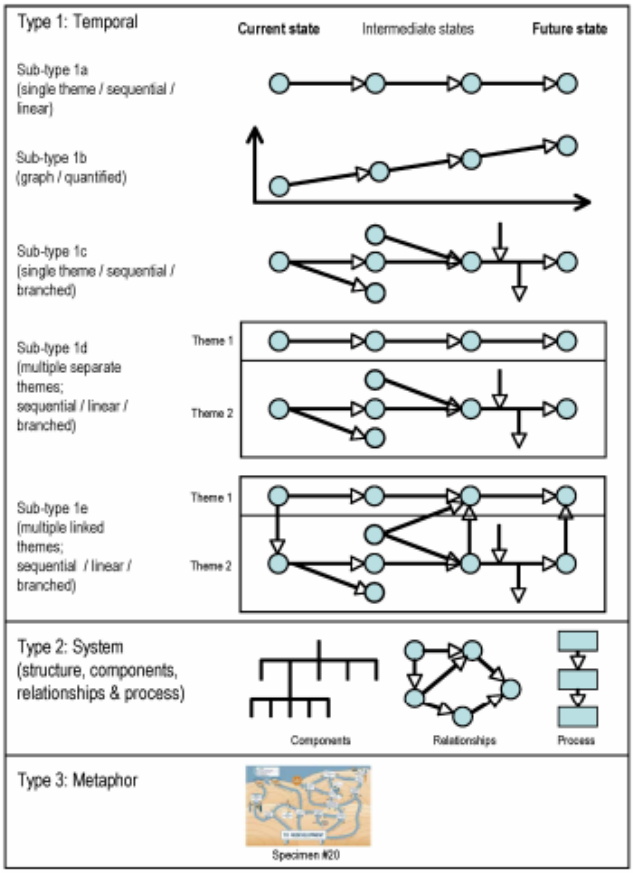


Figure 7: Technology roadmap (Phaal, Farrukh & Probert, 2015)

The choice of using the template for the analysis is made because roadmaps that are used in practice tend to be generic representations of the template, oftentimes incorporating relatively little information or depth.

Phaal, Farrukh & Probert (2009) analysed more than 900 examples of public-domain roadmap documents, and extracted more than 400 examples of graphical roadmaps, which were explored their purpose and structure. This was done in order to propose a method for classification of roadmaps based on their information structure, such as seen in Figure 8.



Figuur 8: Technology Roadmapping Classification (Phaal, Farrukh, Probert, 2009)

The template shown in Figure 7 can be specified as type 1, as it has time as its primary dimension. Furthermore it can be classified as sub-type 1e, as there are multiple themes displayed, along with linkage between these themes. The researchers state that subtype 1e is the most complex form of graphical roadmap. Using this 'most complex' type of roadmap as a basis for the analysis within this study allows for the construction of a recommendation that can also be adapted for application towards a type of strategy visualization or roadmap that holds a lower level of complexity.

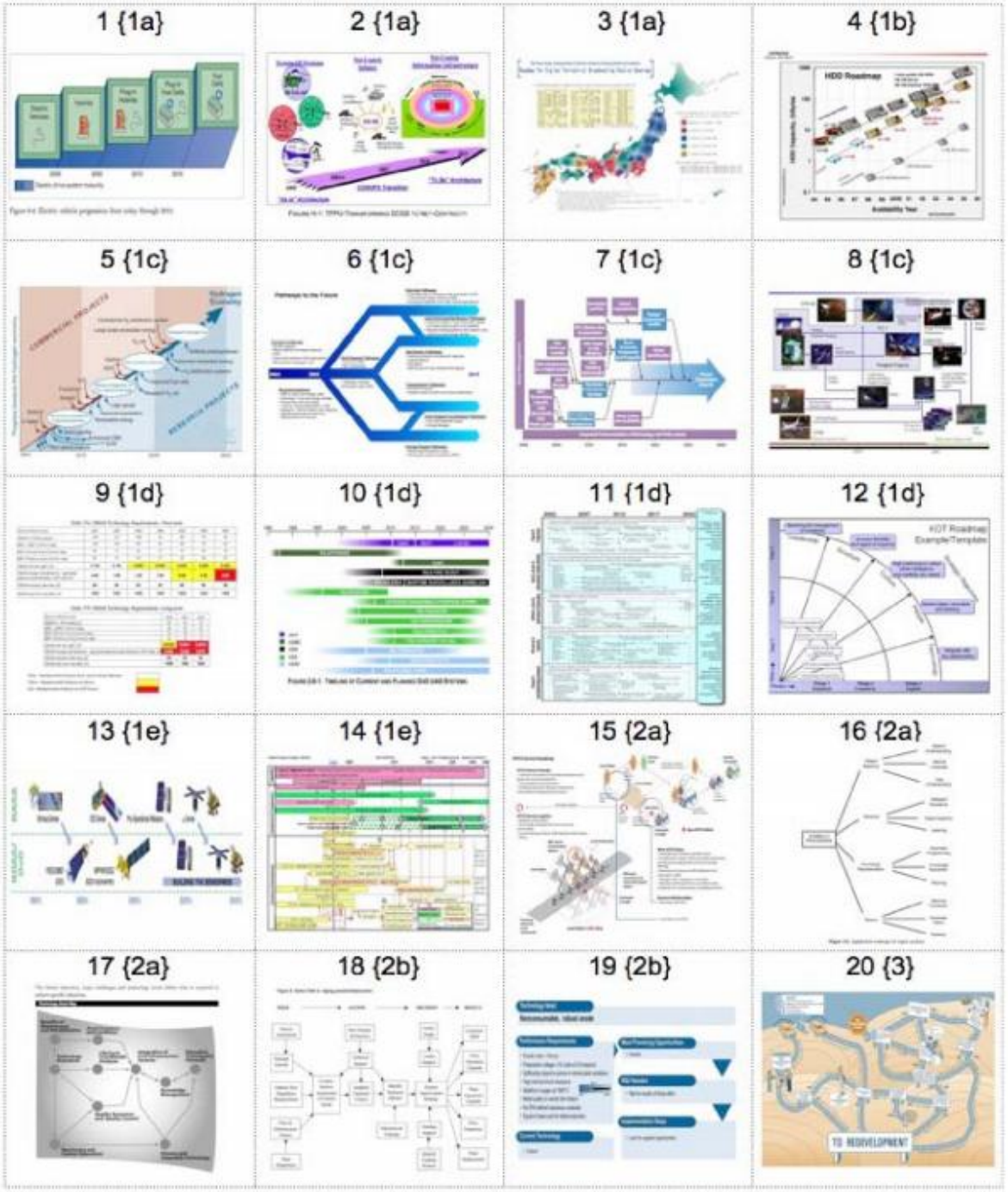
Another reason for choosing the template, a type 1 roadmap structure, as a basis for the analysis is that most of the roadmaps used in practise have the same general structure. Although there are still differences in their levels of complexity, type 1 roadmaps represent more than 80% of roadmaps used in practices, according to the dataset of roadmaps as analysed by Phaal, Farrukh & Probert (2009. The distribution of the use of different types can be viewed in Table 9 below.

Type	*Sub-type*	%
1 Temporal	1a Single theme/sequential/linear	13.2
	1b Graph/quantified	12.0
	1c Single theme/sequential/branched	7.2
	1d Multiple separate themes; sequential/linear/branched	36.7
	1e Multiple separate themes; sequential/linear/branched	11.7
2 System/process	2a System (structure, components, relationships)	5.0
	2b Process	11.7
3 Metaphor	Roads, landscape, board game, funnel, etc.	2.5

Table 9: Roadmap classification: based on information structure, indicating percentage of each type in collection (Phaal, Farrukh & Probert, 2009)

Figure 9 below gives an overview of 20 example roadmaps that were selected from the dataset to illustrate the classification proposed in Figure 8 (Phaal, Farrukh & Probert, 2009). Although only thumbnail representations of the roadmaps are shown, one can get an impression of the general format of these roadmaps.

Using the template (Figure 7) for the analysis and the construction of the recommendation allows the drawing of conclusions that can also possibly be applied to roadmaps of other sub-types, mainly subtype 1d, due to their similarities. The changes might however not necessarily be applicable to roadmaps of different types.



Figuur 9: Twenty representative graphical roadmap specimens with classification (Phaal, Farrukh & Probert, 2009)

5.2 Analysis

To analyse the roadmap template, it will now be checked by reviewing it according to each design requirement individually. This analysis will follow the structure as shown in the key driver graph, if a requirement relates to multiple key drivers, it will only be discussed in the first key driver it is related to. After checking the template using each requirement, a more generalized summary of how the template scores will be provided.

5.2.1 Strategic content

5.2.1.1 Graphical display of strategic plans

The roadmap template shows the business strategy in a structural way, by showing the business' anticipated goals, the current state, and the activities planned in order to achieve the objective(s) from the current state. It does however provide little room to elaborate on the business' objectives, which could hinder agreement to the approach taken.

5.2.1.2 Graphical display of relevant timeline

The roadmap shows a representation of the relevant timeline, it does so by showing the short-term, mid-term, and long-term planning of activities. It shows how these activities are anticipated to transform the business from its current state into its vision over the period of time.

5.2.1.3 Display of linkage between activities

The roadmap shows how the different planned activities, processes or projects are interconnected, it does so by connecting them with arrows. It does however show little detail regarding how this interconnection should be interpreted.

5.2.1.4 Display of implications for daily activities

The roadmap does not necessarily show how employees can adjust their daily activities in order for them to align with the business' objectives.

5.2.1.5 Display of performance measures

The roadmap does not show any performance measures.

5.2.1.6 Display of approach to increasing shareholder value

The roadmap does not show the direct approach to increasing (or at least sustaining) shareholder value, it does however show the approach taken to achieving the business' objectives, and these objectives may hold implications for the shareholder value.

5.2.2 Strategy communication

5.2.2.1 Facilitating value in strategy communication

The roadmap provides value in strategy communication by giving a overview of how the strategy is structured. It shows what activities the different departments have to align their practices to in order for the business to reach the objectives from its current state. It also shows a rough time planning for these activities.

5.2.2.2 Facilitating value in communication of feedback

The roadmap does not directly provide facilitating value for the processing of feedback. However, it could be said that the structured overview of the strategy gives employees a better overview of how they can pinpoint what projects or processes are not running smoothly or sufficient enough, which makes communicating feedback easier. This is also true from the management point of view, assuming that some kind of performance data is available for the activities shown on the roadmap, managers are able to address specifically those employees or departments that require feedback on their activities.

5.2.2.3 Stimulating value towards retention of strategy

The roadmap does not directly provide stimulating value towards the retention of the strategy. It doesn't incorporate mnemonics or any other methods that help viewers of the visualization remember the contents.

5.2.2.4 Stimulating value towards agreement with the strategy

The roadmap does not directly stimulate agreement to the strategy as a whole. It does however show how the different components, i.e. activities, of the strategy interconnect and are supposed to lead to the business to the achievement of its business goals. It could be said that the breakdown of the strategy gives the viewer a better understanding of why certain components have to be fulfilled, which in turn could improve agreement towards the strategy as a whole.

5.2.2.5 Stimulating value towards comprehension of the strategy

The roadmap does provide a stimulating value towards comprehension of the strategy. It gives an in-depth look into how the strategy is structured, providing detail of the different departments and how they collaborate. The breakdown of the strategy into its components shows why different employees have to do what, and when, in order for the business to reach its objectives.

5.2.2.6 Stimulating value to attention towards the strategy

The roadmap does provide a stimulating value to attention towards the strategy. It makes all viewers aware of how the strategy as a whole is structured, the interconnection of the collaborations of different departments and their activities. It also shows how their individual activities are required to be performed as indicated, in order for the business as a whole to be able to achieve its goals.

5.2.3 Functional visuals

5.2.3.1 Display of a clear 'reading route'

The roadmap shows a clear reading route, as indicated by the left-to-right arrow up top. Also it shows a chronologically structured timeline for the business' objectives, indicated by the planning of current, short-, medium-, and long-term activities, and how these relate to the business' vision.

5.2.3.2 Feature layering, enabling withholding of information

The roadmap template does not feature layering, or the ability to withhold information. The template as is, is a static figure of the business strategy, and therefore it can not contain additional layers of information, which makes it impossible to withhold information that is already present in the figure.

5.2.3.3 Feature interactiveness, enabling both detail and overview

The roadmap template does not feature interactiveness, and is therefore less able to provide both detail and overview of the contents. Again, the template is a static figure, in order to be able to interact with a figure, it should first be digitized.

5.2.4 Usability

5.2.4.1 Feature customizability, for use by different parties

The roadmap template, as a static figure, can be customized to the needs of every viewer individually, this would however be very time-consuming, especially considering that changes may be made as time passes. For this reason, hierarchies of roadmaps are often used, so that different levels of granularity can be displayed to different groups of viewers.

5.2.4.2 Feature a high ease of use

The roadmap does feature a respectable ease of use. It is a clear and structured representation of the business strategy, which should be readily interpretable. It can easily be used in the communication of strategy, by showing how the more complex overall plan breaks down into smaller components.

5.2.5 Summarizing observations

The technology roadmapping template by Phaal, Farrukh & Probert (2015) scores predominantly positive. It covers the content of the strategic plans clearly and in a structured way. It facilitates communication of the strategic information both up and down the chain of command, giving a clear overview of what information is relevant for which party. It is not necessarily visually attractive, but incorporates some functional visuals required for communication of the content. The usability of the template is difficult to determine, as it is just a static figure. Being a static figure, its usability is high, but it can not yet be determined if this would still be the case, if the static figure were to become a more interactive or layered.

The technology roadmap does however have drawbacks. It does not really provide the ability to show great detail of specific activities, projects or processes, which in turn makes it difficult for viewers of the visualization to be able to align their daily activities, but also might make it more difficult to foster agreement to the approach taken. The lack of incorporated performance measures makes it difficult to locate bottlenecks or difficulties that individuals, teams or departments are encountering. Also, the roadmap does not directly provide insight in how the business is trying to increase (or at least sustain) its shareholder value. The roadmap does not use mnemonics or other methods to stimulate retention of the content, and also does not directly stimulate agreement to the strategy. The roadmap template does not feature layering of information, or interactiveness, the lack of either makes it difficult to give more a

deeper insight into the information provided, if this were to be required. Lastly, customizing the roadmap, being a static figure, to the viewpoint and needs of every different viewer, is laborious. The current method of customization is to create hierarchies of different roadmaps so that these can be distributed to specific stakeholders respectively.

5.3 Validation

5.3.1 Expert opinion

In order to validate the findings of this study, validation by expert opinion was conducted. This validation is required to justify whether the proposed additions would satisfy the stakeholder goals, were they to be implemented. Expert opinions only work if the expert understands the proposed treatment, is able to imagine realistic problem contexts, and makes reliable predictions about the effects of the treatment within the context. This means that it is essential to find an expert that is suitable for the specific context of the study.

5.3.1.1 Expert: Dr Robert Phaal

This study, its findings and the recommendation were submitted to an expert in the field. The expert that was contacted for this study is Dr Robert Phaal, who coincidentally also contributed to the design of the roadmap template that was analysed. Phaal works at the department of engineering at the university of Cambridge, and researches the application of engineering principles and methods to management and organisational challenges in the context of high tech innovation and strategy. Phaal is particularly interested in roadmapping as a platform for strategic toolkits, as he considers it a flexible class of management tool for supporting strategy and innovation.

Phaal fits well within the context of this study, as his expertise lies with strategic technology management, and particularly because of his interest in roadmapping and strategy visualization itself. Over the years, Phaal has published numerous papers regarding roadmapping and its application regarding development, support and communication of strategy.

5.3.1.2 General remarks

Phaal noted that he liked the framework for the application of visualization in strategy communication, and the focus on roadmapping of this study. Furthermore, he made some remarks regarding several aspects of this study, discussed below.

Relevance

Phaal agreed on the relevance of this study, as there has been very little focus on the general application of visuals in strategy. Also, there has been very little focus on roadmapping in particular, which he found to be strange, given its visual form and wide applicability.

Representative set of roadmaps

Phaal commented on the amount and variability of the roadmaps that were used to substantiate the choice of using the template for the analysis. The researcher originally used a

sample of four roadmaps that were obtained from the industry, concluding that they were similar to the template in terms of information structure.

This lead to use of the sample of twenty roadmaps that was also used for defining roadmap classifications. The paper that proposed this sample also investigated the distribution of what types of roadmaps are used in practice. The diversity and variability of roadmap types along with the corresponding distribution levels supported choosing the template for analysis.

5.3.1.3 Remarks on the results of this study

Improving roadmaps

Phaal noted that roadmaps are currently being used in a great variety of ways. The roadmaps that are used are very varied in terms of purpose, format and most importantly quality. He commented that the quality of roadmaps in practice is typically not great, which suggests that there is plenty of scope for improvement. This means that there is a good opportunity to contribute to improving the roadmaps, their quality, and the overall roadmapping process.

General conclusions

Phaal noted that due to the fact that only the template was assessed using the framework, the researcher should be tentative about drawing general conclusions. For this reason suitable caveats should be included. Although many of the roadmaps used in practice share the same information structure as the template (at least to some degree), this does not directly mean that recommendations based on the template will be applicable and/or useful for such roadmaps.

Some limitations have been added to the recommendations, as these recommendations might not be applicable due to a variety of conditions. These limitations will be described more thoroughly in the discussion.

Analysing a generic template has advantages and disadvantages. Results could be widely applicable to a diverse set of roadmaps, since a lot of roadmaps share similar information structure. However, roadmaps could also differ from the template heavily, resulting in questionable applicability of the recommendations. The template does not account for the diversity of conditions that a company is subjected to, which can influence how they design, use and maintain their roadmaps.

Requirement construction

Phaal commented on the list of requirements that was constructed by using the key driver method, which was used to score the generic roadmapping template. He stated that all the issues that were pointed out in the template are fair enough, although one could also find examples of roadmaps in practice that satisfy each of the formulated requirements, separately. To the knowledge of Phaal, no roadmap currently exists that would satisfy all of the formulated requirements within one figure.

Using a combination of design approaches or components from different roadmaps could be the way to go in order to construct a roadmap that would satisfy all of the requirements in one figure. However, this is also heavily dependent on how the anticipated

'ideal' roadmap would be used in practice. The use of the roadmap as a strategic tool in the real world could possibly alter certain requirements due to specific circumstances.

5.3.2 Validation summary

The researcher set out to validate the results of this study, by expert opinion. The study was subjected to a review from an expert in the field of strategy visualization. The expert acknowledged the relevance of this study, and made meaningful comments that lead to improvements in the approach taken. He supported that recommendations made, based on the formulated requirements, could possibly lead to the improvement of roadmaps and their application in strategy communication. However, he did note that recommendations based on the template may not be applicable to certain real world cases, since the template does not account for specific circumstances that businesses may be influenced by. Due to the fact that the actual application of roadmaps may be very different from a filled-in template, a recommendation may not have the anticipated results.

5.3 Recommendation

Using the key drivers formulated in chapter 4 and the analyzed strategy visualization method of technology roadmapping, a recommendation will now follow. This recommendation uses technology roadmapping as a baseline and criticises how a (new or improved) strategy visualization should be designed in order for it to be more effective for use in strategy communication. The choice of using roadmapping as a baseline was made due to the fact that the method tackles a sizable amount of the requirements that effective strategy visualizations should have, according to the analysis done, in order to be effective for use in strategy communication.

A business that wishes to improve its strategy communication could benefit from the use of strategy visualization. Various methods of strategy visualization exist. Technology roadmaps are one of these methods, which can be described as simple, adaptable *'strategic lenses'*, through which the evolution of complex systems can be viewed, supporting dialogue, alignment and consensus (Phaal, Farrukh & Probert, 2015). Technology roadmaps scored predominantly positive according to the key drivers for effective strategy visualization formulated during this study, suggesting it is an effective method for use in strategy communication. However, the findings of this study suggest that there is room for improvement. Below, a few suggestions to the structural design of the roadmap template will be given.

5.2.1 Extensive business objectives description

First, the roadmap template could benefit from a more extensive description of the business objectives (or vision). Employees who are more informed about the goals of their joint efforts will have a better understanding of why a certain approach towards this goal is taken, and how this approach might affect their daily activities. Next to this, their better understanding of the end goal could positively influence their agreement to the approach. Also, a more elaborate description of the business objective, perhaps with the use of

mnemonics, could make it easier for viewers of the visualization to retain the information presented. Last, a more clear description of how the business attempts to approach its vision in the forthcoming time gives shareholders a better insight into how this might impact the shareholders value along the way.

Currently, there is not a lot of space allocated within the roadmap template to elaborate on the business' vision, without causing clutter.

5.2.2 Performance measures

The addition of some sort of performance measures could provide benefits for the overall use of the technology roadmap. For example, when an employee, a project team or a department is able to indicate how far along they are with the planned activities (behind, on, or ahead of schedule), this would make managing their roles in the larger scheme of the strategy easier. Knowing where bottlenecks or difficulties are being ran into makes it more possible to provide situation-specific feedback, both up and down the chain of command.

It must be noted that the degree to which a certain task, job or project is complete is not always measurable, therefore this improvement may not applicable to certain situations. Also, a real-time method of monitoring activities is required for the effective implementation of performance measures into the roadmap.

Incorporating performance measures into the roadmap would require the design to be fully interactive, connected to other information systems businesses might have, and updated (at least close to) real-time.

5.2.3 Layering of information by implementing zoom

In order to make space within the roadmap to add more detail for each component, but only when this detail is considered important, information layering could be implemented. The layering of information within a roadmap could be realised by implementing the ability to zoom, constructing it similarly to an interactive weather map.

Assume that the entire business is Europe, and that the development of the weather over a set-period of time is the strategy. Now assume that departments of the business are the countries within Europe, which would imply that only the weather developments in a specific country, and possibly the countries around it, would be considered to be relevant to them. Then assume that specific project teams and individuals are provinces and cities, implying that only the weather of these more specific areas and their surroundings are considered to be relevant to them.

Figure 10 on the next page shows an example of the concept. The left picture shows the temperature and wind at a set time in Europe, the middle and right picture shows the same information, but only for Germany and Berlin respectively. Depending on the amount of zoom, additional space opens up to provide more area-specific information. A project manager (Berlin) is mainly concerned with the project-team he supervises (municipality of Berlin), but is also affected by the activities executed by the department in which the project is embedded (Germany) to some extent, and even so by developments that are located in other departments of the company (rest of Europe). The relevance of information regarding the

business strategy, from the perspective of the project manager, increases further and further, as he zooms in on the map.

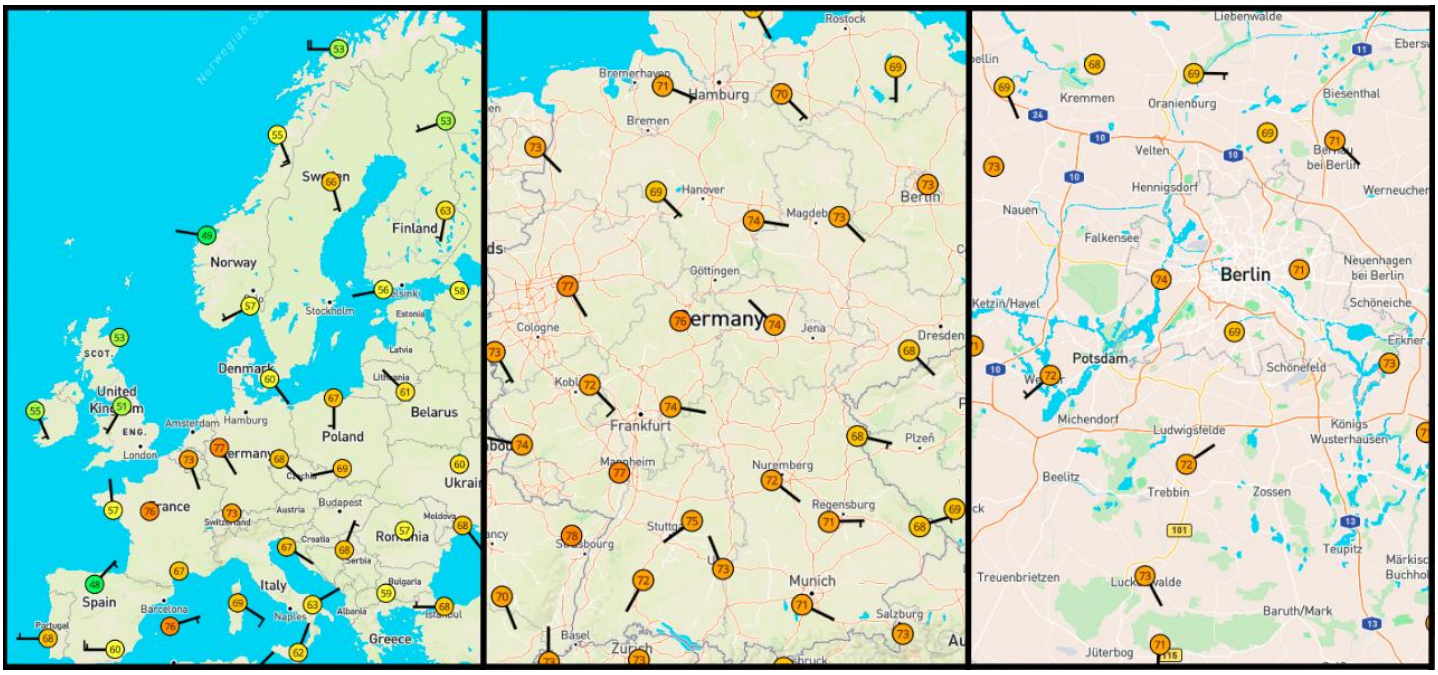


Figure 10: Example of zooming in while increasing detail

Images are retrieved from an interactive weather map: www.wunderground.com/wundermap

Now compare this concept of a interactive weather map to the roadmap design, and therefore the strategy of the entire business. In order to describe and elaborate on the entirety of the strategy to someone, for example to a shareholder, this person would need to see the overview of everything. This means that the amount of detail on smaller components should be kept as little as possible, in order to avoid that the resulting roadmap would appear to be cluttered. However, if the strategy were to be communicated from a middle manager to a project manager, who is responsible for the efforts of one project that a handful employees are working on, this would mean that only certain components of the strategy for one department are relevant. Also, in this case, the amount of detail can be considered to be more important, as the detail is likely required to explain how the project team members are supposed to align their practices. In this situation, the middle manager communicating the strategy to the project manager could for example use only a zoomed in version of the roadmap.

If a method of information layering, such as the zooming in or out described above, were to be designed into the roadmap, it could be used for communication to a wider public, without customizing it to each viewer. Currently, it is often the case that businesses design entirely different roadmaps to communicate different components of their overall strategy to different audiences. Information layering would make it possible to design one roadmap for the business, and depending of the audience of the communication at hand zooming in or out on specific components, to make sure that all information is relevant, and that the proper amount of detail is and can be provided.

This addition to the roadmap design would allow the communicator of the strategy to choose the amount of detail the visualization shows, so that all the information communicated is relevant to that specific interaction. Being able to do so, the viewer of the roadmap is not shown much information that is not relevant to their practices or responsibilities. Keeping most of the shown details relevant to the viewer could positively affect comprehension and retention of the content, as well as provide a better explanation of how the strategic plans are supposed to impact their daily activities.

Addition of an ability to zoom in and out does implicate that the roadmap has to be designed as an interactive digital figure. Currently, roadmaps used in the industry are often static figures. The concept of information layering would require businesses to have an information sharing system that supports such a kind of interactive digital figure.

5.2.4 Filtering of information

Some businesses have a large amount of different departments, as a result of operating in multiple countries or a vast diversity in practices. Other businesses have a strategy that contains sensitive or confidential information. These businesses could benefit from being able to filter out information in the roadmap when it is communicated to a certain audience, both for confidentiality reasons as well as to avoid clutter.

Depending on an employee' s hierarchical position within the company this employee would be granted access to only those details of the strategy that are considered relevant to his/her position, activities and responsibilities, while still being able to view the general overview of the entire strategy.

The idea of a filter mechanism within the roadmap goes hand in hand with the layering of information, as described above. Looking back at the example given of the map of Europe, this employee would be able to see the zoomed out version of the map, thus being able to view the general weather developments in the entirety of Europe. However, this employee would, depending on their hierarchical position, only be able to zoom in on specific countries, and therefore only able to view the more detailed description of the weather development of these countries.

This concept of information filtering based on hierarchical position would allow businesses to use one roadmap for the practices of different departments or even the entire business, while still ensuring that the roadmap is uncluttered. Also, this would make it possible to implement necessary confidential information into the roadmap, while still keeping this information hidden from those that shouldn't be able to access it. Implementation of such an information filtering mechanism would make customization of the roadmap to a specified audience relatively easy, given that the roadmap itself is already created.

5.2.5 Summary of recommendations

The analysis of the technology roadmap template, using the requirements formulated during the key driver method, revealed that it displays some potential shortcomings. In order to address these shortcomings, a few recommendations have been made. The recommendations of improvements to the template could all be implemented by designing the roadmap to be an interactive, digital figure. The interactiveness would allow for information layering and adding performance measures to be implemented. Making the figure digitally accessible should make it possible for viewers to zoom in and out of the information layers, choosing the amount of detail visible. Also, the figure being designed for digital and interactive use would open up possibilities for information filtering, further narrowing down the amount of detail visible. It would be beneficial to be able to customize the visibility of components of the strategy to specific viewers, by filtering out information that is trivial for their individual operations.

The recommendations made are possibly only applicable to roadmaps that are constructed similar to the template, i.e. other type 1 roadmaps, since these mostly differ based on the complexity of the information provided. If the proposed additions to the roadmap template are considered to be only applicable to type 1 roadmaps, this would mean that roughly 80% of the roadmaps that are used in practice could be adapted (Phaal, Farrukh & Probert, 2008). If the recommendations would only be applicable to roadmaps that can be classified as subtype 1d or 1e (due to the fact that these are very similar to the analysed template, also in degree of complexity), this would still mean that close to 50% of the roadmaps found in practice could possibly be improved upon.

6. Conclusion

Businesses need to implement strategies in order to cope with their circumstances and conditions. This strategy has to be communicated throughout the entire organization. Every employee has to align his/her activities with the overall plan in order for it to work. Traditional communication methods such as face-to-face contact and written text-based communication work for this purpose, however, these methods have a low multiplicative power, and it might take a lot of effort or time for the information to reach the entirety of the audience. Mediated communication methods combat this lack of multiplicative power and allow for information to quickly reach a broader audience. Mediated communication methods have not always shown to be beneficial for use, especially when the complexity of a strategy is high. Visualization has proven to be beneficial for reducing complexity in communication, therefore reducing the disadvantages of using mediated communication methods. However, visualization has also been found to have negative effects on communication of strategy, this is due to the fact that there is no clear discourse on how to actually implement visualization into the communication process.

This study set out to research how strategy visualization can be used so that it aids in strategy communication. By conducting a partial design cycle, the first steps towards a new strategy visualization design have been made. The problem has been fully investigated, by analysing the context of the problem and the relevant stakeholders. Requirements for a treatment design have been gathered using different methods, and the key driver method has been used to find what common ground these requirements have. Using this method, the key drivers for effective strategy visualization have been determined to be: *strategic content*, *strategy communication*, *functional visuals*, and *usability*.

According to the findings of this study, a strategy visualization that is developed while paying attention to these key drivers, and their respective requirements as formulated in chapter 4 and 5, will be more effective for use in strategy communication.

7. Discussion

7.1 Findings

This study set out to find how strategy can be effectively visualized so that it improves communication between stakeholders in strategy communication. Literature research and an interview was done in order to get an understanding of the problem and its context. A partial design cycle was followed through with in order to get a more in depth look into the problem. Next, an overview of requirements for such a visualization was constructed using the key driver method. In order for a strategy visualization to be effective for use in strategy communication, it should satisfy requirements that can be grouped under the four determined key drivers: strategic content, strategy communication, functional visuals and usability.

This means that in order to be effective, a strategy visualization must comprehensively display the strategic content, in such a way that it is communicated fully and clearly. The visualization must also make use of functional visual components, that guide the reader into the, for them respectively, right direction. Lastly, the visualization must have a high usability, so that it can be effective for use in practice.

Many of the requirements for effective use of strategy visualizations are covered by the technology roadmapping template design by Phaal, Farrukh & Probert (2015), but there is still room for improvement. Especially because the roadmaps found in practice are typically low in quality. A recommendation was made with regards to improving the roadmap template design, which can be summarized as follows:

More extensive detail should be provided on the overarching business objectives, in order to foster attention and agreement, but also to create a better knowledge base for comprehension of the strategies' contents. Performance measures could be implemented, in order to make it easier to manage strategic plan components, and enabling better communication of feedback both up and down the chain of command. Information layering should be implemented, so that the amount of detail is adjustable to the specific situation, ensuring that only relevant information is presented. And last, information filtering is recommended to be incorporated into the roadmap design. Addition of information filtering would allow the roadmap design to be fully and easily customizable to situations in which the strategy is communicated to a certain stakeholder or another specific audience. Also, implementation of information filtering would make it possible to hide potential sensitive information, this is useful for businesses that have a strategy which incorporates confidential information.

These recommendations do require the roadmap design to be fully digitised, in such a way that it is an interactive digital figure that any stakeholder of the strategy has access to (to at least some extent). Also, the roadmap would have to be connected to an information system that is updated real-time (or very regularly), in order for the performance measures to be implemented. The additions would result in one 'master'-roadmap that must be designed by the business, which incorporates all strategy information and details, so that the layering and filtering system would disperse the information appropriately.

If the technology roadmap template was redesigned in such a way that all the recommendations are incorporated, the new roadmap would score better according to the requirements and key drivers formulate during this study, and therefore be more suitable for effective communication of strategy.

7.2 Comparison to other studies

The literature that was reviewed during this study showed that there is a dichotomy regarding the effects of using strategy visualization in strategy communication (Farace, Monge & Russell, 1977; Griffin, 1995; Foos & Goolkasian, 2005; Vliegen & van Wijk, 2006); Bresciani & Eppler, 2009; Abdallah & Langley, 2014; Kernbach, Eppler & Bresciani, 2015). Burkhard (2005a) found that the use of visualization has potential, but that there is a lack of a clear description of an approach towards implementing visualization. Despite that there are numerous methods to visualize strategy, no golden standard has yet been determined.

In particular regarding roadmapping, Kerr & Phaal (2015) state that the visual design of roadmaps has been largely overlooked, with little attention given to their graphic design, undermining the value of roadmaps as a communication tool. They attempted to provide an approach towards designing roadmaps that are effective for use in practice. This approach was however tailored towards roadmaps in general, not strategy communication in particular.

This study attempted to make the first steps towards designing a method for implementing visualization in strategy visualization, by constructing requirements for such a visualization. To the knowledge of the researcher, no study towards requirements for effective strategy visualizations has been conducted before, within the field of business strategy communication.

7.3 Limitations

This study holds several limitations, discussed below.

The design cycle was only partially conducted, the problem was investigated, the context was analysed, requirements for a treatment were constructed, a recommendation was written, and the requirements and recommendation were validated by expert opinion. However, no design of a treatment was made. The actual design of a treatment to the problem, would allow for better validation of the formulated requirements, this in turn making the findings more grounded. Also, after validation of the end-product, the cycle could have been iterated, using the obtained knowledge as starting point in order to dig deeper into the problem and its treatment. The construct of the design cycle is meant to be iterated to get the best results.

The key driver method was also only partially performed. In order to validate the determined key drivers, these have to be discussed with stakeholders. Similar to the design cycle, the key driver method is also a cycle that is supposed to be iterated, using newly found

knowledge to fuel new approaches to the problem. Although, an iteration of the key driver method was performed using an expert opinion. The expert that was consulted for validation of the recommendation also commented on the requirements that were formulated. His feedback was implemented in order to improve the proposed requirements.

Only one interview with a stakeholder of strategy communication was conducted. This interview allowed for an insight into the practicalities of strategy in businesses the real world. However, it did not create an extensive understanding of how the research problem manifests itself in for example businesses of a different size or industry. Also the perspectives of different stakeholder could give better insight into how the problem is experienced in the field.

Only one strategy visualization method, technology roadmapping, was analysed using the findings of this study. In order to be able to make a more generalizable recommendation, more strategy visualization methods could have been analyzed. The choice of technology roadmapping was made based on its presence in the industry and its flexibility in application. Also within technology roadmapping, the recommendation made in this study may not always be applicable, this is due to the fact that only a template of a technology roadmap was used for the analysis.

One should be tentative of drawing conclusions from the analysis of a template, since real world examples of roadmaps that are based on this template may differ greatly. This difference between real world examples and the template could be so substantial that the recommendations have effects that are not in line with the anticipated goals, or can no longer be implemented.

7.4 Implications

This study investigated the use of visualization in strategy communication. While there are numerous strategy visualization methods, little research has been done towards the actual performance of said visualizations in use, designing new strategy visualizations, or improving existing ones. This study took a step into the direction of improving strategy communication while incorporating strategy visualization. Further research is needed in order to validate and verify the formulated requirements.

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