Innovation Continuity in an IT Incubator

Graduation Thesis | Tom L. Ruedisulj

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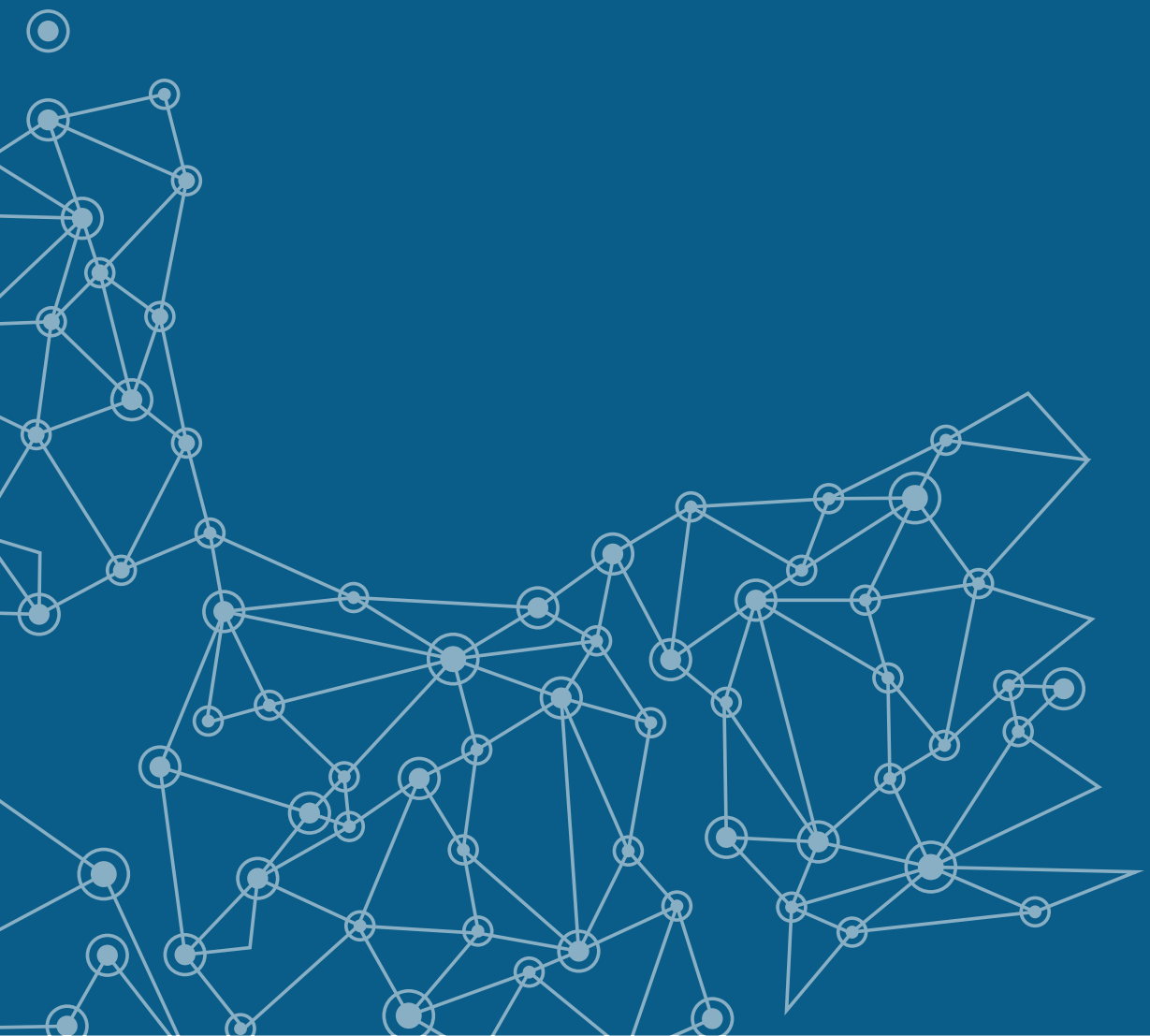

Graduation thesis of Tom Ruedisulj for the Master's degree in Strategic Product Design at the faculty of Industrial Design Engineering at Delft University of Technology

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Abbreviations

BM	Bid Manager
BI	Business Intelligence
BU	Business Unit
CC	Change Capacity
CPM	Commercial Product Manager
CTE	Critical Chain Event
FP	Focus Point
HR	Human Resources
IoT	Internet of Things
KPI	Key Performance Indicator
LoRa	Long range Low powered
LTO	Long Term Objectives
LTV	Long Term Vision
LTS	Long Term Strategy
M2M	Machine to Machine
MD	Managing Director
Mgt	Management
MT	Management Team
NPD	New Product Development
NPS	Proof of Concept
PoC	Proof of Concept
SE	Solution Engineer
SLM	Service Level Manager
STO	Short Term Objectives
STV	Short Term Vision
TPM	Technical Product Manager

Executive Summary

This report is a documentation of a graduation project for the Internet of Things (IoT) department within KPN New Business. The graduation project is commissioned by the Technical University of Delft (Master programme Strategic Product Design).

The main goal of this project is to develop a solution for the IoT department that a) provides continuity in its development direction by becoming resilient to environmental influences and b) facilitates a shared understanding of this development direction by aligning the various disciplinary perspectives that the department holds.

A preliminary investigation of the IoT department identifies two aspects underlying the problem area: 1) the multidisciplinary character of the department causes conflicting priorities and misunderstandings about direction and 2) the department's development direction is susceptible to environmental influences (discontinuities) which cause the employees to constantly have to shift their focus.
These two problem areas have long been acknowledged by various streams of literature and have been appointed the characteristics of *alignment* and *resilience* to overcome them.

A further analysis of the problem is carried out in two subsequent stages. Firstly, a literature study investigates existing theories on resilience and alignment. This study results in a framework that proposes a set of determinants that constitute resilience and alignment.
The theoretical framework can be summarized as follows: In order for an organisation to be resilient to environmental discontinuities it needs to have the ability to identify these discontinuities in a timely fashion and it needs to have the resource and coordination flexibility to address these discontinuities. Furthermore, multidisciplinary business functions can be aligned by establishing a shared vision, working towards one superordinate goal and making sure that tasks are cohesive and goals are congruent to each other.
Secondly, semi-structured interviews are conducted for which the interviewees were selected on the disciplinary differences they showed. These interviews explore the extent to which the determinants of the theoretical framework are present in the department. The interviews lead to the conclusion that the determinants of both resilience and alignment were either absent or insufficiently present.

The opportunity area suggests that the problem situation could be addressed developing an object that stimulates exchanging information about environmental discontinuities and that visually communicates the department's development direction while accounting for the disciplinary differences and considers both short term and long term objectives.

Three iterative development cycles lead to the final design which takes the form of a digital roadmap that supports the department in planning its development projects. The roadmap is intended to be used as an online application that imports information about development projects from a separate database. The roadmap serves two main purposes:
The first purpose is to support the department in dealing with changing targets in revenue. During the process, it became clear that changing targets in revenue cause the most confusion and stress among the employees. The roadmap fulfills this purpose by showing the development projects as building blocks for reaching revenue targets and by showing the implications for the department's development plans when revenue targets are either imposed or changed.
The second purpose is to improve organisational alignment by clearly communicating how the development projects of different business functions contribute to one superordinate goal, which is the department-wide target in revenue. This should lead to a shared understanding about direction as well as stimulate understanding why certain projects are undertaken and others are not.

The roadmap as presented in this report is merely a visual representation and has yet to be built. However, numerous stakeholders have been involved during the iterative design process and their feedback has consistently been incorporated in each subsequent development cycle. This has ensured that the final design reflects the needs of the department and will be perceived to be of value upon implementation.

Acknowledgements

Both the process of the project as well as the content of the report has received a lot of constructive feedback from the people around me.

Firstly, I would like to express my appreciation to the supervisory committee of the TU Delft for making sure that I would not drift off too much and confine the project's scope to a reasonable size.

Secondly, the company mentors of KPN have always provided the support whenever I needed it. Either by giving me access to its resources, or by introducing me to the right people to take the project a step forward.

Finally, my friends and family have consistently been giving me objective feedback throughout the process and applied their expertise in both verbal and visual ways to the final result.

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Phase 1

Orientation

The first phase of the report describes the preliminary investigation of the problem context. After introducing the project, the organisational context is described in which an overview is given of the IoT department, its structure, its business operating model and the current form of governance. The orientation phase is concluded by establishing a problem statement. This problem statement serves as the starting point for the subsequent analysis phase.

1. Introduction

This report is the documentation of a graduation thesis commissioned by the TU Delft for KPN New Business. The author is a Master Student Strategic Product Design at the faculty of Industrial Design Engineering in Delft.

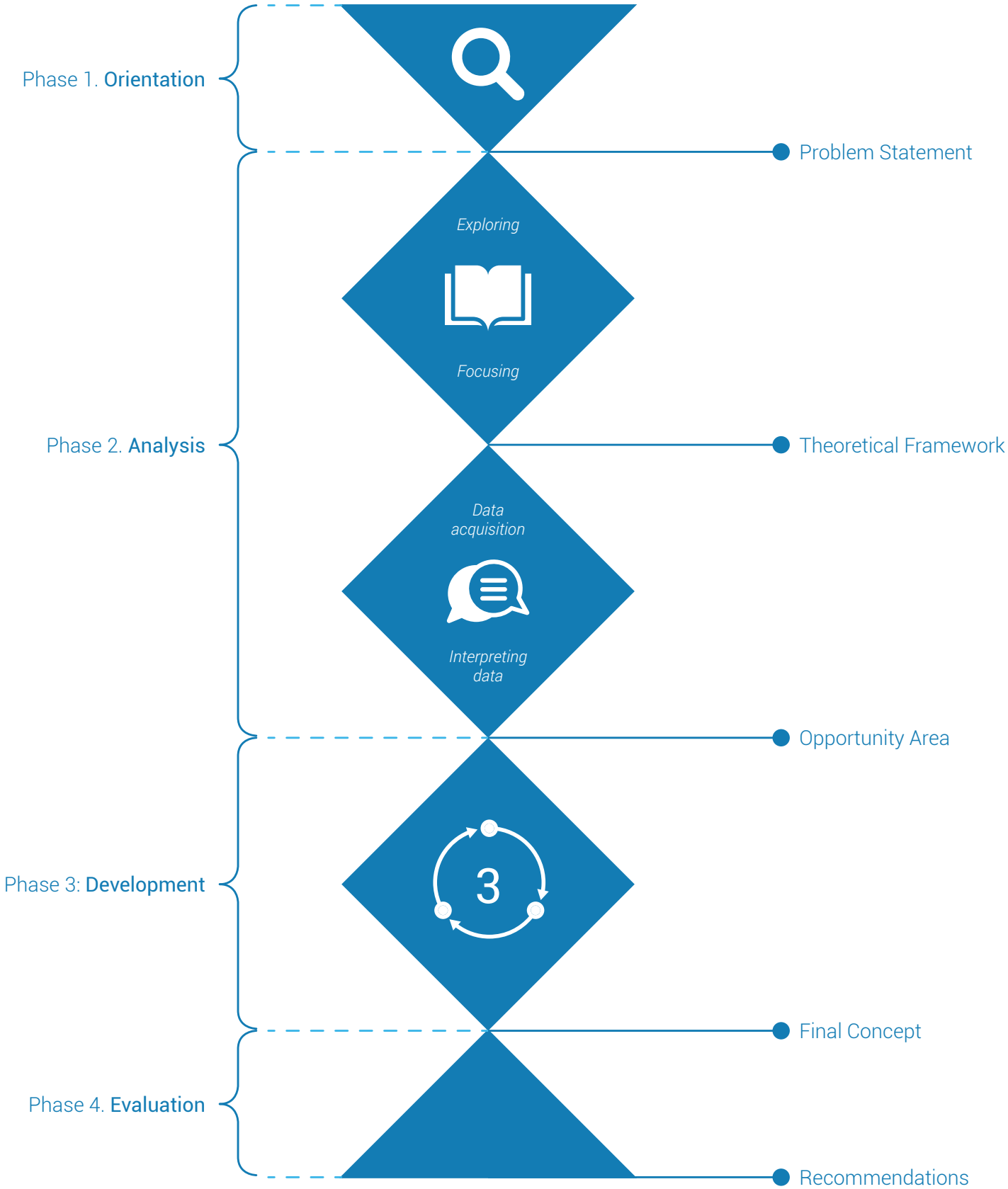
KPN is a Dutch landline and mobile telecommunications company. It was founded in 1989 as a publicly owned fixed-line operator in the Netherlands. Since the beginning of 2016, KPN launched New Business. New Business is an incubator programme that operates seperately from the corporate and is situated directly beneath the board of directors. New Business consists of roughly 300 employees and is established to scout for opportunities that will generate 'new business' for KPN. Within New Business, there are a number of departments. The IoT department is one of them, and consists of roughly 50 full time employees.

KPN New Business is a newly established incubator which innovates in the market of Internet of Things (IoT). The IoT department is experiencing a lot of turbulence caused by various environmental influences. These can be internal influences (e.g: rotation in management) or external influences (market developments). The organisation wants to develop some form of resilience to these influences and establish a level of continuity.

1.1 Structure of the Report

The research part of the report investigates the status quo, gives an overview of the organisation and its structure. A literature study is conducted to establish a theoretical framework. An interview research on the basis of this framework was done. The research part concludes by discussing the interview findings and reflecting them to the theoretical constructs. This serves as the foundation for the second part of the thesis, the development part.

The development part develops a tool that serves as a solution to the problem situation. The tool is iteratively developed by involving the project's stakeholders and the tool's future stakeholders. The development part concludes with a description of the final design and an implementation plan.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2. The Internet of Things

Before the KPN's Internet of Things department is investigated, it is important to gain a general understanding of the Internet of Things itself. This chapter briefly elaborates on the Internet of Things and describes KPN's approach to this newly emerging technology.

The internet of Things (IoT) is a technological development that allows sensors, devices and people to be connected to each other. IoT essentially consists of 1) connectivity (WiFi, 3g, 4g, etc.) 2) a smart sensor/device and 3) data management. When taken together, these three elements allow organisations to gather (real time) data, gain insights from these data and use these insights to gain an organisational advantage (e.g.: efficiency).

2.1 An Example Case

Any successful IoT solution relies on five principles. These principles are explained by means of the 'connected cow'.

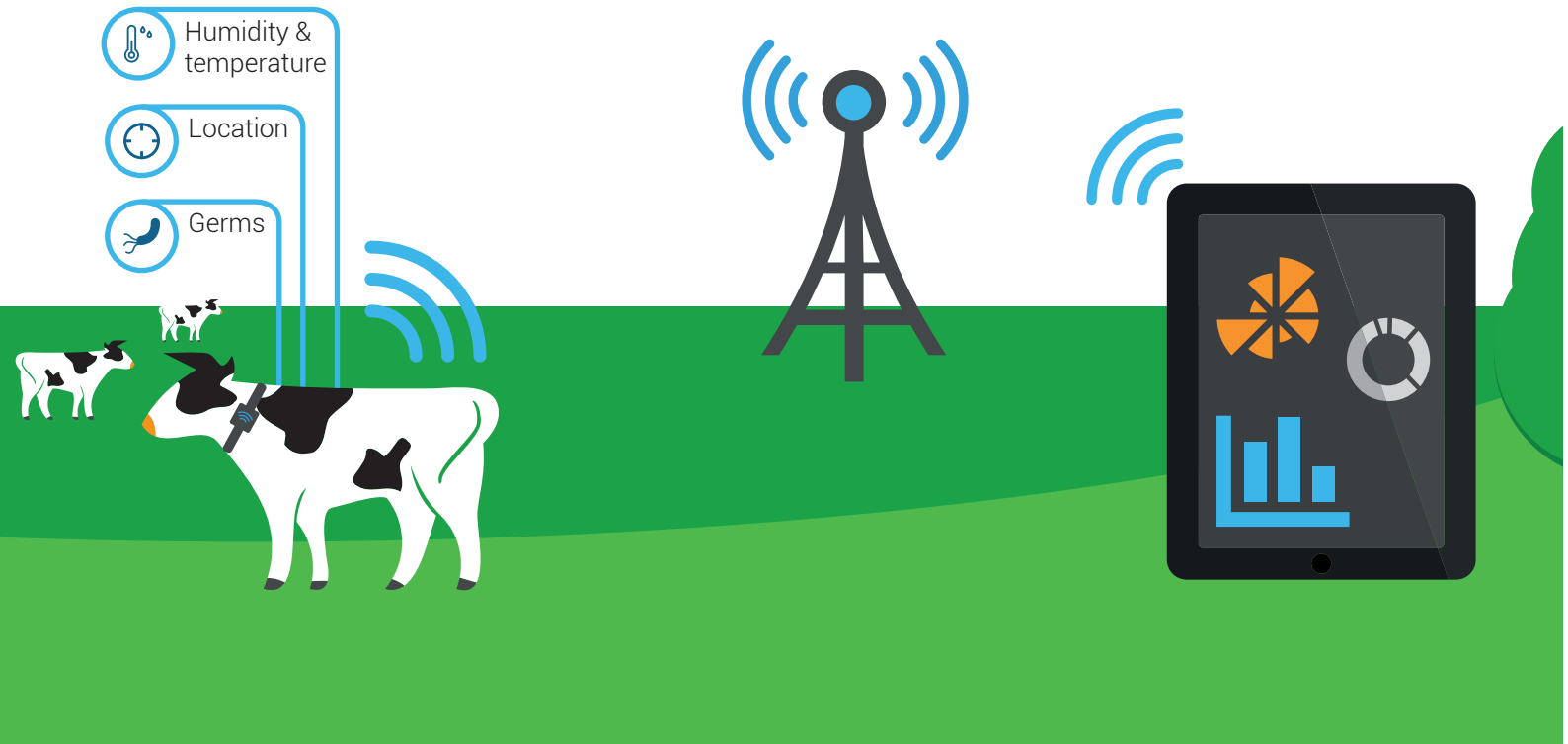
Step 1: Place a sensor on the object of which you need information
A sensor is attached to the cow. Depending on the kind of sensor, it may gather all kinds of values in its environment. In this situation, the sensor may track temperature, the level of oxygen in the air and germs in the cow's body.

Step 2: Make the sensor smart
The device needs to be connected to a device so the user can access the information. The sensor sends the data through an IoT network to this device. The data can be sent through either short range connectivity (Wi-Fi) or long range connectivity (M2M and LoRa). By sending the cow's data to the stockbreeder, he gains insight in his cow's condition.

Step 3: Ensure an accurate data storage
Depending on the user's preferences, the data can be stored in various places. It can be sent directly to his organisation, or it can be stored in the cloud or a professionally managed data center.

Step 4: Exploit the acquired data
Prior to drawing conclusions from the data, it has to be analysed. Complex algorithms transform raw data into tangible information. This information can then be used to recognize that the cow is at risk of disease. This allows the stockbreeder to act preventatively and ultimately become more efficient.

Step 5: Connect smart elements with each other
The possibilities can be taken a step further. When the whole livestock and stable is provided a sensor, it becomes smart altogether. The gathered data in turn are presented to the user in a central, accessible place. For example, the stockbreeder may now know his cows' condition and location, and know the condition of his stable (humidity, etc.). The data that is gathered over time will lead the stockbreeder to better understand his business and will ultimately allow for preventative models and more efficient treatments.

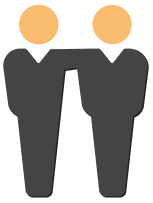


2.2 KPN and IoT

KPN aims to connect everyone and everything. The company possesses a wide range of connectivity. KPN occupies a large role in the IoT market and does so in different ways.

Sparring Partner

KPN takes on the role as a sparring partner for clients. It organizes meetings, brainstorm sessions and workshops to support organisations with discovering the possibilities of IoT.



Co-creators

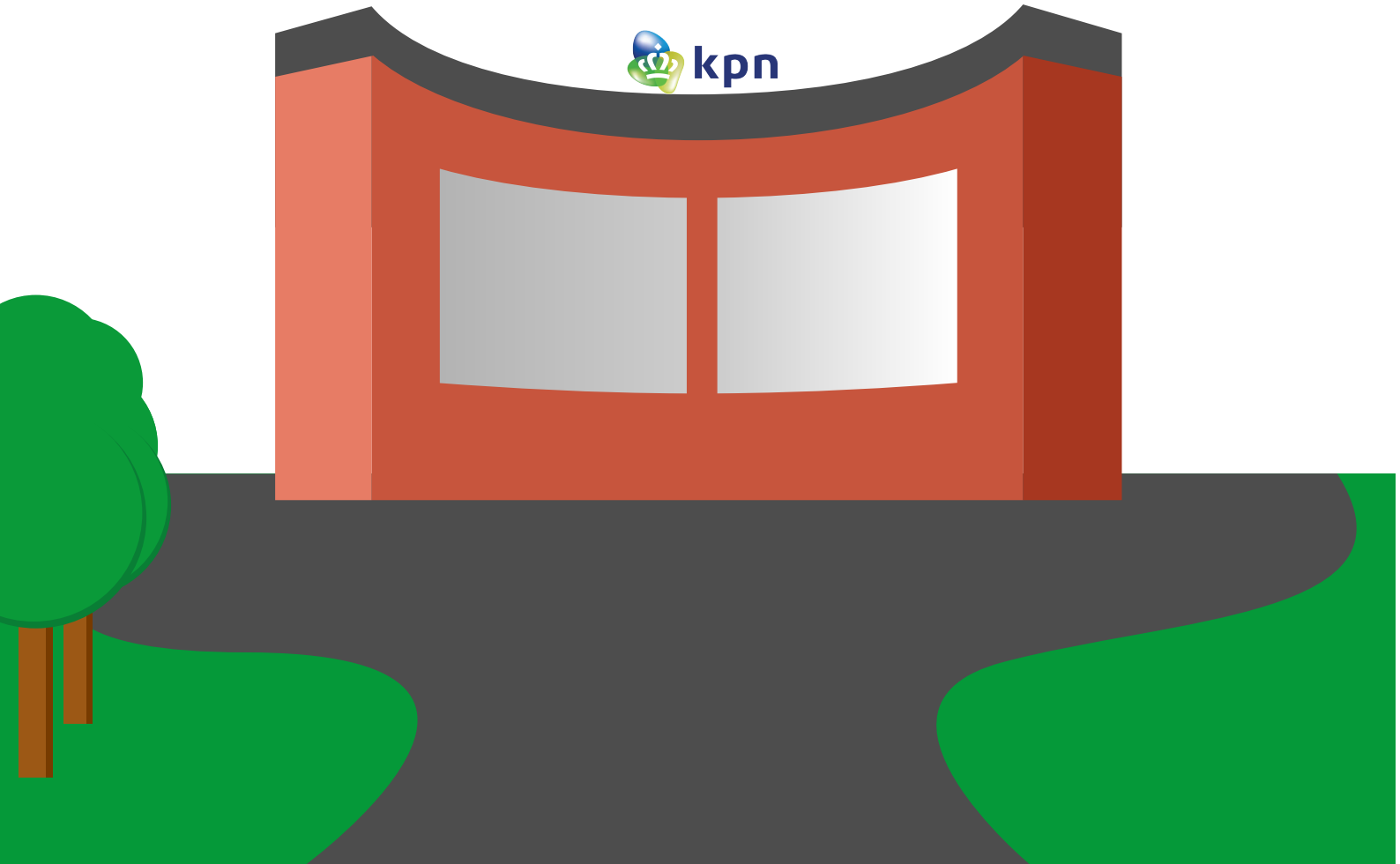
KPN supports open innovation and co-creation and does so by partaking in various IoT initiatives: IoT Acadamy, LoRa Alliance and M2M World Alliance. This enables KPN to deliver reliable connectivity to clients all over the world.

Developer

IoT solutions usually consist of several different components from different suppliers. KPN is part of a large partner ecosystem which collaborates in the development of smart solutions and software.

Data Manager

KPN possesses several data centers which safely store clients' data. Furthermore, it offers services that enable the clients to manage this data and analyse it.



3. Problem Context

This chapter describes the project's problem context. It elaborates on the IoT department, its operating model and its objectives. The chapter concludes with a problem statement. This problem statement is iteratively established by conducting unofficial interviews with employees from the organisation and discussing the problem situation with the project's stakeholders.

3.1 The IoT Department

KPN's IoT department is an important player in developing and delivering IoT products all over the world. It develops and delivers connectivity related products in the form of Machine-to-Machine (M2M) networks and Long Range Low Power (LoRa) networks. KPN's main proprietary asset within this market is their network of masts that allows these IoT appliances to be executed. The department engages in partnerships, develops customized connectivity solutions for large clients and is constantly on the lookout for new IoT solutions and product additions that could enable them to address a larger market in the future.

3.2 Operating Model

3.2.1 Products

The department does not deliver end solutions to customers, but serves as the enabler of the connectivity. Their offering consists of M2M and LoRa. The main way in which they make money is by selling sim cards to Business to Business clients and offering the connectivity for using these sim cards.

M2M

Through M2M connectivity, machines, objects and people exchange information real time with systems and applications. A modem is provided with a sim card and sends all kinds of data through KPN's network. This way, KPN offers their customers the ability to real time track any kind of object and allows the customer to zoom in on these objects to any level of detail. M2M is KPN's main IoT product and provides the department with the most revenue.

LoRa

LoRa is a technology that enables the exchange of small bits of data between objects and systems while using very little power. This technology is a very effective way to support IoT solutions. It can be used for simple, occasional data exchanges like on/off, occupied/free, full/empty, etc. The fact that it uses so little power allows the sim cards to be operational for up to 15 years while running on just two penlite batteries. LoRa is currently being rolled out. It is still in a premature stage and does not yet comprise a large part of KPN's revenue.

3.2.2 Suppliers & Partners

The department has a a number of suppliers and partners that enable it to deliver its products and services to its clients. For example, Jasper is a very important supplier that provides the department with an elaborate platform for managing all clients' accounts. This includes the management of sim cards, monitoring invoices, rate plans and information about shipment, billing, etc.

3.2.3 Clients

The department's clients can be divided roughly into three groups. Firstly, there are legacy clients. These are the clients that helped the department grow. They are still being served, yet the operations are not developed and refined according to their latest needs. As such, the department is migrating (part of) the legacy clients to the newer more advanced operations platforms.
Secondly, there are corporate accounts. These serve as the most important clients because they make up the largest part of the revenue. Therefore, they also influence the department's innovation efforts. Close contact is maintained with these clients in order to find out areas of improvement. These clients are provided with products that are specifically tailored to their needs.
Finally, there are the resellers. A client that requires less than 5000 sim cards is not profitable for KPN to handle personally. In cases like this, the client is redirected to a reseller. These resellers have the authority and the capability to handle these clients autonomously.

3.2.4 Business Functions

The department covers all kinds of disciplines ranging from product development to sales. Figure 1 shows the organisational structure of the IoT department.

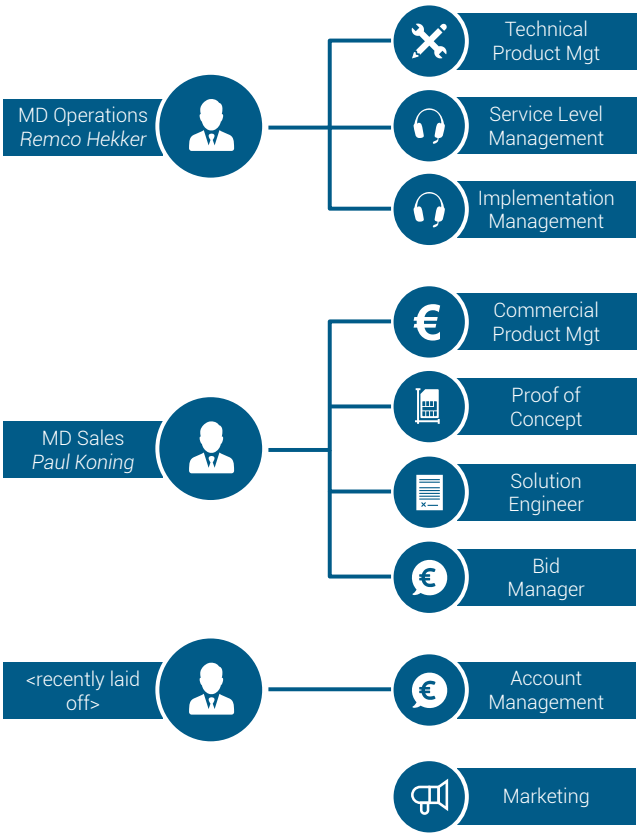


Figure 1. The organisational structure of the IoT department.

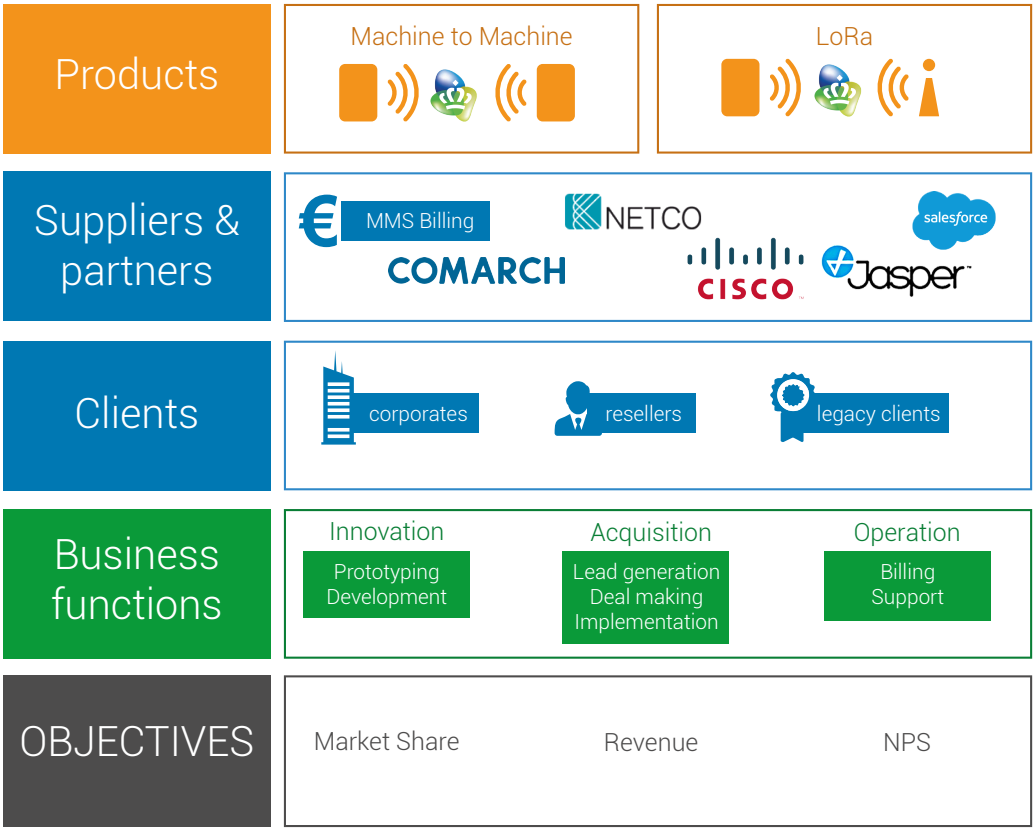


Figure 2. The IoT department's operating model.

The department's processes are carried out by a combination of team members from various business functions. This means that there is no confined territory for individuals. Employees are involved in different parts of the trajectory, often in different ways. Figure 3 shows an overview of the processes, the team members and their role within the former.

Consider the following example: an account manager is accountable and responsible for lead generation. He consults with clients and tries to learn more about the client in order to find out how KPN's products could be of value to him. When the account manager has established an appropriate product structure for the client, he informs the technical product manager and the commercial product manager to find out what is possible in terms of how the product will be offered to the client. The technical and commercial product manager then come up with a way to offer the product that is technically feasible as well as commercially viable.
At that point, the bid manager has to be consulted to find out how and what kind of pricing can be offered to the client. The product platform (Jasper) and the billing system (MMS Billing) possess a very complex interplay, and only the bid manager knows how to handle this. Consequently the bid manager informs the commercial and technical product manager about the possibilities for pricing. When an appropriate pricing has been established, the process moves on to 'deal making', in which the bid manager is responsible for a successful execution.

This is just one example of the many situations that occur in which people from different disciplines are involved in the process with different roles being assigned to them throughout this process. The IoT department shows a lot of secluded roles and responsibilities. With all these responsibilities combined, the department aims to acquire new clients, develop new product offerings and ultimately generate more revenue. However, it seems there is no consensus on how this is achieved on the long run. It was indicated that the department lacks a "clear vision on direction and focus" (Marc Titulaer, technical product manager) and that the employees do not "share the same idea on how the department is trying to achieve its growth" (Remco Hekker, managing director operations).
It can be concluded that the different perspectives and responsibilities inherent to the multidisciplinary character of the IoT department impede the establishment of a shared understanding of direction.

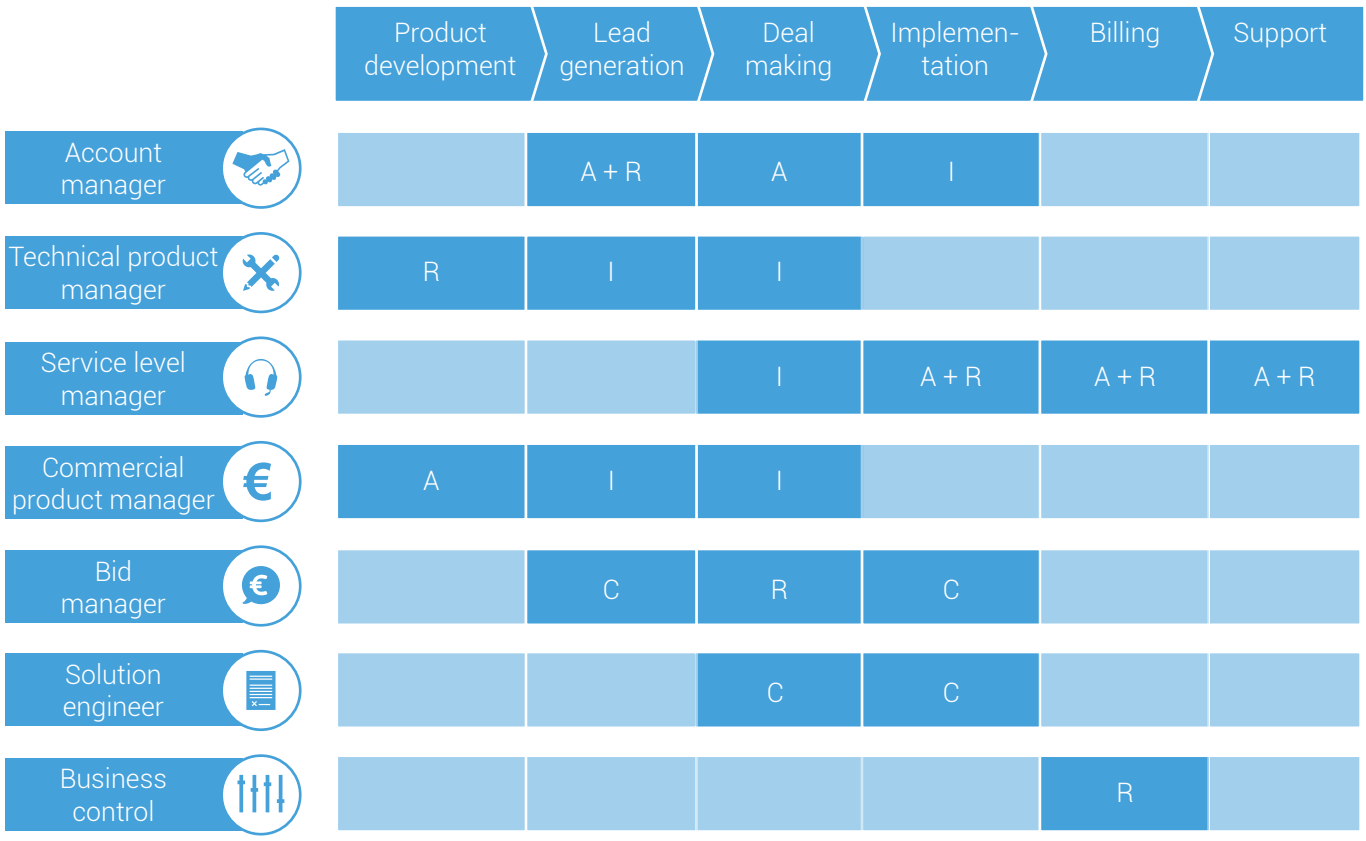


Figure 3. The various roles and processes of IoT operations. R = responsible, the person executing the tasks, A = accountable, the person making the final decision, C = consulted, the person who has to be consulted before making a decision and I = informed, the person who has to be informed after making a decision or taking action.v

3.2.5 Objectives

The department has established a vision as a "means to keep the employees engaged and motivated in their efforts of achieving growth" (Erik Peeters, Managing Director IoT): **"Our vision is to be the number one IoT enabler in the Netherlands by the year 2020."**

The department's vision is broken down into three main objectives that should serve as a guide towards reaching the desired future situation:

- **Revenue**, KPN wants to realise the highest revenue of all IoT enablers in the Netherlands.
- **Net Promotor Score (NPS)**, KPN wants to deliver the best service to their clients compared to other IoT enablers in the Netherlands.
- **Market Share**, KPN wants to have the largest market share of all Dutch IoT enablers.

The management team recently initiated a programme that supports the organisation in achieving the objectives of revenue, market share and NPS. This programme includes 11 focus points which should serve as the pathways to reaching the three main objectives (figure 4). Within each of these focus points, one person (the focus point principal) is responsible for developing action plans.

The three mission statements are all measurable, yet only the mission statement of revenue is presented as a clearly quantified objective. Both NPS and market share depend on environmental developments over time, NPS being relative to previous scores of NPS and market share relative to how KPN's competitors are performing. Furthermore, the mission statements are somewhat ambiguous as they do not specify how the department intends to reach its vision. For example, by specifying what markets or services the department specifically intends to exploit.

As a result, the plans within the 11 focus points are often developed reactively to changes in the department's performance on the three main pillars. For example, a gap in revenue was recently identified which has lead to the initiation of a project called 'revenue recovery'. This project, which is part of the M2M and LoRa focus point, has been the number one priority of the people involved for several months. Mark van den Berg (Commercial Product Manager) indicated that he did not find time to work on other development projects as much as he would have liked during this project. In line with this, both Mark van den Berg as well as Simon Philipsen (Technical Product Manager LoRa) mentioned that other projects were put on hold.

The abovementioned example describes how newly emerging information on the department's performance in revenue disrupts the established development plans. Put differently, a discontinuity causes the department to undertake new projects to recovery from this discontinuity. Considering that these discontinuities pose as a threat to reaching the department's main objectives, the decision to undertake these projects makes perfect sense. However, the ambiguous character of the department's mission and main objectives allows space for the department to focus on all sorts of projects or developments that do not necessarily relate to each other in a meaningful way.

As a result, the department does not operate in a coherent way but instead houses secluded teams of employees that are focusing on projects or initiatives of which the perceived importance is caused by sudden influences or observations of the internal and external environment. In other words, the department's development approach is not resilient to environmental discontinuities.

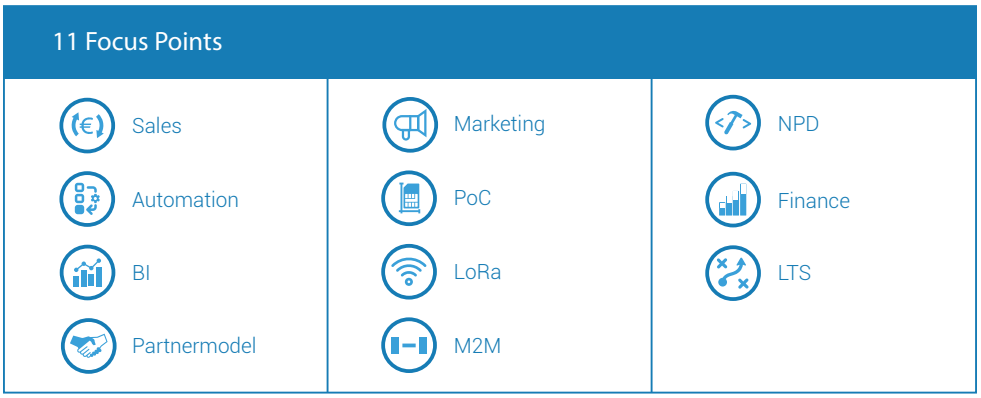


Figure 4. THe IoT department established 11 focus points that should help them to achieve their mission for the year 2020.

3.3 The Problem

The problem situation of the IoT department is twofold. First, the differences in disciplinary perspectives pose as a barrier to establish a shared understanding of the department's development direction. Furthermore, the latter is susceptible to environmental discontinuities. Second, the ambiguous character of the department's vision and mission allows for all kinds of projects to be undertaken. As a result, there is no coherency in development plans.
Both of these problem areas lead to differences in priorities and misunderstandings about responsibilities. This makes it difficult to accurately execute projects and effectively pursue growth. As such, the main research question guiding the project is as follows:

In what way could KPN IoT be supported with shaping continuity in their development direction with all employees sharing the same understanding about this direction?

Phase 2

Analysis

In order to develop a solution to the problem situation it is important to first get a better understanding of the dimensions of the problem.
The analysis phase consists of a literature research, interviews and an interpretation of the results. The literature research investigates the twofold problem situation by exploring the theoretical constructs underlying the problem. This investigation leads to a set of determinants which serve as the foundation for the subsequent interviews.
Semi-structured interviews are conducted with a sample of diverse disciplines. The interviews aim to uncover the extent to which the determinants of resilience and alignment are currently present in the organisation and uncover the areas where the situation could be improved. The interviews are conducted in an exploratory fashion to allow for unforeseen aspects constituting the problem to emerge. The interview findings are presented according to the theoretical framework that the next chapter establishes.
Consequently, the discussion of these findings leads to an opportunity area that will be addressed in the 'Phase 3 - Development'.

3. Literature Research

This chapter investigates existing theories on resilience and alignment. The chapter concludes with a set of determinants that constitute these characteristics which serve as the basis for the interview research.

3.1 Introduction

The department's continuity as mentioned in the problem statement is affected by changes in markets, performance or emerging competitors and new technologies. The ability of an organisation to deal with these discontinuities is commonly known as resilience (Pádár and Pataki, n/a). Developing resilience in a dynamically changing environment is covered by a wide selection of management literature. Resilience serves as one of the theoretical pillars on which the literature research is based.
The lack of a shared understanding within the department is a common situation in multidisciplinary organisations. Unaligned perspectives and concerns are a common barrier to multidisciplinary performance. Organisational alignment serves as the second theoretical pillar on which the literature research is based.
In short, organisational alignment is required for dealing with multidisciplinary environments and resilience is required for dealing with environmental discontinuities. As such, the main research questions for the literature research are as follows:

What constitutes resilience?
What constitutes alignment?

This chapter investigates both theoretical constructs and concludes with a set of determinants that constitute resilience and alignment.

3.2 Resilience

3.2.1 Defining Resilience

In order to identify the applicable determinants of organisational resilience, it is important to establish an accurate definition of this characteristic. The expression 'organisational resilience' is being used a lot in contemporary management literature, yet a lack of clarity of its exact meaning exists.

Organisational resilience is being used to describe various concepts (e.g.: flexibility, adaptability, organisational health). However, different hierarchical levels of these concepts can be observed. Some concepts of organisational resilience constitute a subset of others.

On the first level, organisational resilience refers to "the ability of the organisation to align, execute and renew itself faster than its competitors" (Keller & Price, 2011a). It is about "adapting to the present and shaping the future faster and better than the competition"(Keller & Price, 2011b). This conception of organisational resilience clearly relates to an organisation's core strategy of developing and governing itself. This does not align with the scope of this project, as the project concerns only the IoT department, a fraction of KPN's company as a whole.
On the second level there are different perceptions of resilience. However, the majority of the literature seems to acknowledge that resilience has two types:

1. (Recovery based) operational resilience: "the strength or stability needed in case of a sudden discontinuity" (Lengnick-Hall et al., 2011);
2. (Renewal based) strategic resilience: "what dynamically prevents an organisation from falling into decline, thus ensuring that a crisis never comes" (Hamel & Välikangas, 2003)

As described in chapter 3 - 'Problem Context', discontinuities were understood to constitute the 'ad hoc' way of working in the IoT department, thus from the two types, the recovery based operational resilience applies to the scope of this project and will be adhered to for the subsequent research.
Upon investigating management literature, further clarification on operational resilience is found. Allen (2016) describes operational resilience as an organisation's ability to 1) identify and mitigate operational risks that could lead to service disruptions before they occur, 2) prepare for and respond to disruptive events (realized risks) in a manner that demonstrates command and control of incident response and service continuity and 3) recover and restore mission-critical services and operations following an incident within acceptable time frames.

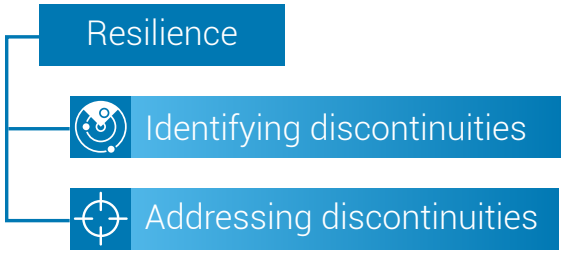


Figure 5. Resilience relies on identifying discontinuities and addressing discontinuities.

Flexibility is one of the organisational characteristics that constitutes resilience. Lengnick-Hall (2011) argues that flexibility, agility and adaptability contribute to resilience but are not sufficient themselves. However, it does make sense to include flexibility as its determinants show similarities with Allen et al.'s determinants described above.
Shimizu and Hitt (2004) among others argue that maintaining flexibility is one of the most important yet most difficult tasks of an organisation's management. They describe flexibility as the organisation's capability to identify major changes in the external environment, quickly commit resources to new courses of action in response to those changes, and recognize and act promptly when it is time to halt or reverse existing resource commitments.
Aaker and Masceranhas (1984) define flexibility as the ability of the organisation to adapt to substantial, uncertain and fast-occurring (relative to required reaction time) environmental changes that have a meaningful impact on the organisation's performance.
The conceptions of resilience clearly show overlapping characteristics. The authors all emphasize the necessity to identify environmental changes that affect operational performance (these changes can be both internal as well as external) and the ability to address these changes (by assessing the impact of these changes and respectively committing resources to the matter). Building on the conceptions of resilience described in this section, the conclusion can be drawn that organisational resilience relies on an organisation's ability to both identify and address environmental discontinuities.

3.2.2 Identifying Discontinuities

The first step in developing resilience is acquiring the capability to identify environmental changes that significantly impact the organisation. Identifying environmental changes require the organisation's members to be aware of environmental influences, internally communicate them, collectively make sense of these influences and come up with appropriate ways to address these influences. Fredericks (2005) refers to these prerequisites as *information sharing* and *sensemaking*. He describes information sharing as making sure that customer and supplier-based information is disseminated to appropriate departments and isused to achieve value for both and he describes sensemaking as collectively interpreting this information. Both information sharing and sensemaking are ways of exchanging knowledge.

Barriers to Knowledge Exchange

Knowledge exchange in multidisciplinary environments can be difficult due to different disciplinary backgrounds. For example: whenever a salesman is required to exchange knowledge with an engineer they might have difficulty in understanding each other.
Any impediment to the exchange of this knowledge due to different disciplines can be considered a knowledge boundary (Carlile, 2002). These knowledge boundaries exist at the intersection between different disciplinary backgrounds. These disciplinary backgrounds are referred to as knowledge domains.
Thus, knowledge boundaries exist between different knowledge domains. Carlile describes a theoretical framework in which he proposes the use of boundary objects to overcome these knowledge boundaries. A boundary object can be any kind of tool or object, both physical as well as digital, that supports the exchange of knowledge. Essentially, boundary objects are a form of common ground that stimulates social interaction. For example, a physical roadmap comprised of a collection of post-its. Anyone can add post-its, and people are likely to start talking about it.

Knowledge Boundaries

The IoT department consists of specialists from different disciplines. The differences and similarities between these specialists are an important step towards understanding its capability of achieving a shared understanding. A multidisciplinary environment like this needs common ground to initiate social and cognitive processes which are required for sensemaking. This common ground may take the form of a boundary object or as common knowledge, which refers to explicit knowledge that is common to all team members (Grant, 1996). This knowledge could take the form of methods, skills, etc. By using common knowledge, team members can "share and access each other's domain-specific knowledge" (Carlile, 2004).
Whenever an employee possesses profound knowledge of his area of expertise that cannot (yet) be fully explicated, it can be considered tacit knowledge. When team members share their experience and apply their tacit knowledge in a new context, knowledge transformation occurs (Nonaka & Takeuchi, 1995).
For example, the bid manager possesses profound knowledge about the interplay between Jasper and MMS Billing. When the commercial product manager and the technical product manager ask the bid manager to come up with an innovative pricing strategy, he is applying his tacit knowledge in a new context.
This specific tacit knowledge related to a function is called functional expertise. It reflects the employee's function-specific techniques and understanding of

information and procedure essential for a task at hand. It is essentially a building block of absorptive capacity (Goh, 2002) and allows the individual to more easily build new knowledge. Knowledge domains within an organisation is the combination of functional expertise and common knowledge. When the flow of knowledge is mapped out on the knowledge domains within an organisation, knowledge boundaries can be identified.

Overcoming Knowledge Barriers

There are several ways to induce successful knowledge transformation. Among these are the deployment of support structures, stimulating problem seeking and solving behaviour and creating the right network centrality. These three ways to induce knowledge knowledge transformation will be elaborated on below.

Support Structures

Many organisations deploy support structures as common ground to facilitate information sharing and sensemaking. As argued by Goh (2002), support structures are an influential factor on effective knowledge transfer. A support structure refers to an appropriate infrastructure to reinforce and support knowledge transfer (Goh, 2002). Support structures can take the form of reward systems, scorecards or roadmaps.

In order to understand how KPN is currently managing its knowledge boundaries, it is important to find out what support structures currently exist and to what extent they effectively address previously mentioned knowledge boundaries.

Problem Seeking and Solving

When employees are encouraged to find problems and solve these problems, information sharing and knowledge exchange is stimulated. Problem-solving/ seeking behaviours should be encouraged as a means to drive information sharing and knowledge transfer. Team members should adopt an attitude of a continuous improvement and learning and being on the lookout for problems and solutions to these problems. Sharing information in the department will contribute to sensemaking in the context of identifying environmental changes.

Network Centrality

Network centrality refers to the extent to which a given individual is connected to others in a network. The network centrality within the IoT department is especially relevant because of information flows. A person with a prime position in a network has the ability to access and control the flow of information (Houston et al., 2004). New product development's critical information embedded with workers in the form of tacit knowledge can flow between employees when a high level of network centrality is present. Instead of every employee having a high level of network centrality, valuable or critical information may flow through a focal person to the remainder of the department. For example, a commercial product manager tends to be involved with lots of different business units within the organisation.

Conclusion

Identifying discontinuities relies on information sharing and sensemaking. These practices are obstructed by knowledge barriers which in turn can be overcome by using support structures. In order to assess the current level of information sharing and sensemaking, established knowledge domains and existing knowledge boundaries need to be identified.

3.2.3 Addressing Discontinuities

After having identified environmental changes, appropriate action has to be taken. As Allen (2016) proposes, resilience involves mitigating operational risks before they occur. In order to mitigate the effect of risk factors, an organisation needs to anticipate on the discontinuity by reformulating its operational strategy, reconfigure the chain of (human) resources, or redeploy other forms of resources. This is what Sanchez (1995) refers to as *coordination flexibility*.

A high level of coordination flexibility is achieved when an organisation possesses the (human) resources to promptly address a large range of alternative issues while the time, cost and difficulty of switching the use of a resource from one to another remains minimal.

The organisation's (human) resources can be applied to a larger range of alternative uses while in terms of human resources, this so called *resource flexibility* (Sanchez, 1995) refers to the number of alternative uses to which the employee's skills can be applied.

3.3 Alignment

The various disciplines operating in the department require an alignment of their frameworks. Alignment stems from similar perceptions of both long term as well as short term objectives.

3.3.1 Long Term Alignment

Achieving a state in which individuals' goals are complementary to each other requires the establishment of *superordinate goals*. Pinto et al. (1993) found in their research that (among other antecedents) superordinate goals significantly and positively affect multidisciplinary cooperation and task outcomes. Superordinate goals are described here as "goals that are urgent and compelling for all groups involved but whose attainment requires the resources and efforts of more than one group". Previous research by Sherif (1962) has shown that introducing superordinate goals reduces intergroup conflict and leads to more cooperation.

Collectively achieving a superordinate goal requires the department to have a *shared vision*. It is important here to know what is meant by a shared vision and how it is achieved. Thoms and Greenberger (1995) describe vision as 'a cognitive image of the future' and argue that vision is the basis of group members' motivation, planning and goal setting. Tsai and Ghoshal (1998) describe a shared vision as shared representation, interpretation and system of meaning among parties. A shared vision is necessary for knowledge exchange to occur because it allows team members to identify and combine resources to pursue long term strategies.

3.3.2 Short Term Alignment

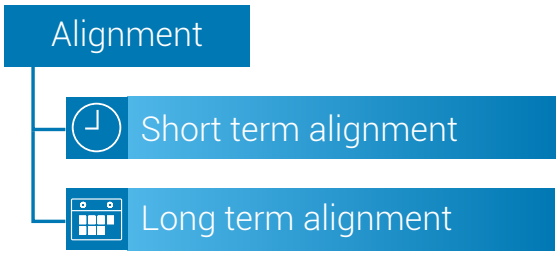
Goal Congruence

An individual's personal goals guide his actions and activities. Yet in multidisciplinary environments like IoT, every employee in the department has more than just one goal. Ideally, different disciplines within an organisation should possess complementary goals that relate to general, organisation-wide goals. In reality, overall goals are broken down to specific discipline-related goals that conflict with each other. Karlsson and Hlrstöm show that team members in multidisciplinary environments may feel reluctant about multiple directions and goals of the team they are operating in when compared to their personal goals. This causes problems with the allocation of their time, effort, attention, and leads to conflicts in prioritisation. Goal congruence refers to the degree of similarity in performance goals among team members (Karlsson and Ahlström, 1996).

A multidisciplinary team's effectiveness increases when the members' individual and shared goals are congruent to each other. Giving the same priority and agreeing on the importance of certain goals leads to goal congruence.

Task Cohesion

Task cohesion exists when members mutually commit to their group's task (Hackman, 1992). It is important that the employees tasks are cohesive since it stimulates employees to hold on to the task direction. It is argued by Mullen & Copper that highly task-cohesive teams operate smoothly because of an increased coordination among its members (Mullen & Copper, 1994).



3.4 Conclusion

This chapter investigated the determinants of organisational resilience and organisational alignment.
Organisational resilience requires an organisation to identify and accurately address environmental changes that significantly affect the organisational performance. Identifying changes relies on information sharing and sense making. In an organisation where employees are regularly sharing information, consciously interpreting this information collectively and are supported in doing so, the chances of identifying environmental changes are much higher.
Barriers to information sharing and sensemaking (knowledge boundaries) exist at the intersection between different disciplines. These barriers can be overcome by making use of support structures, stimulating problem solving and seeking behaviour, and increasing the individual's network centrality (the degree to which they are connected to others in the organisation).
An organisation's ability to address discontinuities relies on the extent to which they possess coordination flexibility and resource flexibility. These forms of flexibility allow an organisation to deploy various forms of resources to different purposes while minimizing the cost, time and difficulty to do so.
Organisational alignment occurs on both short term as well as long term. Short term alignment requires members of the organisation to have the same priorities (goal congruence) and work together on the same projects (task cohesion).
Long term alignment relies on establishing a superordinate goal and making sure that there is a shared vision on the future. A superordinate goal implies that the employees' short term goals are contributing to the same measures of success. A shared vision refers to people from different disciplines having the same future image of the organisation and agree on what would make the organisation successful.
All determinants of organisational resilience and alignment are shown in figure 6. These determinants serve as the basis of the interviews that will be conducted.

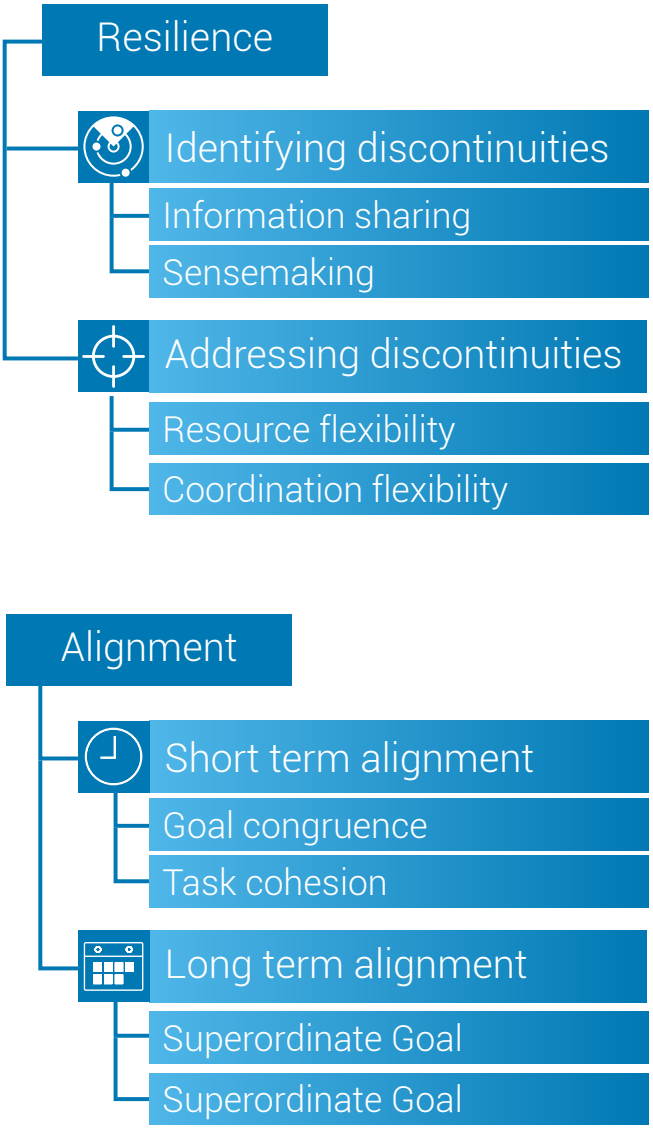


Figure 6. The determinants that consitute resilience and alignment.

4. Interview Setup

The literature study has identified the relevant determinants of developing operational resilience and alignment. This chapter explains how interviews will be conducted to investigate the extent to which these determinants are present in the department.

4.1 Resilience

Identifying discontinuities requires information sharing and sensemaking, or knowledge exchange. The interviews aim to provide an insight in what kind of knowledge is exchanged, by whom and where knowledge boundaries exist. They give insights in the knowledge domains and functional expertise areas of the employees.
It is also important to understand the flow of this knowledge, information and expertise. In other words, to what extent is information sharing and sensemaking present in the department? This information is required for identifying knowledge gaps that impact organisational effectiveness.
It is also important to find out 'Who needs to know what in order to perform activities?'. The interviews aim to find out the team members' demand for knowledge that the individual himself may not possess and where they get the knowledge from. It should lead to the identification of key employees who are serving as the "go to" sources of information and knowledge.
Question 1: What kind of knowledge is exchanged, why and between whom?
Question 2: What kind of knowledge lacks accessibility, and why?

Furthermore, the interviews aim to uncover strengths and weaknesses of both formal and informal methods for knowledge sharing that are currently present.
Question 3: What kind of support structures are used to facilitate information sharing and sensemaking?

In order to effectively identify discontinuities, knowledge about potential disruptions needs to be disseminated through the department. Network positions are an important determinant to this end. This part aims to uncover connected and isolated employees or workgroups that are not (efficiently) accessing sources of information and expertise:
Question 4: What is the department's network centrality?

Becoming resilient to environmental discontinuities requires an understanding of the discontinuities in the first place. The interviews aim to gain an understanding of how environmental discontinuities have affected the department's development projects in the past.
Whenever the department experiences discontinuities, it needs to have the resources to address these discontinuities. It is important to know to what extent the department possesses the freedom to deploy these resources.
Question 5: To what extent is the department flexible to address discontinuities? And what kind of discontinuities has the department experienced in the past?

Any discontinuity may cause the department to reconsider its development direction. It is important to know what makes the department decide to change priorities and directions and what these decisions are based on.
Question 6: Who has the decision authority, and what is this decision based on?

4.2 Alignment

In order to know the level of goal congruence in the department. The differences in priorities between employees or business functions need to be investigated.
Question 7: To what extent do the employees experience differences in priorities, and what are these differences caused by?

A high collaborative performance is achieved when people are working on the same projects, at the same time. For the level of task cohesion, the following research question is established:
Question 8: What are the tasks/activities/occupations of the employees, and in collaboration with whom are they conducted?

Even though every individual may have a clear view on his personal goals and direction, the employees may not have this in a collective form. In this part of the case study, the aim is to gain an understanding of the interrelationships between the team members' sense of direction and their perception of an overall direction for the department.
Question 9: What are the employees' visions on the long term direction of the department?
Question 10: How do the employees perceive to be contributing to this long term direction?

4.3 Interview Sample

Six qualitative exploratory interviews are conducted with people from various disciplines:

- Technical Product Manager M2M
- Commercial Product Manager M2M
- Technical Product Manager LoRa
- Bid Manager
- Service Level Manager
- IoT Consultant (Part of the PoC-team)

The interview questions are developed to provide answers to the research questions described in this chapter. The interview guide can be found in appendix A.

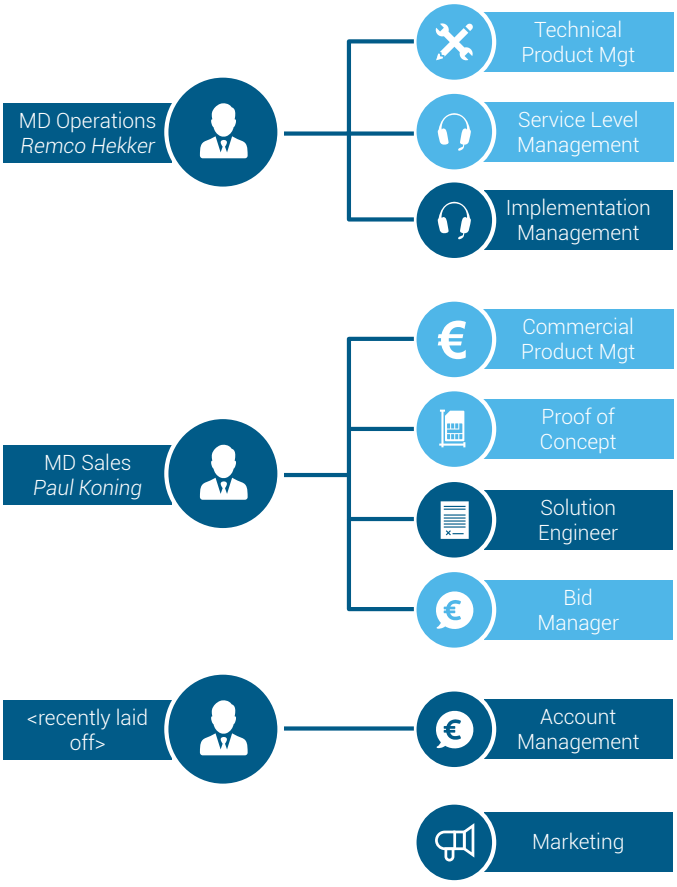


Figure 7. The interviewees are highlighted.

5. Interview Findings

This chapter provides an overview of the interview findings. These are structured according to the research questions described in the previous chapter. Note that this chapter only gives an objective documentation of the findings and does not give any interpretation to the findings. Furthermore, only the information that is relevant for subsequent stage of the project is documented.

5.1 Resilience

Question 1: What kind of knowledge is exchanged, why and between whom?
Question 2: What kind of knowledge lacks accessibility, and why?
All of the participants were asked about the kind of knowledge they are exchanging with their colleagues, and what this information is used for. The participants mentioned both knowledge that they provide to others as well as knowledge that they acquire from others. Table 1 provides an overview of the answers.

Client Requirements

The Consultant indicated to know most about the potential clients KPN is interacting with. She occupies the role of translating the client's voice to her PoC-team. The insights that she gains during her contact with clients are shared (solely) with her PoC-team with the goal of developing valuable use cases for her clients.
The technical product manager, essentially working on improving the product, indicated that he needs to know about a client's requirements in order to accurately modify or expand the product to the client's needs.
Both technical product managers indicated that whenever a client's requirements change, the product development planning usually has to change as well. The development trajectory consists of a complex path of actions that have to be taken and follow each other up. Whenever the requirements change, this sequence of actions is usually affected.

Type of knowledge	Between whom?	Knowledge used for
Client data usage	BM -> BI	To make financial forecastings
Client figures	BI -> CPM	To make and present financial plans to higher management
Financial forecasts	BM -> CPM	To make and present financial plans to higher management
Clients' requirements	AM -> SE AM -> CPM AM -> TPM	For developing and tailoring the product to the clients' needs
Technical product knowledge	TPM -> AM/Sales SE -> SLM TPM -> SLM	To come up with new solutions for clients To solve current issues for clients
Commercial product knowledge	BM -> SLM	To help clients with questions about pricing and payments
Market knowledge	N/A	Anticipate on market developments
Emerging clients' needs	N/A	Anticipate product development plans

Table 1. The different types of knowledge that are exchanged (blue) or the types of knowledge that should be exchanged, but aren't (orange).

Contract Information

All participants apart from the consultant indicated that contract information poses as a bottleneck in information exchange. The client's contract contains a lot of technical information, usage information, connection-related information, etc. This information is required by a lot of people throughout the department for doing their activities. The Commercial Product Manager indicated that he would like to see some sort of 'Google' function to enable an easier way of looking for information.

Technical Issues

The service level manager indicated that whenever an issue with a supplier emerges, he usually experiences this a couple of days or weeks later by clients contacting him with problems. He indicates that when he contacts the appropriate parties about fixing these issues, they were already aware of these issues. But since they did not know of the importance of the issues, they did not seem to care tell others about it.

Product Knowledge

The commercial product manager indicated that knowledge of the product is essential to a good performance. He mentioned this to be mostly reflected in sales. According to him, a profound understanding of the product increases the chances of acquiring new clients. The Technical Product Manager (2) indicated that he irrefutably possess the most profound and complete knowledge of his product (M2M). As of that, he mentioned, he is regularly invited for meetings with clients in order to tell more about the product, give demos or answer the more complex questions a client may have.

This was mentioned by the technical product manager as well. He indicated that the service level team, or new employees in general, frequently require his support by asking him about technical specifications and possibilities of the products. He elaborated on this further by saying that the product and its specifications are simply too complex to just convey during a couple of training sessions.

The complexity of the product was further emphasized by the bid manager, who indicated that she has more than once noticed new employees, after having been trained, still make a lot of grave mistakes due to a lack of knowledge about the products.

The bid manager indicated that she would like to see some sort of understandable overall bible of the department that shows how everything works. This is because she notices a lot of information exchange revolves around clarification on products, pricings or other standard knowledge.

Support Structures

Question 3: What kind of support structures are used to facilitate information sharing and sensemaking?

The participants all elaborated on the currently existing support structures and what they are used for. Figure 8 shows the support structures and what they are used for. Some of these are officially deployed (like the O-drive) and some are unofficially taken in use (like Whatsapp).

All participants elaborated on the O-drive not being an effective repository, since the folder structure has grown very elaborate which makes it very hard to find the right information. Furthermore, the participants indicated that even though roadmaps do exist, they are barely used.

The Service Level Manager mentioned a barrier to interpersonal information exchange, being when someone is not physically present at the office. Another barrier to interpersonal information exchange is mailbox related. Both the Commercial Product Manager and the consultant indicated that communication through email is not very effective due to the amount of emails received every day. They indicated to prefer face to face or calling or whatsapp contact.

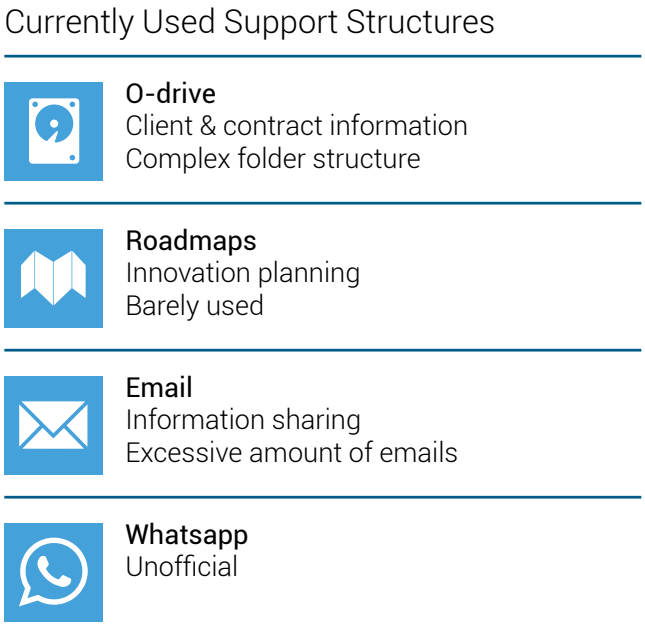


Figure 8. The support structures that are being used in the department.

Isolated Business Functions

Question 4: What is the department's network centrality?
All participants indicated the colleagues or business functions which they are most closely related to and frequently in in contact with. The results of this question are combined with the earlier mentioned knowledge exchange and preliminary investigation to establish the department's network centrality. Figure 9 shows the overview of this network centrality.

The consultant indicated to be most frequently in contact with her PoC-team, by translating the client's wishes to them. Furthermore, she is a lot in contact with the clients themselves, and with generic sales.
The consultant indicated that there has been very little attention for the use cases that she and her team develop. She said that the insights gained during contact with client were almost never shared with the management team, and as a result, were never translated to concrete steps.

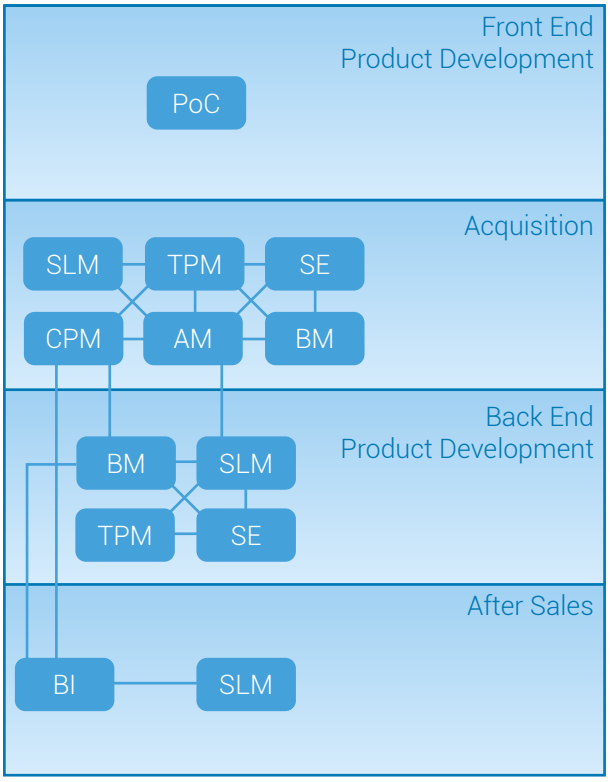


Figure 9. The network centrality of the department. It can be seen that front end product development is isolated from the rest.

Management Related Discontinuities

Question 5: To what extent is the department flexible to address discontinuities? And what kind of discontinuities has the department experienced in the past?
The interviewees together have mentioned the following discontinuities that have happened in the past and had a significant effect on the department: new managing directors (MD), shifting visions on the department, product additions, product eliminations, management rotation and other HR rotation. Figure 10 provides a summarized overview of the discontinuities and their effects on the department. Some of these effects can be considered as another discontinuity and set another chain of effects in motion. These are marked with a white mark.
Furthermore, the Technical Product Manager indicated that whenever management decides to change focus to other projects, that it is frequently the case that he finds themselves having wasted time and resources in projects.

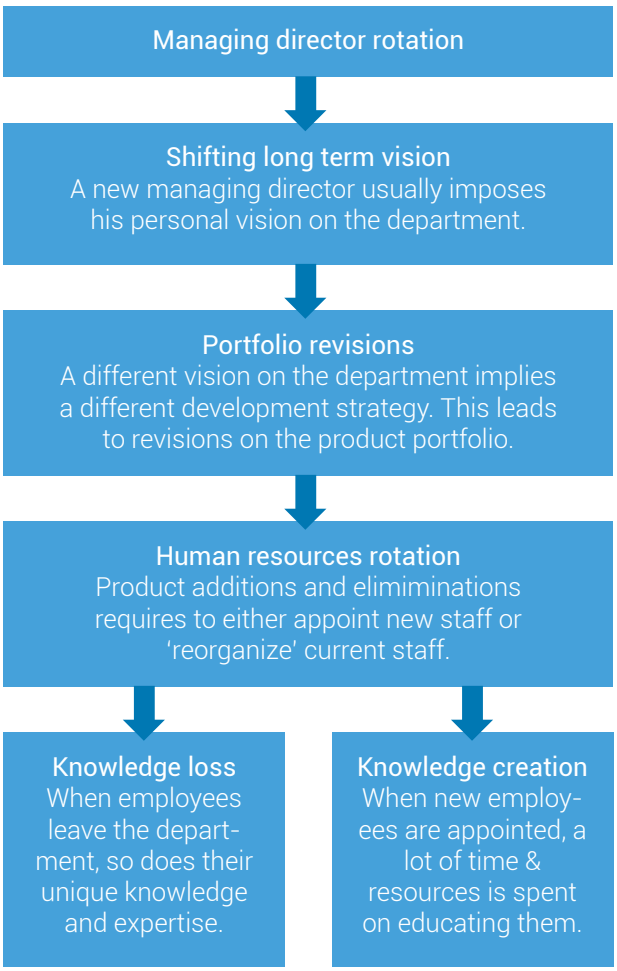


Figure 10. The organisation experiences different kinds of discontinuities, which in turn set in motion other discontinuities.

Coordination

Question 6: Who has the decision authority, on what and what is this decision based on?

Table 2 shows the overview of decision autonomies within the sample of interviewees. There is a clear difference between decision areas to be noted.

The Bid Manager and Service Level Manager only have decision authority in areas related to their own expertise, while the other interviewees have the authority on decisions that affect the department's direction.

Who	Decides on	Bases decision on
TPM	Go or no-go decisions on projects on product level	Estimated value for clients or his perception of improvement to the overall product
CPM	Whether to focus on product or price	The urgency and/or the economic attractive-ness
BM	The kind of product pricing strategy (procurement)	Client information, expected client usage and expected value generated
Consultant (PoC)	Which protential clients to approach	Perception of potential profitability in later stages
SLM	How to solve issues	The effort it will require and the way in which it will address the problem of the client

Table 2. The overview of decision autonomies within the sample of interviewees. The table shows what the interviewee decides on, and what he or she bases this decision on.

5.2 Alignment

Question 7: To what extent do the employees experience differences in priorities, and what are these differences caused by?

The IoT Consultant indicates to be focused on creating awareness by giving workshops and presentations to a wide array of potential clients. She indicates to notice a conflicting difference between her and sales when considering contact with clients.

"Yes, they see signing the contract as their main priority. I just want to start developing as many different things as possible. Of course that clashes sometimes." [IoT Consultant]

The technical product manager elaborated on a so called 'pool of issues' which contains technological product related issues or bugs which all need to be fixed or features that need to be developed and/or implemented. He explained that the department does not possess enough 'change capacity' in order to address all of the issues and as a result they need to prioritize the issues that take the most value for clients. These high priority issues make up a large part of the operation's team short term objectives. These issues can be put forth by any member of the department. For example, the Bid Manager indicated that she sometimes requires modifications to certain aspects of the product or the service platform in order to be able to come up and offer clients a particular form of pricing. She mentioned that it frequently happens that she sends a request to operations to make a modification, and realises only a couple of weeks later that the modification has not been addressed.

The commercial product manager indicated that he sometimes experiences misunderstandings with colleagues from a technological background because technical people do not seem to understand the necessity of making a commercially viable story out of the technology.

The consultant indicated that she has experienced a lack of support from the management team. She describes that human resources are not provided to support her with her issues. Whenever she is putting operations-related issues forth, they're not given priority and are not placed in the roadmap.

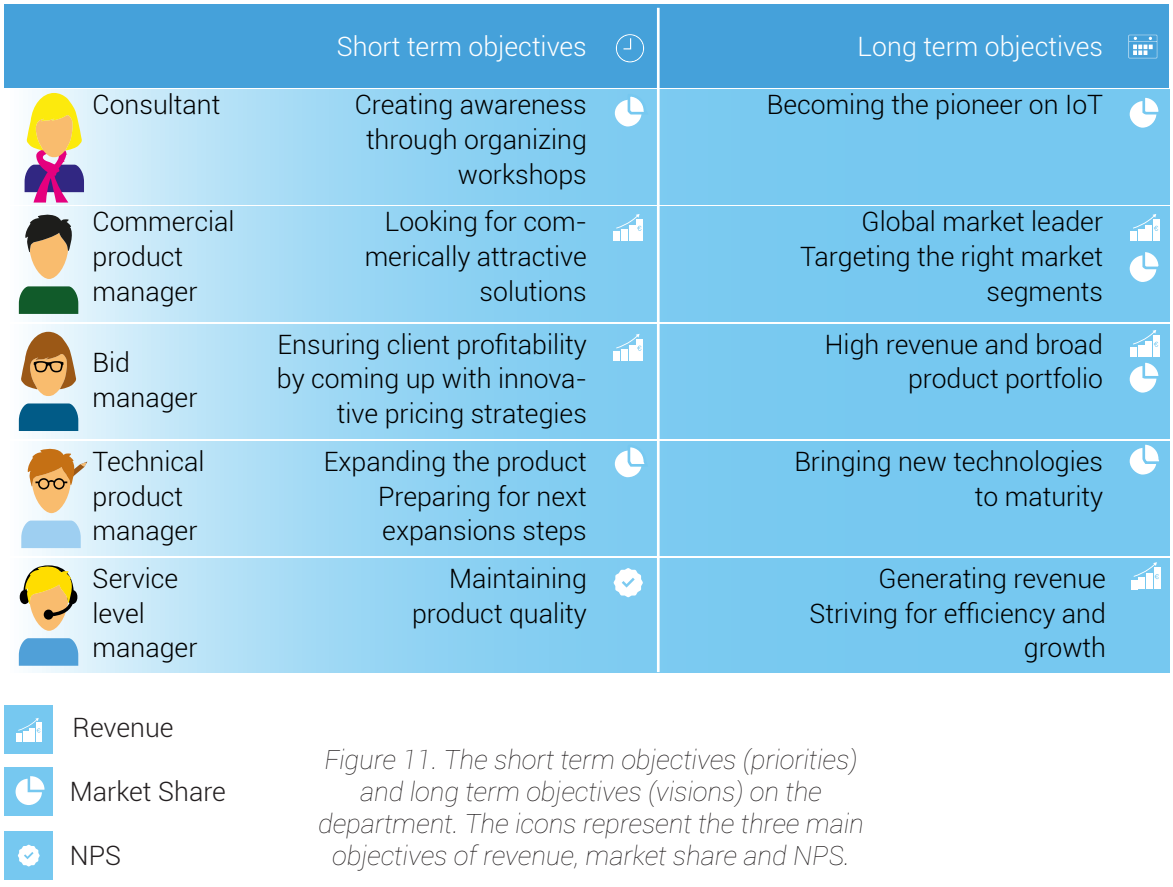


Figure 11. The short term objectives (priorities) and long term objectives (visions) on the department. The icons represent the three main objectives of revenue, market share and NPS.

Question 8: What are the tasks/activities/occupations of the employees, and in collaboration with whom are they conducted?
The bid manager, commercial product manager and technical product manager mentioned the 'revenue recovery' project in their short term objectives. The bid manager added other revenue related objectives to that.
The consultant, Service Level Manager and technical product manager did not mention any revenue-related short term objectives. Rather, the Service Level Manager and technical product manager mentioned solely quality related objectives like improving the effectiveness of operational procedures (Service Level Manager) and successfully finishing the 'migration project' (Service Level Manager & Commercial Product Manager (1)) which involves transferring clients from an old service platform to a new service platform.
The consultant indicates to be focused on creating awareness by giving workshops and presentations to a wide array of potential clients. She indicates to notice a conflicting difference between her and sales when considering contact with clients.

"Yes, they see signing the contract as their main priority. I just want to start developing as many different things as possible. Of course that clashes sometimes." [Consultant]

Question 9: What are the employees' visions on the long term direction of the department?
Question 10: How do the employees perceive to be contributing to this long term direction?
Figure 11 shows the interviewees' visions on the department (long term objectives) and includes what the interviewees perceived to be their contribution to this (short term objectives).

5.3 Conclusion

Identifying Discontinuities

Knowledge exchange within the department does not occur across all knowledge domains. Most of the department seems to be connected quite well to each other, yet only exchanges knowledge about daily operational routines.
There are no accurate support structures in place that facilitate the exchange of knowledge about discontinuities. Within the department, the front end of product development (Proof of Concept) seems to have the most knowledge about external environmental discontinuities (changing client needs and market developments). Nevertheless, they seem to be isolated from the remainder of the department. As such, valuable knowledge about market developments and changing client needs are not disseminated into the department.
Knowledge about internal discontinuities seems to be located at business intelligence. This knowledge is disseminated into the department through the commercial product manager as focal person. This knowledge is interpreted from a commercial perspective to the remainder of the department.

Addressing Discontinuities

The department does not possess sufficient change capacity to address all issues that emerge. Decision making seems to be done from a commercial perspective that prioritizes short term value creation.

Short Term Alignment

It was found that the multidisciplinarity expresses itself in differences in priorities and interests. There is a clear difference to be noticed between commercial perspectives, awareness and quality related perspectives. These differences in priorities occasionally lead to stagnation in projects or confusion about responsibilities.

Long Term Alignment

It was found that the department's employees have different perceptions of the long term successfulness of the department. These different perceptions of long term successfulness can be divided into three categories: Revenue, Quality and Diversification. These categories are similar to the three main objectives of the department: Revenue, NPS and Market share.

6. Discussion

This chapter interprets and discusses the findings from the previous chapter. The chapter strives to identify the core of the problem situation.

6.1 Resilience

No Support Structures

There is no effective support structure that facilitates a form of sense making in the department. A support structure for information exchange is the O-drive, a network drive that is comprised of a complex folder structure and does not offer an accessible way to look for information. This merely facilitates an exchange of information rather than a means to stimulate discussion or interpretation of changes in the environment. Furthermore, there is no real innovation roadmap in use.

Operational Knowledge Exchange

It was found that knowledge exchange in the department happens mainly for daily operational tasks. The employees are working on their own activities and exchange knowledge only when necessary for the execution of these activities. As such, information about discontinuities is only shared whenever it is already playing up.

Network Gap

At the front end of the development trajectory, the PoC-team, together with the IoT consultant serves as the first contact point for potential clients. They are responsible for the pre-sales phase. Therefore, they gain a lot of valuable information about market developments and changing clients' requirements. However, this information is only shared within the PoC team. Which means that the back end of product development does not learn about it.
This information could potentially be of great value for the back end of product development (technical product management, solution engineer and new product development) because it would allow them to tailor their plans while accounting for the future market developments.

Reactive Development

Instead of recognizing changing market needs up front by sharing information across the department, the back end of product development learns about clients' requirements from the account manager at a later stage in the trajectory of client acquisition. As a result, the back end of the development trajectory is not given the time to react appropriately to these developments and are forced to develop reactive to clients' emerging wishes and are experiencing "a certain form of lagging behind" (as mentioned by the technical product manager and the commercial product manager).

Product Complexity

Over time, numerous new large clients have been acquired. Consequently, the department's product has been modified in many ways to satisfy these clients' requirements. Instead of systematically building up the product from A to Z, the alterations have been made over time and one by one. As a result, the product's size and complexity has risen to a level that requires an evenly increasing team of service managers that is continuously solving bugs and issues that inevitably emerge over time.

Pool of Issues

All the issues that originate from the product complexity leads to a so called pool of issues that have to be fixed. Some of these are higher priority than others. Since this pool is never empty, some minor issues will always remain in this pool of issues. This also causes frustration among some of the department's employees. This pool of issues strains the department's change capacity. There are not a lot of free full time employees for new activities or projects. As such, the resource flexibility level of the department is lower than desirable.

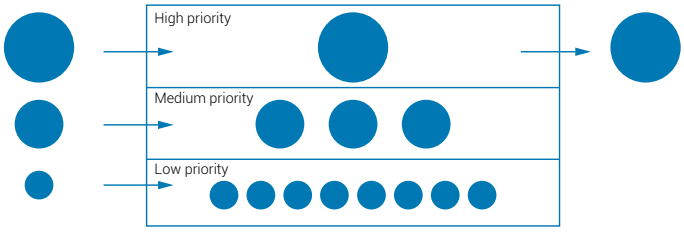


Figure 12. The Pool of Issues contains low, medium and high priority issues. Low and medium priority issues tend to stay longer in the pool of issues.

Past Discontinuities

The discontinuities mentioned by the participants were all management related. Furthermore, they do not directly affect the department's development projects. Instead, they're more likely to burden the department with a loss of knowledge. Although these discontinuities fall out of the scope of this project, other discontinuities were derived that do affect the development plans directly. Table X gives an overview of these discontinuities and how they affect the department.

The department experiences a number of discontinuities which directly affect development projects. When a client's requirements change, the department needs to make modifications to service platforms in order to meet the new requirements. In other words, new development projects are undertaken and the 'pool of issues' increases in size.

Financial discontinuities (revoked budgets or a deviation in financial performance) causes the department to focus on short term monetary value creation. This in turn leads the department to undertake only projects that will lead to an increase in revenue.

Problems with suppliers are the cause of projects stagnating.

Service level discontinuities drives the department to undertake projects that improve the quality of the product. This causes the department to put low priority projects on hold.

It can be concluded that all of the abovementioned discontinuities causes the department to shift its focus to other development projects. As such, the level of resilience can be considered low.

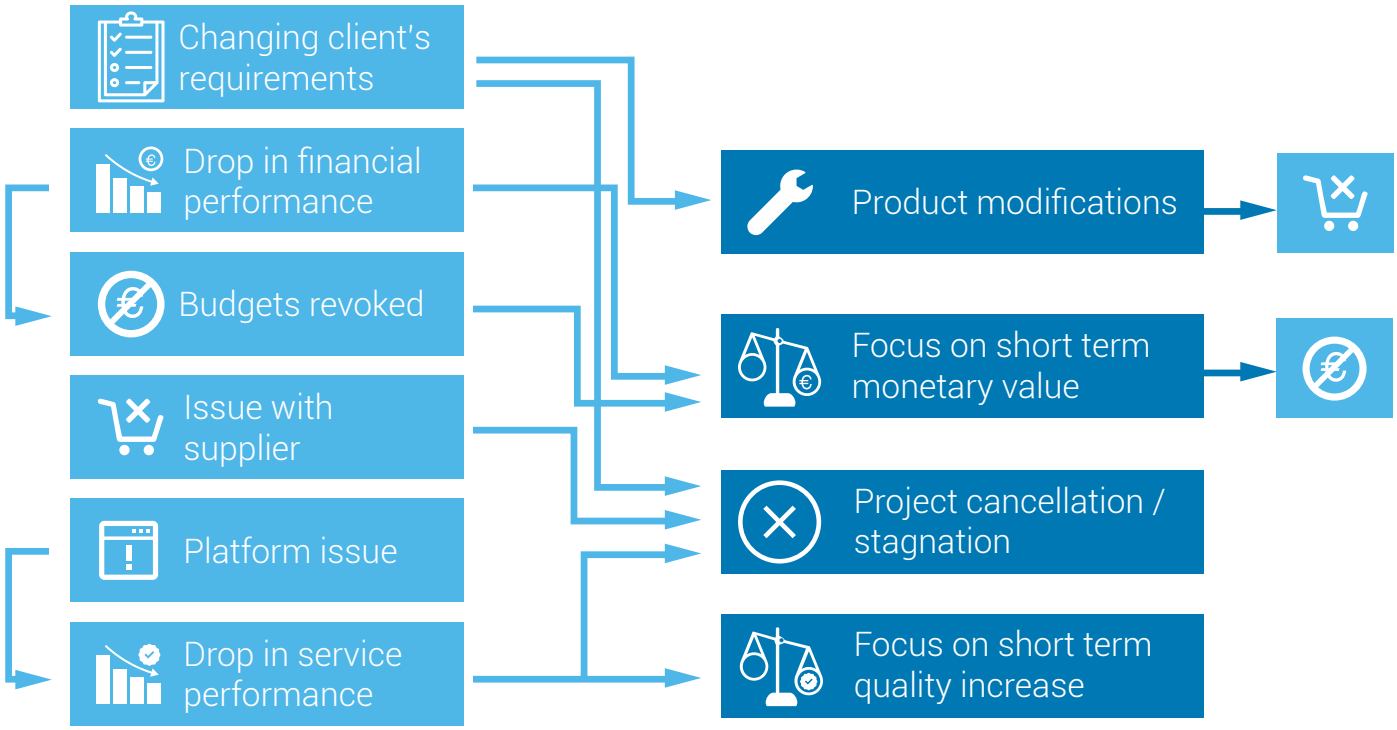


Figure 13. Discontinuities are constantly affecting the department's development plans. These discontinuities causes priorities to change and budgets to be revoked.

6.2 Alignment

Priority Conflicts

Differences in short term objectives and the lack of task cohesion it causes together leads to differences in priorities. Individual business units often have their own KPI's that they are working towards. Activities and projects that constitute these KPI's are thus given priority. However, the Pool of Issues that was described in the previous section is prioritized according to short term value creation. Third level management prioritises addressing the most important issues before addressing the minor ones. Consequently, some of the minor issues in this pool are not addressed at all, because there is always an issue more important which need fixing. Although addressing high priority issues may be the most efficient way to maintain value in the short run, it does lead to stagnation of other projects. This in turn leads to annoyances and friction between team members. Furthermore, there is not always a full understanding of the rationale behind changing directions or priorities.

"This causes frustration among the people in the department, because they identify the same issue over and over again, and do not see people working on it." [Technical Product Manager]

Short Term Commercial Decisions

Whether or not discontinuities are addressed usually depends on the (commercial) severity of the issue. Go or no-go decisions on product level are made by employees (Commercial Product Manager) that are concerned with economic business value. For example, when the department noticed that a number of clients was receiving incorrect invoices (platform issue). This would prevent the department from being paid appropriate for their services, which obviously is a commercially undesirable situation to be in. Consequently, the issue was immediately picked up by the commercial product manager who made sure that the cause was investigated and a solution was developed within a week.

These perceptions of potential business value are generally established by assessing short term project outcomes. As such, the department's form of coordination flexibility is mostly comparable to a project management approach, which is the planning, organizing, directing, and controlling of company resources for a relatively short term objective.

Conflicting Visions

During the interviews, it became clear that there are a number of different visions on the future of the department. The front end of the development trajectory is concerned mostly with client and product diversification. When moving towards the back end of the trajectory, the vision shifts more towards one which concerns improving the quality of the current offering.

These two viewpoints can be considered conflicting. Diversification within the current portfolio requires modifications to the product and its supporting platforms in order to accommodate this diversity of clients. Modifications in turn lead to a wider array of issues and cause turbulence in the technological foundation of the department. As a result, change capacity is pressured and priorities are given once again to short term objectives.

Vision Differences

Although a multidisciplinary department requires the viewpoints from various disciplines, it also benefits from the employees having a clear understanding of how their personal goals constitute to a superordinate goal. This superordinate goal did not seem to be present. As of that, there is no department wide consensus on the long term direction which makes it difficult to shape the activities of different business units so that they become cohesive and complementary to each other.

A possible reason for the absence of a shared vision and superordinate goal could be rotation in management. Managers seem to favour different directions and impose different views on the department. Yet it takes time to articulate a meaningful vision to a large number of employees and shape the department in such a way that allows to collectively work towards this vision.

Although influencing management rotation is out of the scope of influence of this project, it makes sense to refer here to Pearce et al. (2004), who argues that the creation of a vision is best done at team level in a form that is shared between the members of the team. Instead of one individual developing a vision and sharing it between all the members of the team, the team rather co-develops the vision.

6.3 Reflection on Theory

The interviews were conducted to find out the extent to which the determinants of resilience and alignment are present in the department. Figure 14 provides an overview of all determinants and highlights the most important findings with respect to these determinants. It can be concluded that there are problems with all determinants. The next chapter elaborates on the opportunity that this situation poses for the project.

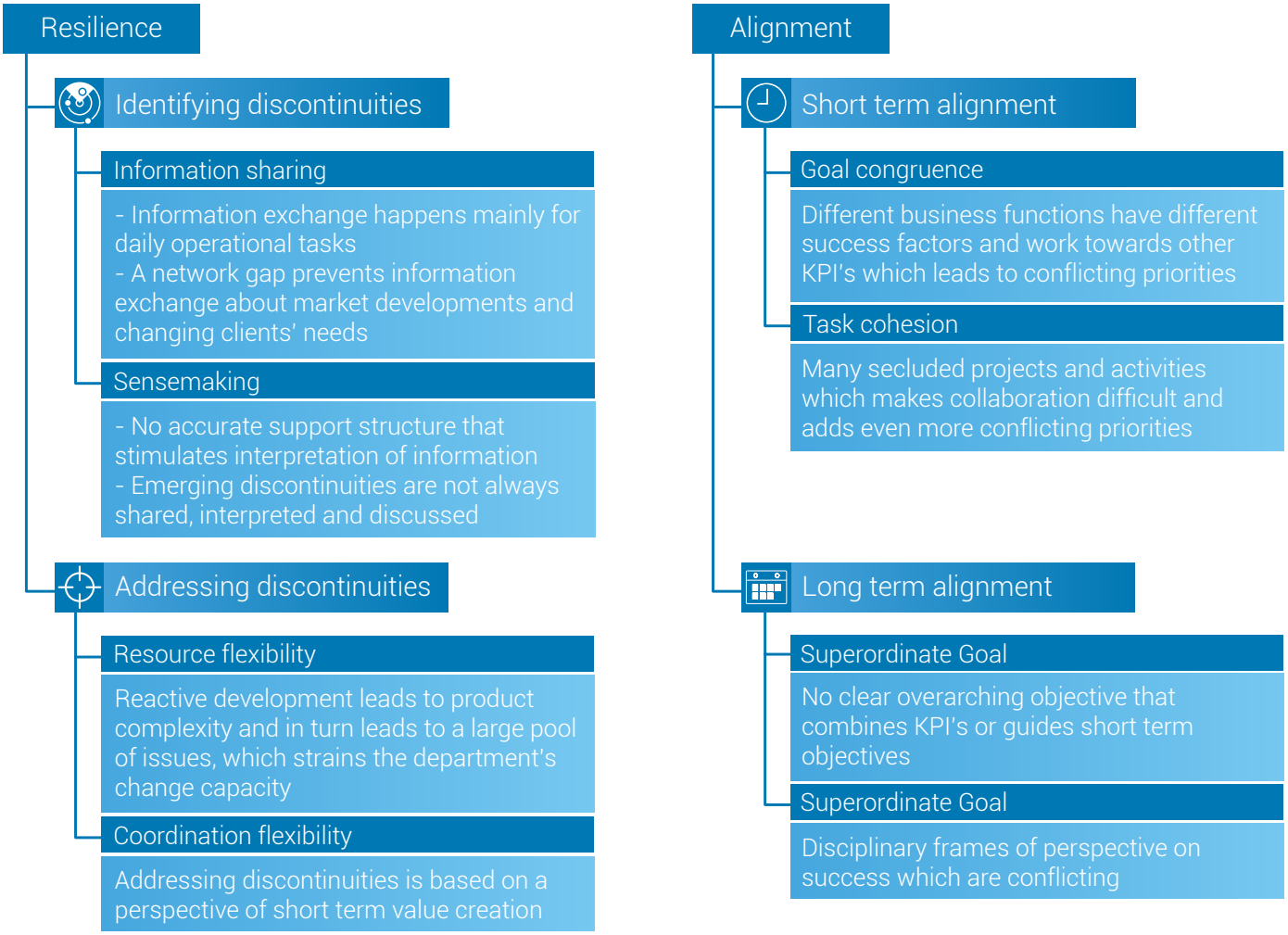


Figure 14. The determinants for resilience and alignment were investigated. None of the determinants scores higher than average. The reasons for this are listed in the table.

6.4 Conclusion

The department suffers from a number of different discontinuities that directly affect the department's development projects. These discontinuities are frequently unforeseen because the department lacks an accurate form of knowledge exchange.
When discontinuities emerge, the decision to address or neglect them is based on assessing short term monetary or quality-related value (Revenue and NPS). Addressing discontinuities happens by either shifting priorities or revoking budgets both of which in turn lead to either project cancellation or stagnation. Product expansion (market share) is not prioritized because it does not provide short term value (and because the decision-making authority lies with people who favour short term value creation).
Inherent to this prioritization is a lack of monetary resources for the front end of product development (PoC). This in turn has lead to a network gap between the front end and back end of the product development trajectory. This network gap causes an obstruction to exchanging information about the market developments and the evolving requirements of (potential) clients.
Changing client requirements in itself is considered a discontinuity because of the necessity to shift resources as a reaction. At the same time, this causes the product to be developed unsystematically, which on the long run causes numerous more technical issues to emerge.

The combination of sudden discontinuities and a short term oriented form of management sets in motion a chain of events that ultimately causes more discontinuities. As such, the problem situation is a self enforcing circle (figure 15).

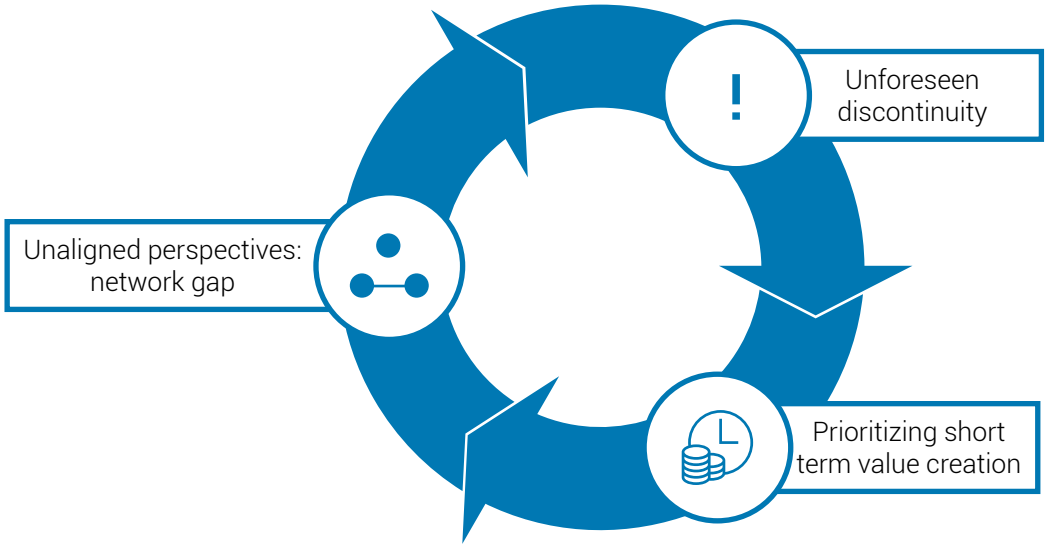


Figure 15. The problem situation in the IoT department is a self enforcing circle.

7. Opportunity Area

The analysis phase has identified problem areas within both resilience as well as alignment. This chapter summarizes the problem areas that emerged from the interviews and highlights the opportunity for improvement by making use of a boundary object.

7.1 Resilience

Concerning resilience, the department lacks an accurate form of information exchange. There is a network gap that prevents the department from relevant environmental information from being exchanged. The information that actually is shared between the organisation's members concerns mostly daily operational tasks. As a result, information about internal and external environmental changes (e.g.: new client's needs, market developments or internal performance) is not accurately shared. The department requires a solution that facilitates exchanging information about these discontinuities.
Addressing discontinuities happens by changing priorities. However, the department lack change capacity, which means the employees are constantly changing their focus. Furthermore, the decision making authority lies with people with a commercial perspective. Addressing discontinuities is done based on short term business value and does thus not take into account long term development planning.
The problem situation as described above could be improved by making use of a boundary object. A boundary object could serve as support structure for exchanging information about discontinuities. Furthermore, the boundary object could be used as a tool that helps the department with planning development projects in such a way that it takes into account more than just short term commercial perspectives.

7.1 Alignment

The department suffers from the absence of a superordinate goal that guides individuals' short term objectives. Individuals are working according to their own frames of perspective which leads to an incongruence in goals and conflicts in priorities. Furthermore, a lot of different tasks and projects are conducted at the same time. This in itself is not a problem. However, the coherence is not always clear. As a result, there is not always a clear understanding of why certain directions are undertaken and why certain projects are given priority.
There is no clear connection between individuals' KPI's and a superordinate goal. In line with this, the employees do not share the same vision on the future of the department. This problem could be addressed by providing a certain form of communication about the department's considerations on direction. This could help the employees with understanding how they are working together and how they are all part of the same development direction.

7.2 Conclusion

As described in this chapter, the issues with both resilience and alignment could be addressed by making use of a boundary object. This boundary object could serve as a digital support structure that facilitates the exchange of information about discontinuities. Furthermore, by containing information about the department's projects, business functions and objectives, it could help the department to improve their planning in such a way that it incorporates all perspectives and deal with its lack of change capacity.
A digital object also serves as an appropriate solution area for improving the department's alignment. The boundary object could be developed in such a way that it communicates the department's development direction and superordinate goal. Individuals that are working towards the same superordinate goal implies that the individuals' goals are congruent to each other. More goal congruence should also stimulate collaborative efforts, hence increasing the task coherence. Ultimately this could lead to a better collaborative performance and more continuity in the department.

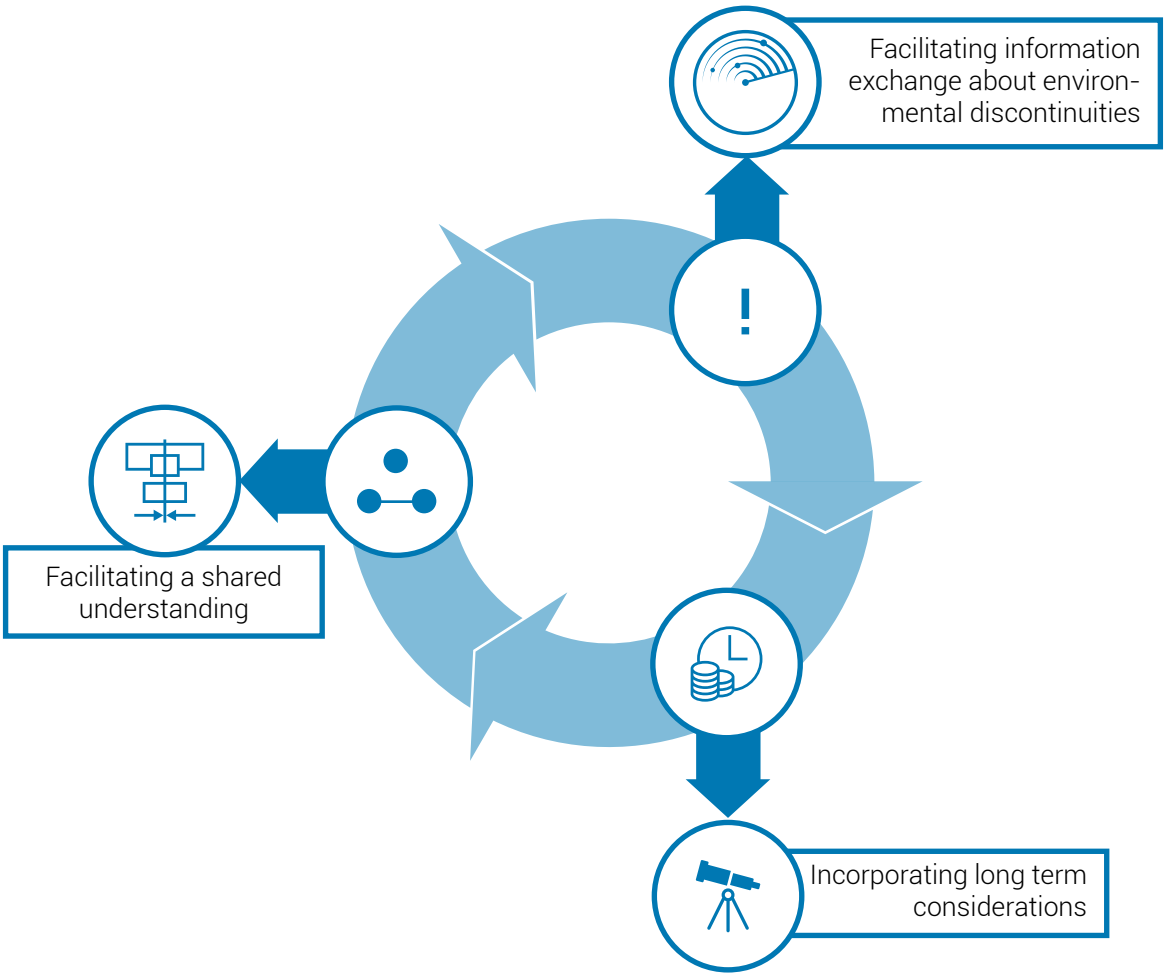


Figure 16. The self enforcing circle can be breached in different ways.

Phase 3

Development

The previous phase identified an opportunity area in which the department could increase its resilience to discontinuities and improve its organisational alignment. This opportunity area suggested making use of a boundary object to overcome the challenges involved. This phase describes the process of developing this boundary object. Three iterations were required to come to the final design. Each iteration is documented and structured as follows:

1. The vision describes how the design iteration intends to address the opportunity area and tackle the problem situation.
2. The objectives describe how the design intends to fulfill the mission.
3. The approach describes the key concepts that go into the design.
4. The design describes the result of the design process and elaborates on how the usage is envisioned and how the result could provide value and solve the problem.
5. Afterwards, the concept is validated to learn whether the design is feasible, usable and understandable and to what extent it will be able to live up to the objectives. This aims to identify areas that need improvement.
6. Based on these validations, a conclusion is drawn that serves as the basis for the next design iteration.

8. Iteration One

This chapter describes the vision, the approach, and the result of the second design iteration. It ends with a validation round that serves as the basis for the next iteration.

8.1 Vision

The situation at KPN IoT could be improved by making sure that the right people will be aware of discontinuities before its effects become visible. This way, they are given the time to react to these discontinuities properly. In the case that an unforeseen discontinuity occurs and development direction has to change, the department should suffer as little as possible by minimizing the amount of resources wasted.Furthermore, the department should be facilitated to execute projects more accurately and collaboratively, and made sure to realize that it is operating as a coherent whole.

8.2 Objectives

The design should enable the exchange of information that is relevant to decisions on whether to further pursue a project or not.
This objective should prevent employees from being confronted with critical information after the effects have already emerged. For example, whenever the commercial product manager senses that a certain budget will be cut in the near future, the technical product manager should be informed about this as soon as possible. Otherwise, he may continue working on a project that will not be pursued anyway.

The design should enable the department to postpone decisions to go for either one or another development direction.
Different development projects regularly require the same building blocks. For example, there are two development plans running that target the automotive market segment and both of these plans require the M2M product to be reconfigured in the same way. This reconfiguration would be an overlapping building block. Spending time on this reconfiguration will be resources well spent, regardless of choosing either one of the development trajectories later on.

The design should help the department to reduce the number of projects that people are working on at the same time.
This should prevent conflicts in priorities. In the department, a large number of projects are running at the same time. Imagine that next to the two development projects mentioned above, there are three more development projects running each of which also requires the M2M product to be reconfigured. Yet New Product Development only has a limited amount of change capacity. This inevitably leads to some of these projects stagnating.

The design should show how various objectives throughout the department relate to each other.
The employees are viewing the department's future from their own disciplinary perspectives. The different business functions have different KPI's and different priorities. Unknowingly however, these business functions are sharing the same interests and ideas nonetheless.
Consider the following example: The Automation principal indicated that he wants to prepare the department for future growth by increasing efficiency. He intends to do so by implementing a new contract registry that supports the acquisition process. At the same time, the Marketing principal indicated that she wants to contribute to the department's revenue by generating more leads. In order to do this, she needs an automated follow-up on leads. Both principals are thinking about automation in the acquisition process yet they are not aware of their shared concern.

8.3 Approach

The first iteration draws on existing management approaches and intends to combine them to develop an accurate solution that addresses the vision and objectives as described.

8.3.1 The Foundation

All of the department's development plans require certain assets to be realised. These assets could be suppliers,

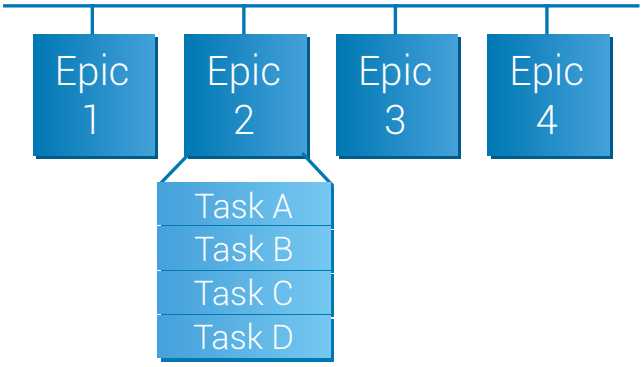


Figure 17. The department's projects consist of a number of epics each of which consists of a set of tasks.

money, product features, etc. Together they form a chain of events which together comprise a process that delivers significant business value, a so called critical chain event (Steyn, 2002). The department's development plans can be compared to these critical chain events.
Whenever a discontinuity occurs, the this essentially means that one of the assets is missing. For example, there is no budget, or a product feature has to be configures, yet there is no-one available to do this.
In order to make sure that this information becomes known to the relevant people, the status of these critical assets needs to be monitored constantly. Monitoring a portfolio of projects is referred to as program management (Morris and Pinto, 2010). The department recently started using Jira as project management tool. This tool allows for all projects to be submitted. Therefore, the design draws on Jira as foundation. The focus point principals should submit their focus point plans through Jira. They will do this in the form of a set of epics, with each epic containing a set of tasks required (figure 17). These epics together describe exactly what is needed to execute the plan.

8.3.2 Communicating Pathways

The development paths can be shown in various ways. However, as was found in the analysis, any development trajectory usually consists of a complex sequential pathway. Each of the steps within this pathway is represented as an epic. The balanced scorecard strategy map (figure 18) describes an appropriate way to show sequences in development strategies. Instead of strategic objectives however, the design could adhere to epics. The focus point principals should submit their development plans in Jira while indicating their sequential relationships. Thus, the design will be able to export sequential pathways of epics (building blocks) required for the development plans. Note that the term 'epic' refers to the basic unit of work in a SCRUM way of working (agile).

As was found in the analysis phase, different development projects occasionally require the same building blocks, without the involved employees being aware of it. Since the focus point principals will have to submit their development plans in a predefined fashion anyway, the design should be able to recognize overlapping building blocks and communicate this to the department.
Communicating overlapping building blocks will not only emphasize interrelationships between different development strategies, but will also enable the department to postpone their decisions to choose for one or another direction.
For example, there are two development plans running that target the automotive market segment. The first plan revolves around offering transportation companies a more effective form of fleet management. This project is conducted in collaboration with Daf (a truck manufacturer). Meanwhile, the second plan revolves around the development of connected navigation that enables a smarter form of route planning. This project involves a collaboration with Tesla. Both of these projects require the M2M product to be able to handle location tracking. This would be the overlapping building block. Now imagine that at a certain point, Daf has to suspend the partnership for an unknown reason. At this point, the decision is easily made to shift their focus to the development plan with Tesla, without the remorse of having wasted resources. They have focused on acquiring mostly the overlapping building blocks and have minimized the resources lost.

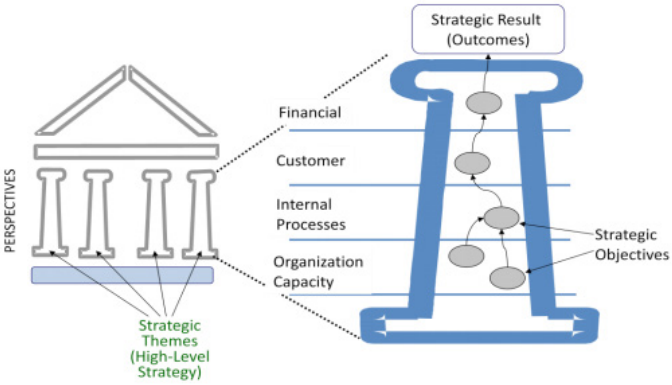


Figure 18. The self enforcing circle can be breached in different ways.

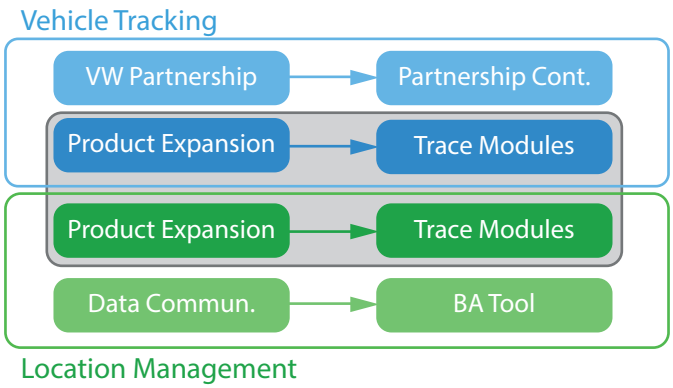


Figure 19. Some development projects require the same building blocks.

8.3.3 Establishing Strategic Themes

Strategic pathways are best implemented by establishing strategic themes (Britz & Buys, 2007). An appropriate way to establish strategic themes within the focus point development plans is by drawing on Portfolio Kanban systems. These systems track epics and describe a number of stages that an epic passes through. Within Portfolio Kanban systems, epics are divided into 'value streams' by labelling them with capabilities and features. As aforementioned, the focus point principals should be required to submit their development plans in a predefined fashion. While they are doing that, they could easily label their plans with characteristics. These characteristics in turn could enable the tool to identify frequently recurring characteristics and hence establish a number of themes.

8.3.4 Prioritized Execution

In the situation that a number of strategic themes is established that all comprise of a number of development plans, it should be up to the management team to make a clear prioritization on which themes to pursue first.
When a certain theme is given priority, all development plans within this theme will then automatically also be given priority. And since these development plans are submitted through Jira with a set of tasks and people assigned to these tasks, it will be easy to permeate the management team's prioritization to individual project level tasks prioritization.

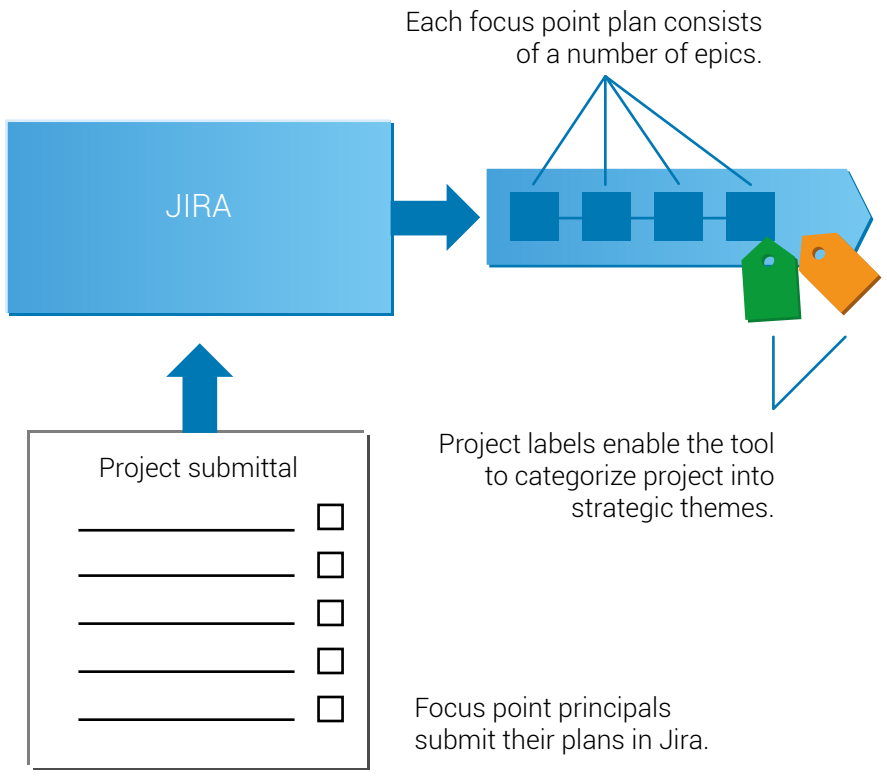


Figure 20. The process of submitting focus point plans.

8.4 The Design

The first concept has taken the form of a web based roadmap that communicates both the strategic development plans from the 11 focus points and shows how these plans are to be executed. The roadmap imports data about projects from Jira and visualizes this data in a comprehensible and meaningful way. The roadmap consists of three views: strategic, tactical and operational. Each of these views focuses on different matters and provides information on different levels of detail. This way, the user can easily see the 'status quo' of the department on both macro and micro level.

Focus point plans are submitted by focus point principals through Jira. These plans are labelled with characteristics and are categorized in strategic themes. The focus point plans are categorized according to the characteristics of the project which are specified by the focus point principals in advance. For example, a focus point principal may indicate that his plan involves 'product expansion', after which he indicates the market segment 'automotive'. Whenever another focus point principal indicates the same characteristics, both plans will be placed in the same strategic theme. A couple of strategic themes can be seen in figure 21. After having submitted a focus point plan, it becomes part of the development roadmap.

The roadmap relies on the usage of Jira. Employees that are working on certain projects are required to indicate their progress in Jira, so this becomes visible in the roadmap. And whenever they encounter or identify potential issues with any of the 'epics' that they're working on, they should indicate this in Jira as well. This way, the members of the management team will be aware of these discontinuities and may adjust their planning accordingly.

8.4.1 Strategic View

Figure 21 shows the first screen that pops up when opening the application. It shows all the strategic themes that the department is currently working on (top), prioritized from top to bottom. The management team is supposed to indicate which themes are to be prioritized.

When any of the themes is clicked, it expands and shows the focus point plans within these strategic themes(bottom). Because the focus point plans are labelled, the roadmap is able to establish meaningful linkages between the focus points. For example, in the bottom part of the figure it can be seen that fleet management and automotive security are interrelated. The reason why these two focus points are interrelated will be elaborated on in the next section.

By providing a global overview of development plans and their interrelationships, the strategic view aims to increase the department's shared understanding of direction and hereby improve the department's alignment. This should add to an understanding of how the department is collaboratively working towards their main objectives.

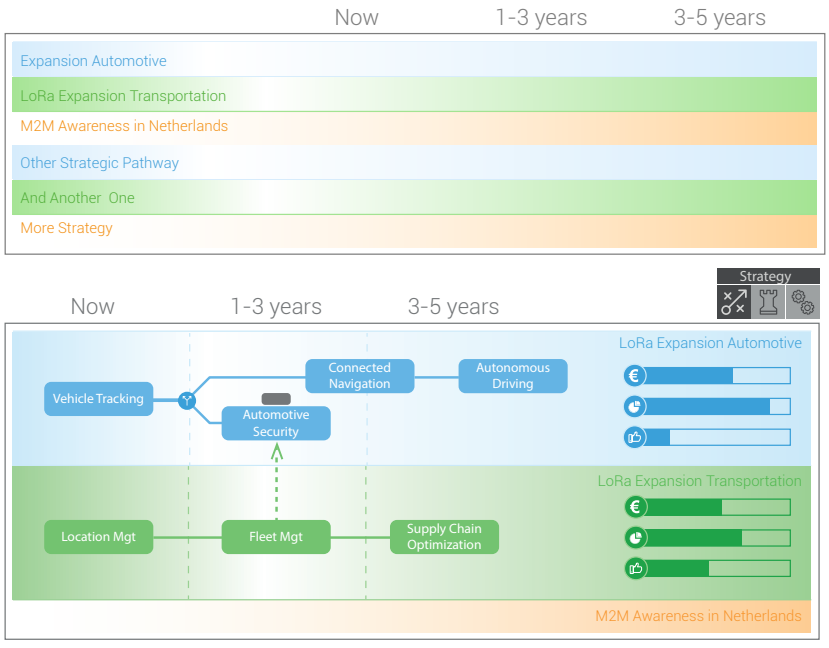


Figure 21. The roadmap shows all of the department's strategic themes that have been derived from the focus point plans' characteristics. When any of the strategic themes are clicked, they expand. The expanded view shows all focus point plans and interrelationships.

8.4.2 Tactical View

The tactical view illustrates the focus point plans in more detail. An expanded view of the development trajectory shows the building blocks (critical assets) required for the execution of this trajectory. It also shows overlapping building blocks, the assets required for multiple focus point plans.
Each of the building blocks can be clicked to show more details. Whenever an issue was identified by any of the employees, it is shown in this detailed view. This should enable the management team to more easily anticipate on potential discontinuities.
Figure 22 shows the tactical view for two strategic themes: expansion to automotive (blue), and expansion to transportation (green). Within automotive expansion, there are three focus point plans: Vehicle tracking, automotive security and connected navigation. Within transportation, there are two focus point plans: Location management and fleet management. In this situation, the roadmap has indicated (grey box) that two of the building blocks required for vehicle tracking show overlap with two of the building blocks for location management within the theme below.

In this situation, the department could decide to prioritize the overlapping building blocks. This way, whenever an issue occurs with any of the other building blocks, they will not have wasted resources and can easily leave one of the strategies (e.g.: transportation) and focus on automotive.

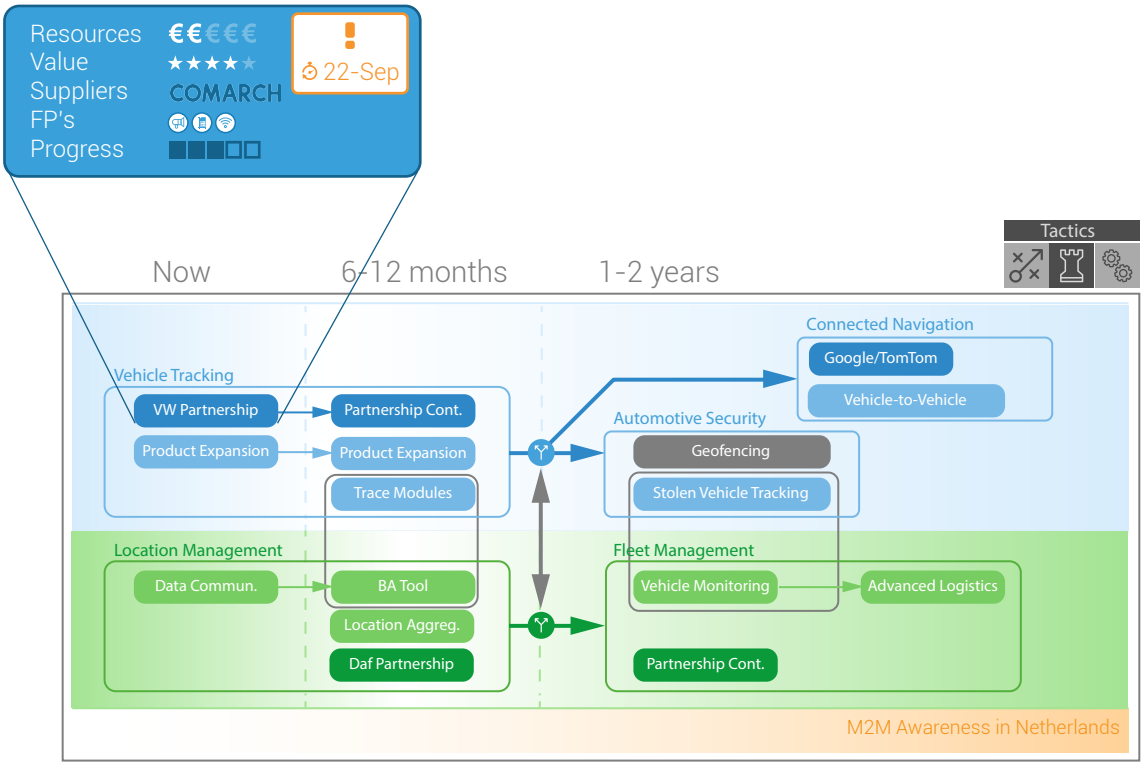


Figure 22. The tactical view (below) shows the department's focus point plans in more detail. The grey cadres indicate that the building blocks required for both strategic themes are overlapping. Any building block can be clicked to show more details (left).

8.4.3 Operational View

The operational view enables the department to effectively execute the epics that are part of focus point plans. Each epic essentially has its own operational view. Figure 23 shows the operational view for the VW partnership. Within this epic, a number of activities have to be done. The left part shows the tasks that the tactical cluster involves. This view clearly shows which tasks are currently in progress, and which tasks have yet to be done. This is to help the employees to prioritize the most important tasks.

The second column shows who is working on these tasks. Since the tool imports project planning information from Jira, epics are assigned employees that are supposed to work on them. This should make clear who is currently working on what and it should help the department to gain a sense of working together. As can be seen, each portrait includes two blocks. This is to indicate to how many projects/tasks the employee is assigned. Whenever an employee is assigned to two tasks, his bars are full/empty and should not be assigned to more tasks on top of that. This should help the department to first finish currently running projects prior to taking on more projects. Hence the department's task cohesion should be increased.

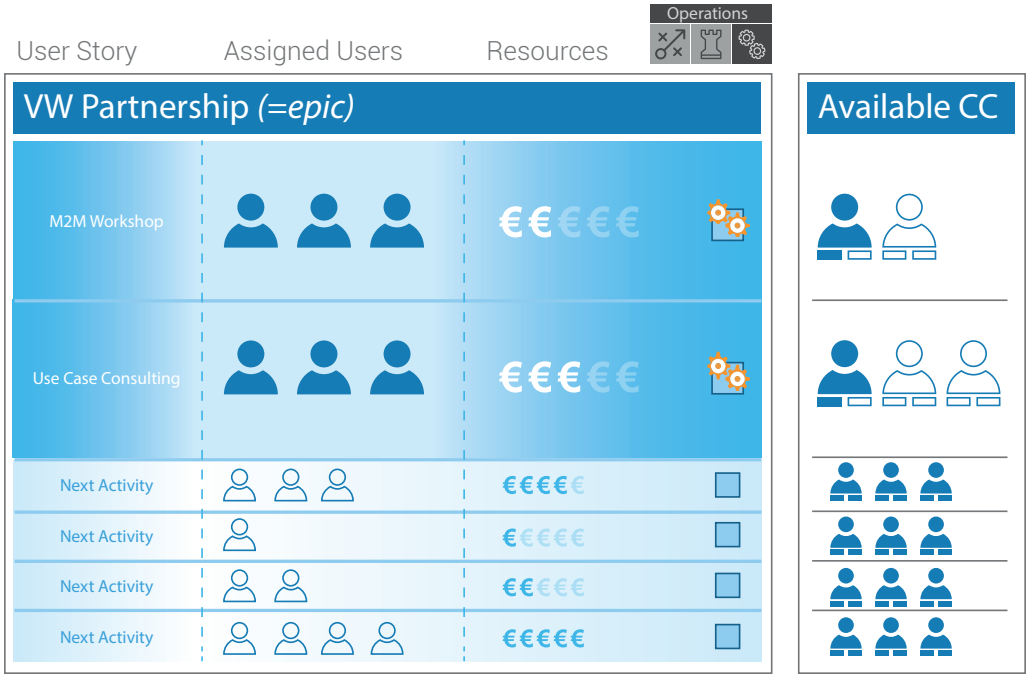


Figure 23. The operational view shows the required epics to complete the focus point plans. In this case, the focus point plan is developing a partnership with Volkswagen

8.5 Validation

The concept as described in this chapter is validated by interviewing three focus point principals. During these sessions a set of questions was asked, after which the design was presented.

1. The focus point principal was asked about three development plans within his/her focus point.
2. Subsequently, he/she was asked to label these development plans with 5 labels each.
3. Afterwards, the focus point principal was asked to elaborate on the building blocks required for these development trajectories and indicate the sequential relationships between these building blocks.

Furthermore, the design was discussed with the two main stakeholders of the project (Marc Titulaer and Remco Hekker). During the validation of the design, several issues with respect to the objectives emerged.

The design should enable the exchange of information that is relevant to decisions on whether to further pursue a project or not.

In its current form, the focus point plans show their building blocks in a very explicit way. It was indicated that having the employees continuously update the status of any of these building blocks may become too demanding. Furthermore, the people assigned to certain projects (in Jira) would not necessarily have to be the people that learn about the discontinuities in the first place.

The design should enable the department to postpone decisions to go for either one or another development direction.

It was indicated that the development process is not always as linearly sequential as was assumed. The participants indicated little trust in that the design would be effective assessing what would be the wisest epics to focus on. Furthermore, it was indicated that many of these epics rely on external parties as well. When an epic relies on an external party, the department depends on the delivery time of this external party. As of that, it is very difficult to predict what the ideal order of execution would be.

The design should help the department to reduce the number of projects that people are working on at the same time.

Task cohesion was aimed to be established by permeating project priorities from strategic level to operational level. However, this lead to a very complex architecture that was expected by the participants of the validation to pose a large challenge both on usability matters as well as on HR planning. Furthermore, the inclusion of three different views was considered as overwhelming and complex. And the (hierarchical) interrelationships between the three views were not entirely clear.

The design should show how various different objectives throughout the department relate to each other.

Although the way that the roadmap showed the interrelationships between focus points, the current way of categorization (by means of focus point plan labels) was considered somewhat mundane. The labels indicated by the focus point principals varied enormously from each other. Therefore, the variety of projects that the 11 focus points include are expected to cause the roadmap to become unnecessarily large.

8.6 Conclusion

The first concept was developed to increase resilience by supporting identifying discontinuities and addressing discontinuities and increase alignment by improving task coherence and communicating a shared vision. The validation of the concept lead to several implications for the following iteration.

The building blocks required for focus point plans originate from both internal as well as external sources. Monitoring the status of all these building blocks is too mundane and at some points even impossible to do.

Furthermore, there are a lot of these building blocks and they can be very diverse and/or unexpected. Therefore, it would be too ambitious to develop an application that could make sense of these building blocks and identify flexible pathways that would anticipate on potential discontinuities.

Categorizing focus point plans was experienced as a valuable way of communication, yet the way in which the focus points are categorized is not yet effective and needs to be revised.

9. Iteration Two

This chapter describes the vision, the approach, and the result of the second design iteration. It ends with a validation round that serves as the basis for the next iteration.

9.1 Vision

The department should be supported with adjusting their planning whenever a discontinuity occurs. Furthermore, the tool should align different business functions and employees by showing how the focus points are related to each other and how all focus point plans are adding to the same objectives.

9.2 Objectives

The tool should show how discontinuities affect development projects.
Exchanging information about the status of all required critical assets would be too demanding for the involved employees. However, the department could also benefit by knowing how a discontinuity affects the currently running focus point plans.
For example: A given project requires a modification to be done to the department's service platform Jasper. However, Jasper's moderators (external party) are experiencing technical issues that prevent them from making modifications. Chances are that there are more projects running that also require modifications to be done in Jasper. At this point, it would be desirable for the management team to know which other development plans are also affected.
As such, this design iteration focuses on communicating how one or several development plans are affected whenever any critical assets that they depend on are missing. This should allow for easier decision making on how to anticipate or mitigate these discontinuities.

The tool should show focus point in a logical interrelated categorization.
Categorizing the focus point plans in strategic themes would lead to an excessive amount of themes. This iteration intends to portray the development plans in a simpler way with less categories.

The tool should communicate how all focus points are adding to the same objectives.
The possibility to communicate the department's superordinate goal is explored. Focus points may be concerned with different development directions and ideas on a successful future, but they should ideally all add value to the three main pillars of KPN's mission (revenue, share and NPS).
For example: Partnerships are needed to be able to offer new product varieties. The principal of Partnerships indicated that he wants to improve partner conversion rate. Although his development plan focuses on increasing the exposure to partners on the department's website, the exposure itself is not the main goal. More exposure to potential partners ultimately leads to having more partners, being able to offer a wider product offering and expand the department's market share.
This iteration intends to show how focus point plans are adding to the department's main pillars, hereby emphasizing how short term plans from different disciplinary perspectives are constituting long term goals.

9.3 Approach

9.3.1 Dependencies

The department does not have control over all of the building blocks for its development plans. As indicated, some building blocks are related to suppliers. In order to know the impact when any building block goes missing, it is important to know which other projects rely on the same building block. Therefore, the focus point principals were asked specifically "what does your project depend on to be executed". The answers can be categorized as follows:

- Money
- Cisco
- Jasper
- Actility
- Certain employees

If the focus point principals submit their focus point plans while clearly specifying what their plans depend on, this can be incorporated in the tool.

9.3.2 Information Filter

The previous design was indicated to contain too much information and that the visual representation needed some simplification. However, most of the information that the tool included was relevant to offer its functionalities. Instead of removing information, the tool could filter information to show only the information relevant to its user. In order to know what kind of information is relevant, several people were asked specifically what they would want to learn from the roadmap. The results are incorporated in the design by including view filters. These filters will enable the user to view the presented information according to the following:

- Product type: the user wants to be able to view only

M2M, or only LoRa projects
- What he or she is involved in: the user wants to see per person, which projects he or she is involved in. This includes other people as well as the user himself.
- Focus Point: the user wants to see only the development plans that are within one of the focus points (e.g.: only marketing plans)
- Time scale: the user wants to see projects that are running now, and projects that are planned for some time ahead.

9.3.3 Categorization

The 11 focus points together cover all of the department's development plans. It was found that categorizing these development plans into strategic themes would lead to an excessive amount of themes. Therefore, a different way of categorization is applied.
Prior to establishing the new categorization, Martijn Mulder was consulted. Mr. Mulder (principal of the finance focus point) is currently working on a visualisation of how focus points are interrelated. He divides the focus points from right to left in 'support', 'function' and 'primary'.
It can be argued however that this is not the best way due to various reasons. Firstly, the reading order should be the other way around (stratography). Furthermore, since the department is working towards NPS, revenue and market share, it makes more sense to divide the focus points differently. Figure 24 shows the focus points divided into 'long term outlook', 'delivery', 'assets' and 'support'. This way of categorizing is based on the balanced scorecard.

- **Long term outlook** is concerned with identifying or coming up with ways to improve the department's score on the three pillars. Long term strategy establishes a strategy for reaching the market and which parts of the market to penetrate (market share), finance is responsible for making sure the revenue curve is living up to its expectations (revenue) and business intelligence, monitoring the department's current performance identifies opportunities to improve NPS.
- **Delivery** is concerned with making sure that the products and services reach the target market. Sales and marketing are in charge of delivering the products to the market segments that are set by long term strategy.
- The focus points within **Assets** are the concerned with making sure that the department has 'the goods' to be delivered to the target market.
- Finally, **Support** includes automation, which is concerned with making everything more efficient and enabling the department to handle future growth.

9.3.4 Added Value

The way that short term plans are contributing to long term goals is not always clear. Currently, the department measures its successfulness in retrospection. Whenever a project is finished without exceeding budget and within the established schedule, it is considered successful. However, assessing the delivered value on the three main pillars (NPS, market share and revenue) after finishing the project would be a more true representation of the project's success.
Translating all of the department's development efforts to the three main pillars would require merging various KPI's. For example, marketing campaigns lead to more awareness, but not to more revenue directly. Many organisations use a so called 'performance index' to merge different KPI's. Yet, the department essentially has three 'performance indices': revenue, market share and NPS.
This design draws on a framework called value triple constraint, which in turn is based on the classic triple constraint framework. The value triple constraint includes value, scope and capability. For the purpose of the department, the dimensions will be adjusted as follows:

- Scope: defines which of the pillars the project adds value to
- Value: the estimated value that is added to this pillar
- Capability: the estimated value is divided among the different epics that the project consists of.

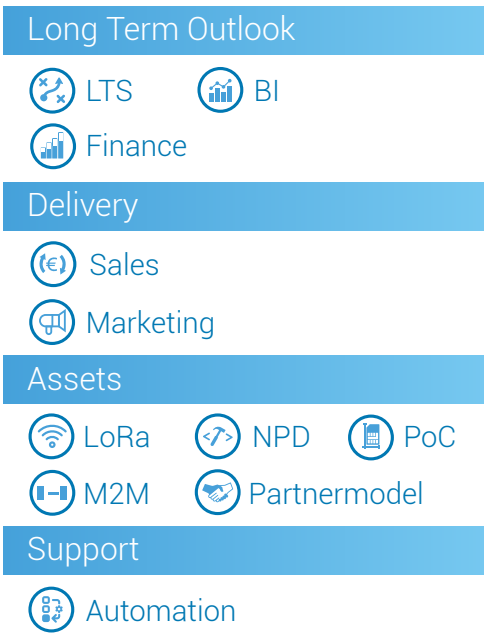


Figure 24. The focus points are categorized in four categories, based on the balanced scorecard.

9.4 The Design

This section describes the result of the second design iteration. The concept is comprised of an interactive roadmap and a dashboard that offers extra functionalities. Its main purposes are showing the impact of missing dependencies, communicating both short term and long term goals and how the department is working towards a superordinate goal.

The roadmap as illustrated in figure 26 shows the department's development trajectories as proposed by the department's 11 focus points. These focus points are divided into four categories that cover the following themes: Long Term Outlook, Delivery, Assets and Support.

The dashboard is used in combination with the roadmap. This offers the tool the functionalities that provide the extra value. The dashboard's information and functionalities change according to the project that the user selects on the roadmap. The user may select any of the pathways portrayed in the roadmap or an individual project tile. Consequently, the dashboard imports the required information about the project (pathway) from Jira to be able to offer its functionalities. The dashboard contains six tiles each of which offers a different functionality. The tiles can be expanded by clicking on them.

The tool still imports project information from Jira and the focus point principals are still required to submit their focus point plans through Jira. However, the employees are not anymore required to monitor and update the status of each individual building block.

The roadmap shows both short term as well as long term paths. At the top of the roadmap, the user may change the time scale that ranges from one week to one year. Instead of switching to a different view (like in the previous concept) the same window is shown, only the project tiles that are planned for the indicated time scale are shown. The time scale of the roadmap does not reach further than 1 year, because it was indicated that at this point, the environment does not allow for making plans or assessments for more than one year ahead. This allows the user to easily see how short term plans are related to long term plans.

Figure 25. The dashboard adds the functionalities to the roadmap.

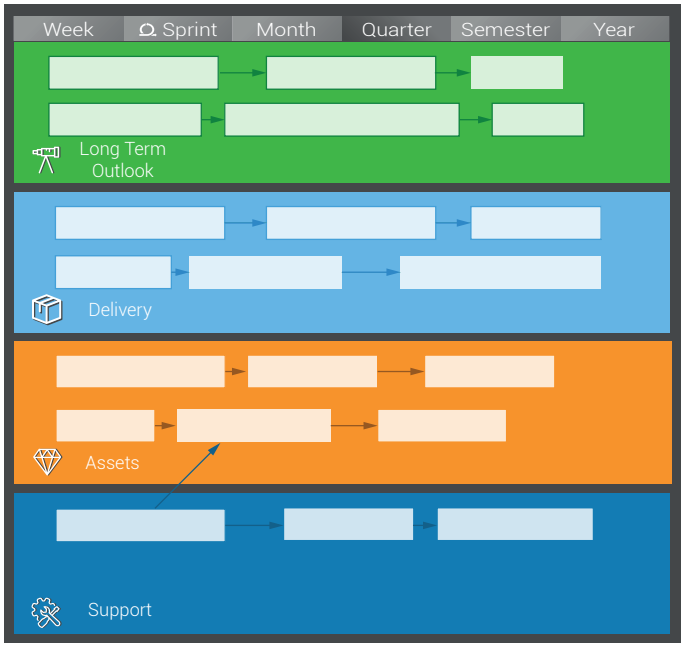


Figure 26. The roadmap shows all focus point plans divided into four categories.

9.4.1 Dependencies

This tile shows the building blocks that the project depends on for successful execution. These resources can take various forms. For example, the project may depend on a certain budget, or the project may require cooperation from any of the department's suppliers, like Cisco. Upon selecting one of the dependencies, the roadmap highlights all other projects that have the same dependency. This way, it becomes easy to see which other projects or pathways are affected when a resource is missing. For example, when the management team is being informed about problems with Cisco, they can just click the Cisco button to see what this means for the other focus point plans. As such the management team is supported in its effort of making plans to anticipate or mitigate the impact of this missing building block.

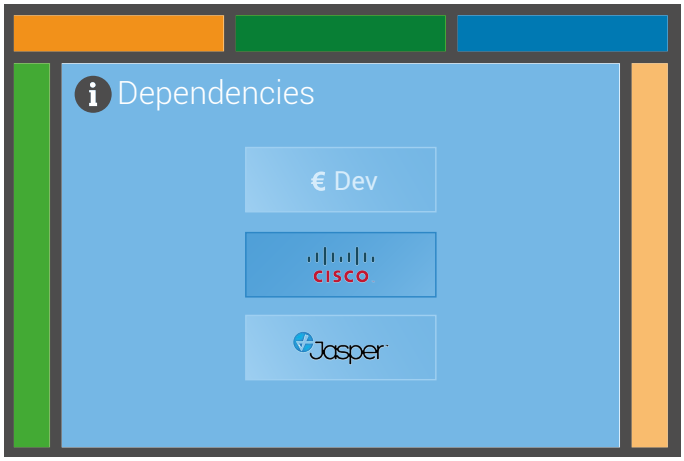


Figure 27. The dashboard dependencies tab shows the critical assets that the selected project depends on. When any of the dependencies is clicked, all other projects that depend on the same asset are highlighted.

9.4.2 Assignees

This tile allows the user to see who is working on the selected project or pathway. Furthermore, any of the assigned employees can be clicked. Consequently, the roadmap highlights all projects that this employee is currently working on or is assigned to work on in the future. This way, the management team can more easily understand the consequences if they were to change their project planning.

For example: the management team is considering to initiate a certain development project three months earlier than planned, which means that the project will be starting next month. Before they make this change in the planning, they can click each of the individual assignees to see what other projects they are assigned to. In the situation that they click person X and notice that there are three projects highlighted which are also running or starting one month ahead, the management team may want to reconsider making this change in order to prevent priority conflicts.

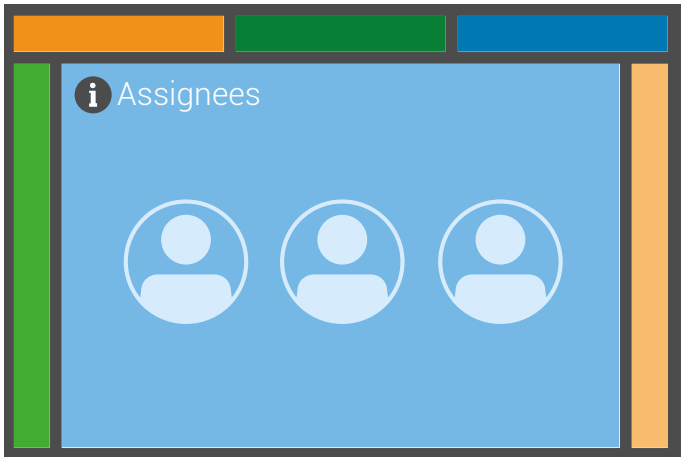


Figure 28. The dashboard assignees tab shows the people assigned to the selected project depends on. When any of the assignees is clicked, all other projects to which the same person is assigned are highlighted.

9.4.3 Value

The value tile is developed to communicate the department's superordinate goal and how short term plans are contributing to this goal. This tile shows the estimated value that the project may add to the three main pillars of the department: revenue, market share and NPS. Whenever the user selects a project pathway, the bars show how much value they add to these three pillars. Whenever the user selects just one of the project's building blocks, the bars adjust accordingly to show the value of this activity only. This emphasizes how different focus point plans are contributing long term goals (three main pillars).

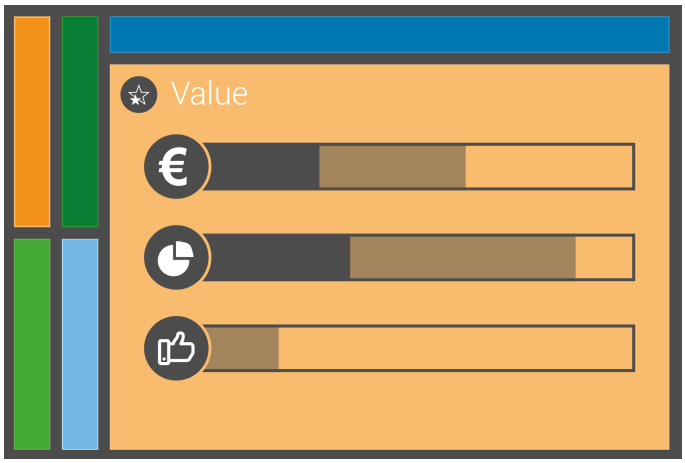


Figure 29. The dashboard value tab shows the estimated value that the selected project adds to the three main objectives. When any of the sub projects (epics) is clicked, the value tab shows the adjusted estimated value.

9.5 Validation

The result of the second iteration is validated in two ways. An interactive workshop with four future users from within KPN is organized, and a two sessions with the project's stakeholders was conducted in which value propositions were ranked.

9.5.1 Workshop

The workshop was organized to gain objective and unbiased feedback on the design. Furthermore, organising a workshop causes the participants to become familiar with the tool which in turn leads to more buy-in in the implementation phase. The workshop consisted of two parts (for the full documentation of the workshop, see Appendix C):

1. A creative session in which the participants were brainstorming about potential discontinuities and were collectively coming up with solutions or other ways that would help them manage these discontinuities.
2. A presentation of the design while explaining all the functionalities. After the presentation, the participants were asked to give feedback on its functionalities. In particular: the categorization, the dependencies, the view filters and the added value.

Results

Creative Session

The participants came up with a lot of different discontinuities that could affect the department negatively. Among these discontinuities was 'a changed or new target in revenue'. After voting on the importance of each discontinuity, it became very clear that changing or new targets in revenue affect the department by far the most, in comparison to the other discontinuities. Changing a target leads to a lot of micromanagement and an increased number of meetings to update on the status of projects. Furthermore, when a target is adjusted, the road towards the target also has to be adjusted. This usually leads to the same projects having to be finished in less time hence leading to a higher performance pressure.

"Targets vanuit het MT zorgen altijd voor veel stress en verwarring binnen de afdeling." [Marketing Manager]
"Internally imposed targets cause a lot of stress and confusion among the employees of the department." [Marketing Manager]

"Er heerst niet altijd volledige transparantie in hoe we naar onze doelstellingen toe werken."
"The way we are working towards our objectives it not always entirely transparent."

"Het is belangrijk om te vertrouwen op elkaar. Dat mist hier nog wel eens. Men moet erin geloven dat we door samen te werken er wel uit komen." [Service Level Manager]
"It's important to trust each other. That's missing sometimes. One has to believe that by collaborating things will turn out okay." [Service Level Manager]

Design Feedback

The participants indicated that they like to have insight in the cost, duration and value of projects. In line with that, they expressed their content with the value bars that the dashboard shows. However, they indicated to be mostly interested in seeing where the revenue comes from and added to it that it could pose to be rather difficult to make accurate assessments on added value to NPS and market share.

The participants liked the way in which the focus points were categorized, but they did not really see the value of the vertical composition of these focus categories.

The participants liked the way in which they could see which projects would be affected whenever a dependency was missing, but they also indicated that this would not be the reason to start using the tool, as it was not considered the most valuable part of the design.

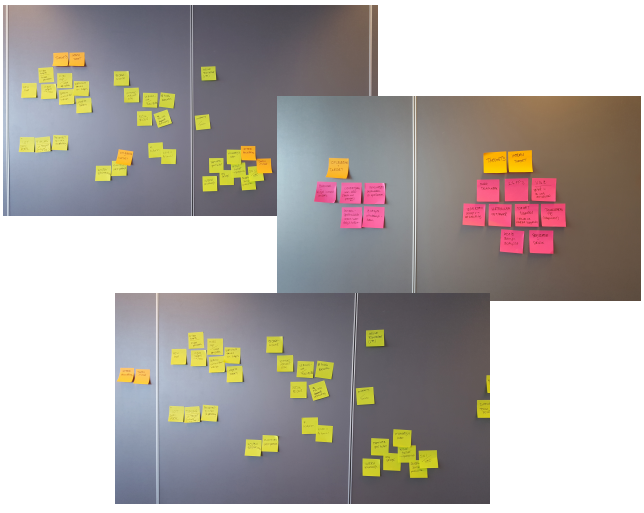


Figure 30. The participants were asked to write on post its what they considered discontinuities.

9.6 Conclusion

The tool should show how discontinuities affect development projects.
The dependencies as implied in this iteration are not the most important discontinuities affecting the department. Instead, a more eminent form of discontinuity are changing targets in revenue. This does not relate to 'missing building blocks'.
The tool should show focus point in a logical interrelated categorization.
Categorizing focus points is considered valuable, but the current composition of the categories in which they relate to each other is not necessary.
The tool should communicate how all focus points are adding to the same objectives.
The three main objectives of the department are not equally important. Instead, the tool should communicate only how focus point plans are adding to the revenue stream of the department.
It is important to clearly state which projects are required for reaching the revenue targets and in turn which building blocks or business functions are required for executing these projects.

From the feedback of the workshop's participants can be concluded that the foundation of the design (importing project related information from Jira) should be dropped. However, this would significantly change the core architecture of the tool.

Therefore, an extra validation is conducted which involves the project's two main stakeholders within KPN (Marc Titulaer and Remco Hekker). This validation is to ensure that dropping the Jira related functionalities is indeed the right way to go. After all, the workshop only included a limited number of participants, and is not representative for the whole department. This validation includes 12 value propositions which are ranked on importance.

10. Iteration Three

This chapter describes the vision, the approach, and the result of the third and last design iteration. It ends with an example use case and an implementation plan.

10.1 Vision

The department suffers from performance pressure and confusion whenever targets in revenue are changed or new targets are imposed. The tool should support the department by being able to better deal with these revenue targets. The tool should provide transparency in how the department aims to reach the new targets and thus help the employees to reach the target in a more serene way, hence minimizing the amount of micromanagement and status updates.

10.2 Objectives

Understanding the consequences on the roadmap of focus point plans when targets in revenue are changing.
Upon validating the previous concept, it was learned that the most discontinuity originates from targets or changing targets. This iteration focuses on finding out what it means for the focus point plans when targets in revenue are changing.
For example: when the board imposes a new revenue target, the management team starts discussing on how this new target can be achieved. As a result, some projects may need to be accelerated, or projects that do not provide a high return on investment within a certain amount of time may need to be postponed. When a situation like this occurs, the department could benefit greatly from an object that supports them by communicating what the new revenue target means for its current project planning, and by supporting the reformulation of development plans according to this new target.
This iteration intends to enable the the department to understand exactly what it means for focus point plans in terms of planning whenever a new revenue target is imposed. In a way, this is a form of sensemaking, because it facilitates the department to interpret the impact of changing targets (the discontinuity).

Understanding how focus point plans together are constituting the revenue target.
It was learned that it can be very difficult to assess the value that any project may add to market share or NPS. Furthermore, revenue seemed to overrule NPS and market share in importance.
While the previous concept portrayed the department's long term goals in terms of the three main pillars that the department is working towards, this iteration focuses on revenue as the sole long term goal. The concept should clearly show from each focus point plan its contribution to the department-wide target in revenue.

Allowing the management team to plan and replan focus point plans while dividing the workload evenly between focus points.
It was indicated that changing targets in revenue cause for higher workload, high pressure and confusion among the employees. Essentially, (changing) targets strain/burden the department's change capacity. The design should minimize the added load on the department's change capacity while still being able to handle requirements in (changing) revenue targets.

Show the building blocks of each focus point plan in a generalized manner.
Upon validating the previous concept, it was learned that the participants liked to see the building blocks of each focus point plan, yet they also indicated that doing this in a too detailed manner would require data sources which are currently unavailable. Therefore, this iteration intends to show the building blocks of focus point plans in a more generalized manner, one that relates to general business functions.

10.3 Approach

When analysing the department's situation with the new knowledge, it can be concluded that the roadmap of focus point plans are characterised by three dimensions:

- A. Time: Each focus point plan takes a certain amount of time to complete
- B. Revenue: Each focus point plan should generate a certain amount of extra revenue
- C. Requirements: Each focus point plan requires certain assets to be realised

All focus points combined should enable the department to reach its target in revenue. This target is characterised by two of the abovementioned dimensions:
- A. Time: the target is set for a certain point in time.
- B. Revenue: a certain amount of revenue needs to be reached before the moment in time specified in A.

Essentially, all focus points combined needs to add up to at least the required revenue:
Bfpx + Bfpn > Btarget

At the same time, the focus point plans need to be finished

before the deadline, so:
Afpx + Afpn < Atarget

Based on the abovementioned equations, a simple puzzle emerges that requires focus points to be positioned on the roadmap in such a way that both the composition stays within the A axis and meets the B axis.
However, the C dimension, requirements, also needs to be incorporated. In order to do that, the focus point plans that have been developed are analyzed. It is important to mention here that these focus point plans were not developed up until now, considering the fact that this analysis would have been valuable for the previous iterations as well. Each focus point plan is documented in a PowerPoint template that requires the principal to answer the following four questions:

- A. What do I want to achieve?
- B. When do I want to achieve it?
- C. Whom or what do I need to achieve it?
- D. When will I be successful?

B. Every focus point principal seemed to be able to specify the duration of his project. Either by mentioning when the project should be finished, or by mentioning

C. Especially the third question: whom or what do I need to achieve it, is relevant in this situation. Those are essentially the building blocks or requirements for the focus point plans. Upon analysing all focus point plans, five categories of requirements were derived:

- Budget: does the project need money or not?
- Internal Support: internal support relates to marketing, sales, etc.
- External Support: refers to either departments within KPN, but outside of the IoT department, or external companies (like consultancies)
- Technology: for example, some projects need modifications to be made to platforms or requires a physical form of technology
- Direction or decisions: refers to support from higher management by clearly deciding on direction, or supporting
-

Interestingly, internal support and technology combined cover all of the department's 11 focus points apart from long term strategy. Yet long term strategy clearly falls into the category of direction/decision. As can be seen, all focus point plans require one of the 5 abovementioned matters. This makes it very easy to depict the requirements of the focus point plans. As such, the third dimension is established.

The result is as follows: the tool will be a roadmap that includes time on the horizontal axis, revenue on the vertical axis. In this roadmap, all focus point plans are positioned as rectangles (project tiles) of which the horizontal measure is the amount of time it will take for the focus point to be done and the vertical measure is the (assessed/estimated) amount of revenue the focus point will add. Within these focus points, simple indications are given of its requirements. This way, it is easy to see whenever multiple focus points require the same assets concurrently.

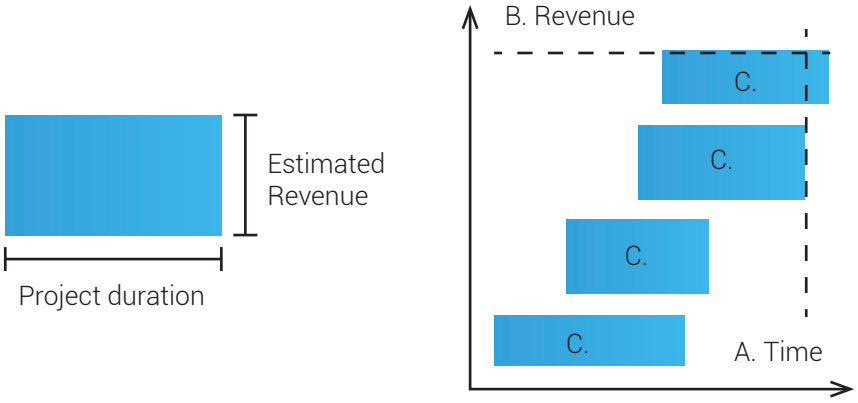


Figure 31. Each project is represented by a tile of which the dimensions are established by the duration of the projects and the estimated value it will add in terms of revenue.

10.4 The Design

The result of the third iteration is an online tool that includes several functionalities, a couple of screens and a small database. Its main purposes are: 1) Communicating the department's development direction, 2) providing provide visual insight into how focus point plans are collectively constituting long term goals and 3) facilitating a serene execution of focus point plans by balancing workloads.
The tool consists of two main components; the intake screen and the roadmap. The intake screen is used by focus point principals to describe their plans in such a way that it becomes comparable to other principals' projects and that it becomes easy to quickly see the implications of undertaking a project. The roadmap is an interactive representation of all of the principals' projects that are being undertaken and how they collectively add to the department's revenue stream. Furthermore, the roadmap shows how the plans within focus points are related to each other. The next two sections describe these components in more detail.

10.4.1 Intake Screen

The intake screen is comprised of two tabs; project characteristics (figure 32) and dependencies (figure 33). Project characteristics includes five aspects of the principal's plan that he or she is required to specify. The dependencies tab includes five aspects that may or may not play a role in the execution of the project. Both tabs together cover all the information that emerged in the FP analysis.
When all of the required information is specified, the principal submits the project, after which it is transferred to the online database and automatically emerges in the second part of the tool, the roadmap.

By specifying all of the project's characteristics, a tile is formed which represents the principal's project. The tile's colour is determined by one of the four categories it belongs to. The size of the tile is determined by a) the amount of time required for execution, b) the estimated amount of revenue to be gained by completing the project and c) the time it takes for the value to become apparent.

Project Category
The Principal specifies to which focus point the project belongs. The projects are colour coded according to four categories: long term outlook (green), delivery (orange), assets (blue) and support (grey).

Project Description
The principal describes in one or two sentences the project. For example: increasing awareness of IoT in the LoRa segment.

Project Duration
The principal specifies the estimated number of months it takes to finish the project after initiation.

Project Value
The principals specifies his estimation of revenue that the project will generate.

Time to Value
The principal specifies the number of months it takes before the extra revenue becomes visible.

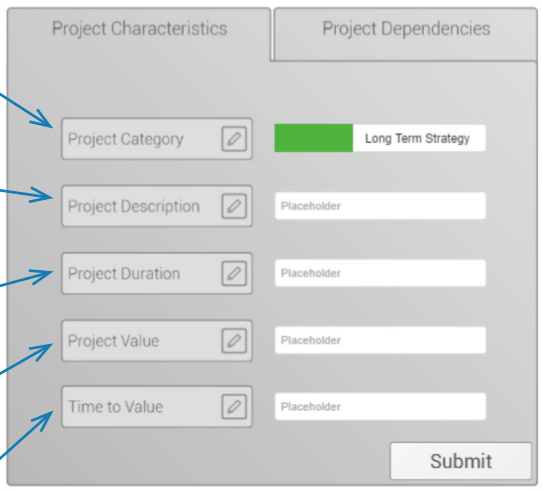


Figure 32 The project characteristics tab allows the focus piont principal to specify all of the relevant details of the development project.

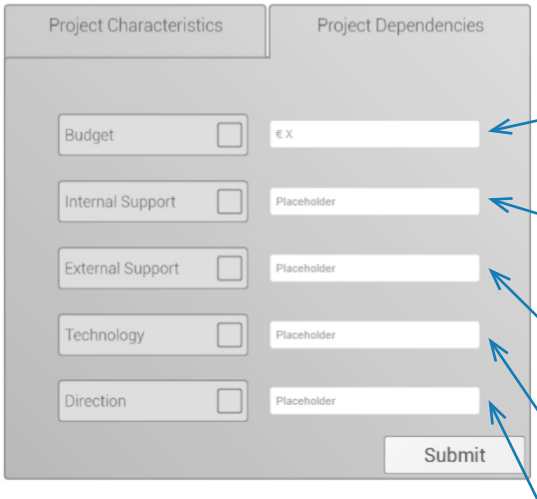


Figure 33. The dependencies tab allows the focus piont principal to specify all of the critical assets that the development project depends on.

Budget
Does the project need money? If yes, how much?

Internal Support
Does the project need internal support to be executed? If yes, specify the involved focus points. For example: a plan within partnership model requires support from marketing for generating exposure among potential partners.

External Support
Does the project need external support to be executed? External support can be other departments within KPN, but can also be an external consultancy agency for example.

Technology
Is there any technology-related dependency? For example, one of the M2M plans requires an analytics tool to be developed.

Direction
Some trajectories require decisions being made or direction being given. For example, the sales principal indicated that he requires a predictable and reliable product innovation roadmap.

The dependencies as described above can be considered the critical assets for the projects. They are symbolically represented in the project tiles. Figure 34 shows the symbolic representations of the dependencies.
After indicating all the relevant dependencies of the project, the principal submits the project by clicking the submit button. This transfers the project tile including all specifications to the roadmap.

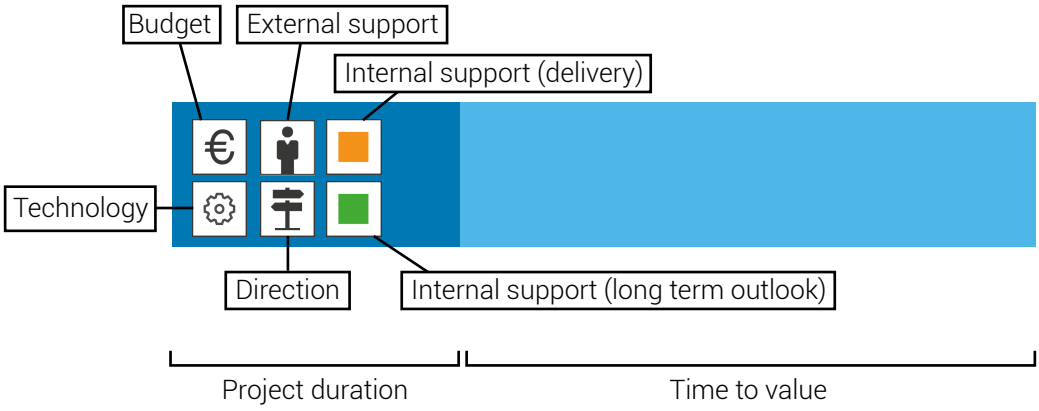


Figure 34. The visual representation of a project is determined by all the project's characteristics and dependencies.

10.4.2 Roadmap

The roadmap (figure 35) contains two fields. The roadmap itself, which shows all projects that are currently being undertaken or that are planned to be initiated within the specified time frame.
The second field is the pool of projects. This window can be expanded by clicking on the button next to the roadmap. The pool of projects shows the projects that have been submitted by the principals, but that have not yet been planned.
The roadmap includes two movable bars which represent the two dimensions of the department's long term goal; the amount of revenue that the department needs to realise and the point in time at which this revenue needs to have been realized.

The management team plans the department's development direction by dragging projects from the pool into the roadmap. The value that the roadmap adds to this way of planning comes from the following:

The vertical dimensions of the project tiles represent the estimated amount of revenue that the individual projects will generate. By positioning these tiles above each other, the roadmap provides a clear overview of how much revenue the projects collectively will generate and whether the revenue target can be met.

The project tiles symbolically represent their dependencies. Internal support is indicated by means of a colour coding. Two or more projects including the same colour indicates that the management team should be aware that they do not plan the project in such a way that a certain focus point's business unit within the department receives too much extra workload. This can be verified by clicking on the project tile and checking the involved focus point.

The project tiles clearly show how long it takes to finish the project and when the revenue will become visible. This helps to plan projects in such a way that all the potential revenue is realised before the target's deadline.

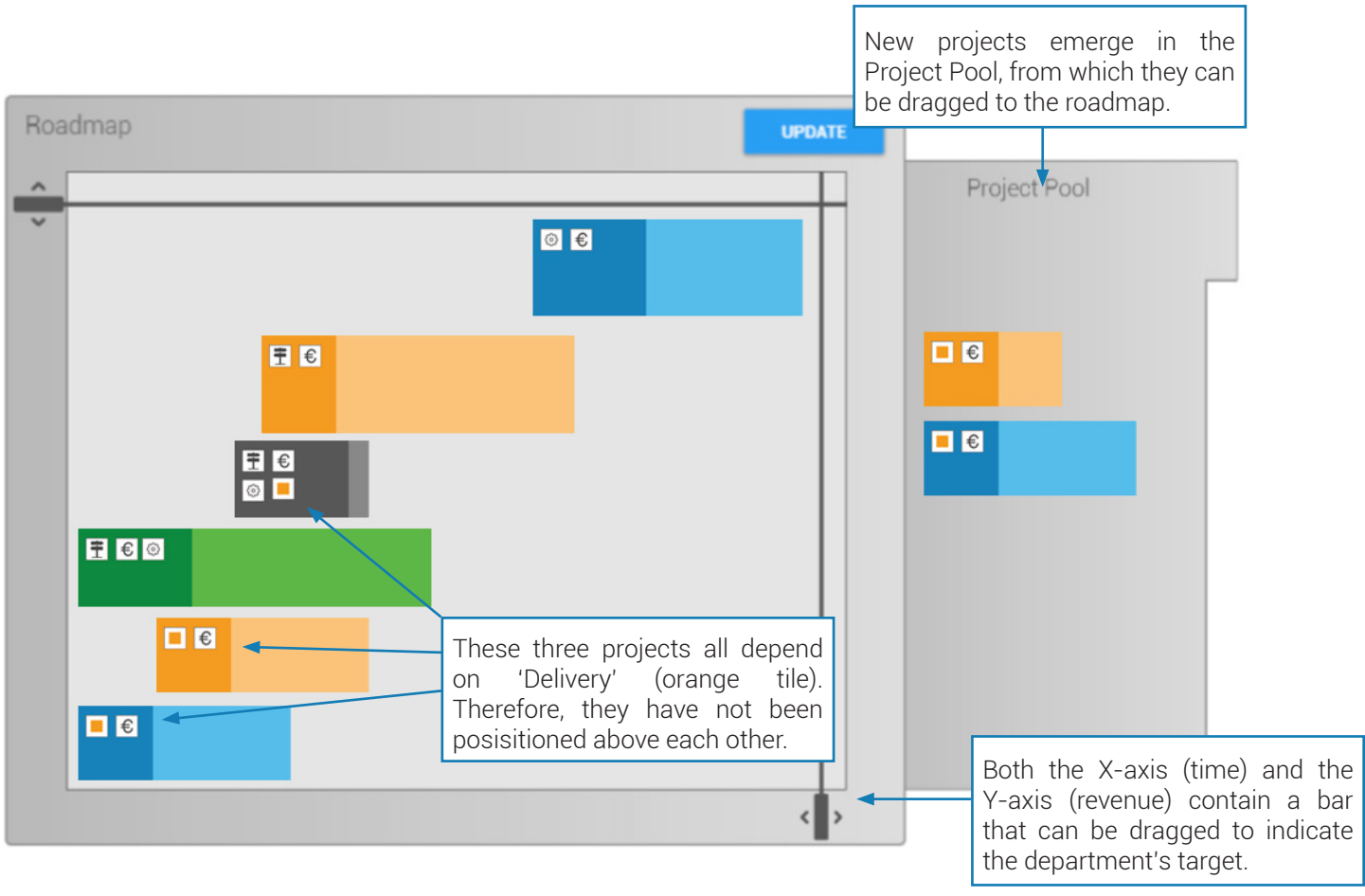


Figure 35. The roadmap shows all projects that have been submitted by the focus point principals and how they together add up to the revenue target.

10.5 Validation

The concept as described in this chapter is validated by using an interactive prototype. All of the concept's screens were placed in an interactive powerpoint presentation that allowed to click all of the buttons and experience the usage of the tool as it should be.
The prototype was sent to several stakeholders from KPN after which the design was discussed during a conference call and another face to face meeting. The concept was received very well. All functionalities were confirmed to be understandable and the overall way the concept would support the department was considered feasible. A such, the stakeholders indicated to want this concept to be further developed and being made ready for implementation.
Considering the fact that this design is the result of three iterative design cycles, it strikes as plausible that the design does not need any major alterations. However, some modifications were suggested and remarks were made:

- The stakeholders indicated the importance of being able to maintain the tool after completion of the project. The stakeholders indicated that they are not entirely sure that the current 11 focus points will remain the same over time. As such, they want to be able to add or remove focus points in the future
- Furthermore, the stakeholders indicated that they envision that the tool may be developed without the intake screen at first. Instead of the intake screen, they proposed making use of an MSAccess database from which the relevant data would be automatically transferred to the roadmap.
- The stakeholders indicated that occasionally, a focus point plan depends on another focus point plan to be initiated. This should be reflected in the design of the roadmap.
- It was indicated that some projects do not directly generate revenue. These projects should nevertheless be incorporated in the roadmap.

10.6 Conclusion

The third iteration lead to a design of which the global outline and functionalities have been 'accepted' by the project's stakeholders from within KPN.
It was confirmed that targets indeed play a major role in the department and that each focus point plan should ideally generate a certain amount of revenue. The visual representation of the focus point project tiles was received well and the way in which they communicate how the department-wide revenue targets are aimed to be reached was considered accurate. However, several aspects were not taken into account yet, and need to be covered before taking the tool into use.
The project dimensions of the intake screen were considered relevant, yet the intake screen as a separate application was considered unnecessary. It was suggested to make use of a simpler form of submitting data (such as an MSAccess data sheet).
As such, the intake screen will be left behind and the roadmap will receive some further development. The next chapter elaborates in the development considerations that the refined tool will adhere to.

11. Example Case

This chapter describes a hypothetical case in which the current situation is compared to the future situation in which the new tool is used.

Situation

At January the first of 2017, the IoT department generates a yearly revenue of €20 mln. With LoRa being rolled out and an expected increase in clients for M2M, the department forecasted this revenue to rise to €25 mln on year basis by the end of 2017.

Recently, the board of directors has presented the corporate financials and underpinned the necessity to generate more revenue in 2018. This revenue increase has to be covered by all parts of the company. KPN New Business is expected to generate €30 mln extra revenue. From this €30 mln, €5 mln is expected to be generated by the IoT department. This means that the department has to generate a yearly €30 mln by the end of 2017 instead of €25 what was forecasted.

The situation is communicated at the IoT department internally. At this point, there is a revenue gap of €5 mln which has to be bridged with new initiatives. The 11 focus points are the pillars on which the department builds to reach this new revenue target.

1. Plan Development

Unspecific & Differently interpreted

The 11 focus point principals are developing plans according to the powerpoint template which has been analyzed earlier in this report. The principals specify 1) what they want to reach, 2) when they want to reach it, 3) what they need to do it and 4) when their plans are successful. However, the templates are not very specific. Most of the principals are specifying their plans according to their own perception and in different ways and formats.

2. Decision Making

Elaborate

Partly due to the level of abstraction of the PowerPoint templates, a meeting is held every two weeks in which the management team (MT) consults with one or several focus point principals about the plans that they have developed. Together they try to come to an agreement about their plans on whether or not to execute them, when to initiate them and what to provide in terms of resources.

3. Plan Awareness

Unaware of bigger picture

At this point, the majority of the employees do not have a clear idea about the content of the focus point plans. Most likely they do not have time to carefully read through all the powerpoint templates. And even if they do, they will not be able to see the bigger picture and the relationships between focus point plans. The newly imposed targets make them realise that there will be a period of high workload, yet they do not see exactly to what extent their efforts are contributing to these targets.

4. Plan Execution

High workload & Micromanagement

The newly imposed target has lead to the MT's decision to take on more development projects. Essentially, more has to be achieved in less time. As a result, the majority of the department feels pressured to work harder. The overall workload is higher yet the MT has not been able to clearly assess who got affected (burdened) mostly, which leads to imbalances in workloads.

Furthermore, the level of micromanagement increases. Considering the importance of the targets being met, employees are constantly giving each other status updates. People are being involved in numerous development projects at the same time and are experiencing differences in priorities which in turn leads to stagnation of projects.

5. Conclusion

The department is struggling to meet the newly imposed target. Employees feel stressed and are confused about the plans for reaching the new target. Workloads are imbalanced and there are clear differences in priorities. There is no shared understanding of direction.

1. Plan Development

Predefined & Comparable

The 11 focus point principals are free to develop their plans in the way that they like. However, they need to submit their plans through a dedicated intake screen that forces the principals to clearly specify their plan in such a way that the plans are self explanatory and that their formats of characterization become comparable. The intake screen covers all information that the MT needs to make decisions on the execution of the principals' projects.

2. Decision Making

Balancing pro's & con's and workload

Instead of organizing a meeting every two weeks, the MT can now just decide on project planning without the principals having to be there. The MT has a clear insight in all of the plans in terms of revenue added, the time it takes for the revenue emerge and the main building blocks of the project. Since these building blocks also cover internal business units, it becomes easier to plan development projects without burdening the same business units too much.

3. Plan Awareness

Simple & accessible representation

At this point, all employees can easily learn about the focus point plans. All of the plans that are being undertaken appear in the interactive roadmap which is accessible to anyone in the department. The roadmap clearly shows the department's development plans for reaching the new target. It also shows which focus points are involved in the development plans. The plans collectively add up to the required revenue target, hence giving the employees a sense of trust in their plans and clarity on the direction.

4. Plan Execution

Accurate and minimized

The MT has laid out the focus point plans in a careful way while considering the time required, the stakeholders involved and the value generated. The plans have been made in such a way that no more projects are undertaken than necessary. More work may have to be done in less time, but the workloads are evenly distributed and the department understands the rationale behind initiating these projects. In other words, the strain that has been imposed on the department caused by the new target has been minimized and distributed evenly.
Furthermore, the employees do not need to continuously update each other on the status of projects since it is clear what everyone is occupied with. The atmosphere is rather serene.

5. Conclusion

The department knows how to reach the newly imposed target. Employees are calm and trust the ability of them reaching their targets by executing the plans. Workloads are balanced. The employees share the same understanding of the direction that the department is heading and accurately executes the plans to get there.

12. Refinement

Based on the design validation several aspects of the tool are refined. This refinement concerns the global architecture of the tool and the functionalities of the roadmap.

Tool Architecture

Based on the validation, the decision was made to leave out the intake screen and instead adhere to the usage of an MSAccess database. This changes the core architecture of the tool. Figure 36 shows an overview of the tool's architecture. Each component of the tool is hereafter discussed shortly.

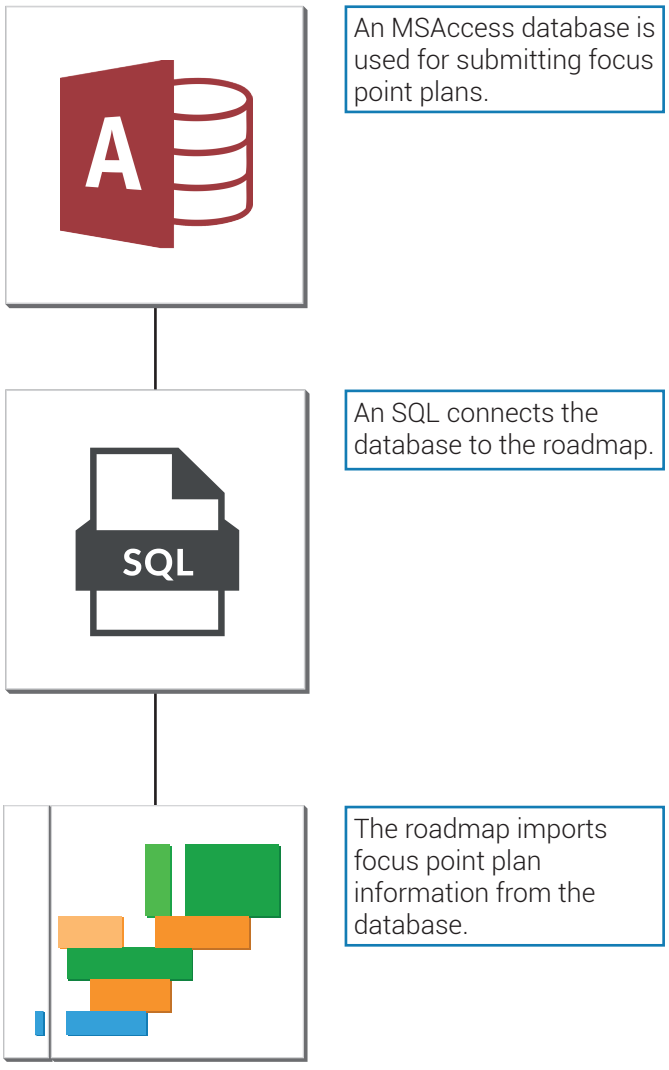


Figure 36. The product's architecture consists of three parts: a database, an online SQL connection and the roadmap application.

12.1 Database

The Access database is essentially a simpler alternative to the intake screen. Although the exact form of the database is yet unknown, it will consist of a simple data sheet in which the focus point principals are to submit their plans.
The intake screen ensured that the focus point principals submit their plans in a consistent manner that makes them comparable to each other.
Therefore, it is important that the Access database is accurately tested and developed in such a way that the usage achieves the same result as the intake screen.
Furthermore, the department should be able to autonomously maintain the usability of the tool after it has been implemented.
For example, the managing director of IoT mentioned the possibility that the 11 focus points' composition may be altered in a later stage. This would also have implications for the currently established categorization. Therefore, it is important that the database is developed in such a way that it allows for simple alterations by the users themselves.

12.2 SQL connections

SQL is a database interaction language that makes it possible to add, edit, retrieve and delete information stored in databases. An SQL connection enables the roadmap to retrieve focus point plan data from the Access database.
However, in a later stage, the roadmap might need to export project related data from Jira (when it is adopted). This can be achieved in two ways: by linking the roadmap to Jira directly, or by making use of the same database. In case of the latter, an extra SQL connection needs to be set up that allows Jira to add, edit and delete information from the database. The exact specifications of these SQL connections are unknown at this point and will be left unspecified until a later stage.

12.3 Roadmap

Next to some visual tweaks to its graphical user interface, the roadmap will be developed to incorporate an extra functionality which allows the user to click on a focus point plan to see the focus point plans that need to be finished before the focus point plan can be initiated.

13. Implementation

The managing director of IoT has requested the design as presented in the previous chapter to be implemented before the end of 2016. In order to do this, several steps need to be taken with respect to further development. This chapter describes what needs to be done in order to successfully implement the tool.

13.1 Development Steps

The development starts with doing test runs with focus point principals. They will be asked to specify their focus point plans in an excel document that includes the same characteristics and dependencies as the intake screen presented in the previous chapter. This test aims to find out whether the focus point principals are actually able to specify their plans, and to what level of detail they can do this.
At the same time, a physical or digital prototype will be developed that clearly demonstrates the way the roadmap is used.
After the prototype is finished, it will be used to do several test runs with members of the management team to find out whether any important functionalities are overlooked. Their feedback will be incorporated in the subsequent phase of development.
When the test runs with the management members are successfully finished, the graphical user interface of the roadmap will be developed.
At the same time, the architecture of the roadmap will be developed. This will be done in .html. The architecture and the GUI of the roadmap are developed concurrently to enable constant testing and iteration.
The roadmap will import the required data from an online database. This database will initially be linked to Excel. In this stage, an SQLR connection will be developed that allows the roadmap to be linked to such a database. This connection will be developed in such a way that it allows the roadmap to be linked to Jira in a future stage.
Overlappingly, an SQLR connection will be developed that allows the online database to be connected to Excel. This connection will be developed in such a way that the Excel database can be changed to a certain extent, and still be correctly connected to the roadmap. As indicated by KPN, the possibility exists that changes will be made in the composition of focus points.
When both SQLR connections have been developed, test runs will be conducted during which the focus point principals submit their focus point plans to the roadmap. These test runs are mainly aimed at uncovering bugs in the data transferral.
At the same time, test runs will be conducted in which members of the MT will use a fully functional version of the application that includes actual project tiles submitted by focus point principals. These test runs aim to uncover bugs in the user interface.
The last stage of implementation involves revisions on any bugs that were uncovered. After having fixed any bugs that my have emerged, the tool can be used and will be ready for implementation.

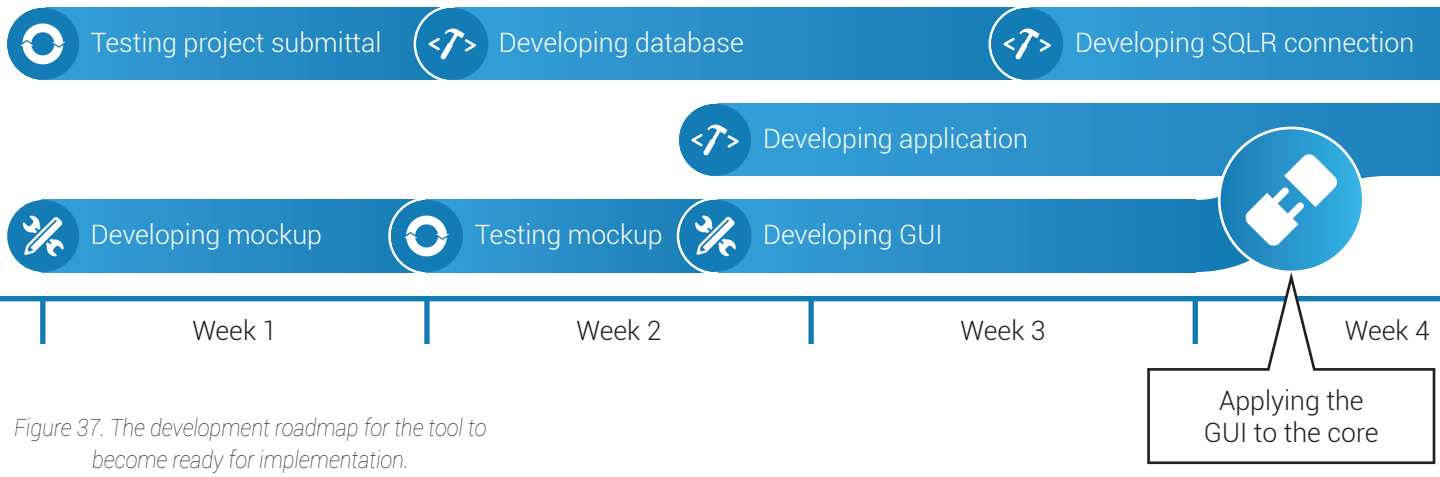
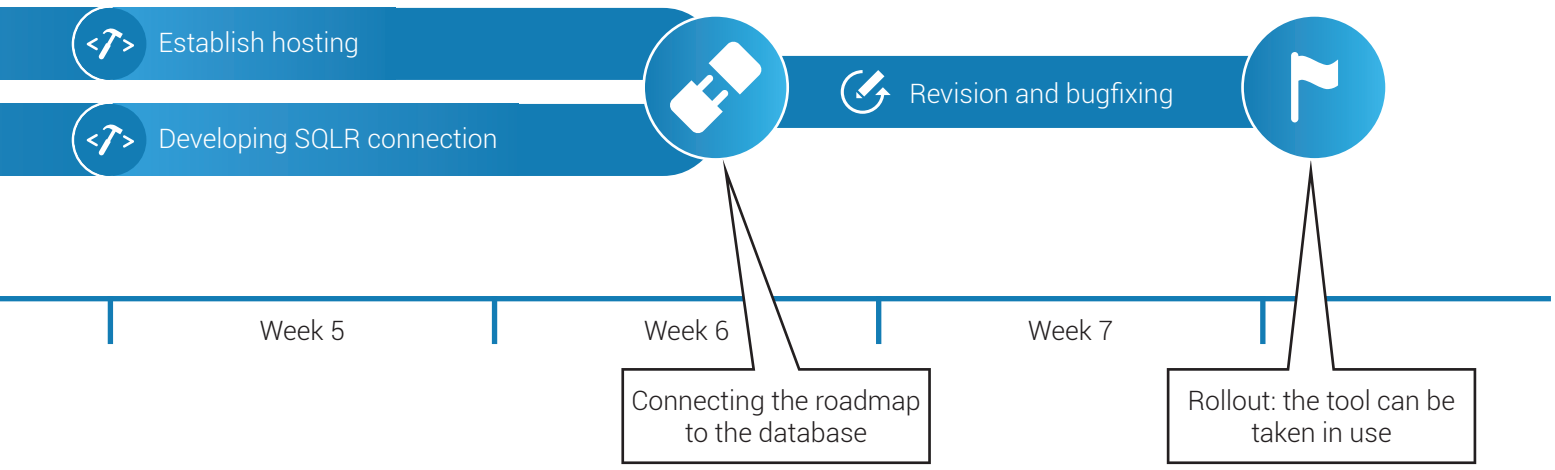


Figure 37. The development roadmap for the tool to become ready for implementation.


Establish hosting
Developing SQLR connection
Revision and bugfixing
Week 5
Week 6
Week 7
Connecting the roadmap to the database
Rollout: the tool can be taken in use

Phase 4

Evaluation

The fourth and final phase evaluates the result of the project. It reflects on the tool by discussing its benefits and limitations. Furthermore, it describes recommendations for the future.

14. Design Reflection

This chapter reflects on the final design. It discusses what the tool could add in practical terms as well as how the tool is a reflection of the theory that it was based on. Furthermore, it describes some limitations and considerations that have to be taken into account.

14.1 Benefits

The tool is designed for KPN IoT specifically. Although the usage will have to be tested over a longer duration, there are several benefits assumed to emerge.

Awareness of Direction

The roadmap gives the user a simple visual representation of all focus point plans that are currently being undertaken. All employees will have access to the tool and hence will be able to know which development plans are running.

Understanding Rationale

All employees know that the department is required to reach certain revenue targets. The tool represents a simple computation that compares the added revenue of a collection of focus point plans to the required revenue. This way, the tool communicates the rationale behind project planning.

Balanced Workloads

Each focus point plan shows what it depends on to be executed. These indicators cover internal business functions as well. By adhering to a simple colour coding, the management team is stimulated to establish a planning without causing too many conflicts in business functions.

Dealing with Targets

The tool represents the focus point plans in such a way that it clearly shows the implications of changing targets in revenue. Whenever a situation like that occurs, it becomes visually clear what this means for the current planning and how the new target could be reached by adjusting the planning.

14.2 Limitations

Although the tool may potentially address the problem situation and is developed according to the earlier established value propositions, there are also some limitations.

Flexibility

The tool aims to make the department more flexible by reducing the load on its change capacity. It does so by dividing the workload between the department's 11 focus points. However, the tool assumes that the department's business units correlate seamlessly with the focus points. The project tiles indicate focus points, but not business units. For example, one business unit may be involved in the plans of more than one focus point. This way, minimizing imbalanced workloads becomes more difficult.

Superordinate Goal

The tool assumes that a business case can be made for all focus point plans that establishes the revenue that they generate. However, for some of the focus points it may be very difficult to do this. For example, Marketing included an increased awareness as an objective. It may be difficult to translate this increased awareness to an exact revenue it will generate.

14.3 Reflection on Theory

14.3.1 Resilience

The final design improves resilience by helping the department to quickly recover from changing targets in revenue.

Identifying Discontinuities

Information sharing: In a way, one might say that the design supports information sharing, since information about focus point plans is submitted into the tool. However, it does not support the exchange of information about (environmental) discontinuities and therefore does not address this determinant as intended by the theoretical framework.

Sensemaking: The tool supports sensemaking by helping the department to interpret the impact of discontinuities. The discontinuities in this context are changing targets in revenue and the interpretation is done by visually communicating how these changes affect the current project planning.

Addressing Discontinuities

Resource flexibility is considered in the design of the tool. This has expressed itself by supporting the MT to plan projects in such a way that they divide the workload required across business functions. Whether this actually leads to less performance pressure has yet to be validated.

Coordination flexibility: One might argue that coordination flexibility is addressed by the tool. It can be considered as such because decisions on projects take into account how short term plans constitute long term goals (instead of just looking at short term value). However, it takes into account only revenue related objectives and does not look at the department's other main objectives.

14.3.2 Alignment

The final design increases alignment by stimulating a more logical and clear direction planning.

Short Term Alignment

Task cohesion & goal congruence: Both task cohesion as well as goal congruence are addressed by the tool in the same way. The tool intends to support the management team to take on only the projects that are necessary for reaching the revenue target. This way, less projects will be running parallelly, and consequently employees will be working more as a coherent whole (task cohesion). In line with this, less projects at the same time leads to less conflicts in priorities (goal congruence).

Long Term Alignment

Superordinate goal: A superordinate goal has always been present in the department, but has not yet been emphasized as such until now. The superordinate goal that guides individuals' objectives is the target in revenue. The link between focus point plans (and the tasks inherent to these plans) is clearly established.

Shared Vision: One might argue about this determinant. Building on the literature research, a shared vision refers to a "shared cognitive image of the department's future state" (Thoms, 1995). Building on this definition, it is important to establish what one considers a state.

The design only specifies the future level of revenue that the department will generate. However, it can be argued that any organisation's future state relies on much more than just the level of revenue. For example: how large will the organisation be? What kind of governance will it experience? What kind of market segments will it be targeting? The tool does not provide an answer to these questions, nor does it take into account the viewpoints of different individuals (or business functions) on the future of the department.

15. Recommendations

This chapter offers both practical implications for incorporating the tool as well as more general recommendations for the IoT department.

The newly developed tool has gained buy-in from the management team and will be adopted within the foreseeable future. This implies that all employees will have to get used to a new representation of focus point plans. It is advised that the management team makes sure that everyone in the department becomes familiar with this new representation. This can be achieved in various ways. For example: the management team could adhere to the same visual representation during a monthly business update. This way, all employees will become acquainted with it.

In its current form, the tool provides the department with a clear understanding how they will reach their long term objectives in revenue and supports the department with planning their development projects by assessing the projects' value in a quantitative way.
However, this form of innovation planning allows the department to take on many different projects that do not necessarily relate to each other. Although this fits in the organisation's governance which is focused on reaching revenue targets, "working towards many different objectives at once or constantly changing strategic direction can make it difficult for an innovation agency to deliver impactful innovation" (Nesta).
It is therefore recommended that the department assesses innovation projects in a more qualitative way and reformulates its vision in a more compelling way as a starting point. A meaningful vision determines the markets that an organisation intends to address, it specifies in what way the organisation intends to be unique and it establishes possible strategies to pursue in order to reach the vision.
It can be argued that the department would significantly benefit from establishing a clear vision on the future. When a vision is clearly articulated and followed, "everyday decisions and actions respond to current problems and challenges in ways that move the organisation toward the future rather than maintaining the status quo"(other reference). This would help the department with differentiating itself in the future.
Deploying a more consistent form of innovation in which separate projects relate to each other and the overarching vision helps employees to understand the meaning of their work to the organization. A well formulated vision provides meaning to work by specifying its purpose, how it impacts the organization and how it relates to other work.
A more qualitatively oriented innovation approach does not necessarily imply that the department will generate less revenue. Other innovation agencies have already come up with innovation processes that help with quickly developing innovation projects to a point in which they can be measured and assessed whether to be worth the investment (e.g.: Mozilla's lightweight innovation process). An innovation approach in which projects are qualitatively assessed on a meaningful future vision could help the department to differentiate itself. This would return on the investment in the long run. At the same time, the loss in short term revenue can be minimized by applying a different innovation approach.

References

References

A

Aaker, D. A., & Mascarenhas, B. (1984). The need for strategic flexibility. Journal of business strategy, 5(2), 74-82.

Allen, J. (2016). Managing Operational Resilience | CSIAC. Csiac.org. Retrieved 1 November 2016, from https://www.csiac.org/reference-doc/managing-operational-resilience/

C

Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. Organization science, 13(4), 442-455.

Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. Organization science, 15(5), 555-568

F

Fredericks, E. (2005). Infusing flexibility into business-to-business firms: A contingency theory and resource-based view perspective and practical implications. Industrial Marketing Management, 34(6), 555-565.

G

Grant, R. M. (1996). Toward a knowledge based theory of the firm. Strategic management journal, 17(S2), 109-122

Goh, S. C. (2002). Managing effective knowledge transfer: an integrative framework and some practice implications. Journal of knowledge management,6(1), 23-30.

H

Hackman, J. R. (1992). Group influences on individuals in organizations. Consulting Psychologists Press.

Hamel, G., & Valikangas, L. (2003). The quest for resilience. Harvard business review, 81(9), 52-65.

Houston, M. B., Hutt, M., Moorman, C., Reingen, P. H., Rindfleisch, A., Swaminathan, V., & Walker, B. (2004). A network perspective on marketing strategy performance. Assessing marketing strategy performance, 247-268.

K

Karlsson, C., & Ahlström, P. (1996). The difficult path to lean product development. Journal of Product Innovation Management, 13(4), 283-295.

Keller, S., & Price, C. (2011). Beyond performance: How great organizations build ultimate competitive advantage. John Wiley & Sons.

L

Lengnick-Hall, C. A., Beck, T. E., & Lengnick-Hall, M. L. (2011). Developing a capacity for organizational resilience

through strategic human resource management. Human Resource Management Review, 21(3), 243-255.

Morris, P., & Pinto, J. K. (2010). The Wiley guide to project, program, and portfolio management (Vol. 10). John Wiley & Sons

Mullen, B., & Copper, C. (1994). The relation between group cohesiveness and performance: An integration. Psychological bulletin, 115(2), 210.

Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. Oxford university press

PÁDÁR, K., & PATAKI, B. What Lies Behind The Concept of Organizational Resilience and Related Concepts? An Analytical Literature Review.

Pinto, M. B., Pinto, J. K., & Prescott, J. E. (1993). Antecedents and consequences of project team cross-functional cooperation. Management Science, 39(10), 1281-1297.

Sanchez, R., & Mahoney, J. T. (1996). Modularity, flexibility, and knowledge management in product and organization design. Strategic management journal, 17(S2), 63-76.

Sherif, M. E. (1962). Intergroup relations and leadership: Approaches and research in industrial, ethnic, cultural and political areas.

Shimizu, K., & Hitt, M. A. (2004). Strategic flexibility: Organizational preparedness to reverse ineffective strategic decisions. The Academy of Management Executive, 18(4), 44-59.

Steyn, H. (2002). Project management applications of the theory of constraints beyond critical chain scheduling. International Journal of Project Management, 20(1), 75-80.

Thoms, P., & Greenberger, D. B. (1995, August). Training business leaders to create positive organizational visions of the future: Is it successful?. In Academy of Management Proceedings (Vol. 1995, No. 1, pp. 212-216). Academy of Management.

Tsai, W., & Ghoshal, S. (1998). Social capital and value creation: The role of intrafirm networks. Academy of management Journal, 41(4), 464-476.

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