KTH ROYAL INSTITUTE
OF TECHNOLOGY

Degree Project in Computer Science and Engineering, specialising in ICT Innovation (Human Computer Interaction and Design)

Second cycle 30 credits

# Integrating User Centred Product Planning Approaches in Multi-Product Tech Companies

**BENEDETTA CERVONE**

Stockholm, Sweden 2022

# Integrating User Centred Product Planning Approaches in Multi-Product Tech Companies

BENEDETTA CERVONE, KTH Royal Institute of Technology, School of Electrical Engineering and Computer Science, Sweden

This study aims at exploring and developing an approach for user-centred product planning for product managers in multi-product tech companies. Applying the Design Thinking methodology in this research project allows for product managers to be involved in the design process as a whole. From research and interviews with product managers it can be seen that there is a global understanding of the importance of a shift in focus towards user experience rather than product features while planning, but that there are no clear means yet to facilitate this. Through co-design with product managers as well as individual prototyping, a lo-fi prototype of a planning tool is developed and tested. The results show that the prototype successfully facilitated multi-product planning and shifted the focus from features to experiences. The methodology used can be reproduced in analogous companies and the results can be used as a starting point to continue adapting and developing the approach.

## SAMMANFATTNING

Denna studie syftar till att utforska och utveckla ett tillvägagångssätt för användarcentrerad produktplanering för produktchefer inom tekniska produktutvecklingsbolag som utvecklar flera olika samverkande produkter. Metoden Design Thinking har använts i detta forskningsprojekt, vilket möjliggjort att produktchefer kunnat att vara involverade i designprocessen som helhet. Från initiala intervjuer med produktchefer framkom det att de förstod vikten av att ha fokus på användarupplevelse snarare än produktegenskaper under planering av flerproduktslösningar, men att de i dagsläget inte finns några tydliga verktyg för att underlätta detta. Genom samdesign med produktchefer formades ett antal prototyper av ett planeringsverktyg. En Lo-Fi-prototyp utvecklades och utvärderades av produktägare. Testerna visade att multiproduktplanering framgångsrikt underlättades och flyttade fokus från funktioner till användarupplevelser. Den metodik som använts här kan reproduceras i liknande företag och resultaten kan användas som utgångspunkt för att fortsätta anpassa och utveckla arbetssättet.

Additional Key Words and Phrases: User Centred Design, Multi-Product Planning, Design Thinking

Author's address: Benedetta Cervone, cervone@kth.se, KTH Royal Institute of Technology, School of Electrical Engineering and Computer Science, Stockholm, Sweden, SE 100 44.

## 1 INTRODUCTION

As technology advances, user needs rapidly evolve and competition rapidly rises - it is more important than ever for companies to differentiate themselves and offer the user the best experience possible [6]. The value that a product creates for the user plays a key role in its success [33]. In order to put products on the market that create value for the user and consumer, the user must be at the centre of the product creation [16]. Therefore, an increasing amount of tech firms are incorporating user-centred methodologies in their workflow. However, in order to be successful, these methodologies should be made an integral part of the company's processes, being most beneficial when these are introduced as early as possible in the product workflow [15, 16]. Oftentimes, implementing user-centred methodologies is limited to executing more user tests and user research at specific product design stages. Furthermore, implementing these practices in large tech firms has proven to be challenging, as analytical and fact-based decisions are still dominating in company cultures, leaving little space for design-based approaches [21, 26].

In early-stages of tech product development a central phase is the product planning. In product planning the resources that should be used, timing of development and the vision of the product vs the vision of the company is specified. Oftentimes this planning is feature-centred, focusing on what features should be built when [19]. This approach has been proven to not be so effective and successful anymore, especially in long term planning [22]. Research shows that by putting the focus in understanding the user, solving problems and sketching a long-term vision and thus shifting the focus from features to experience and product goals can provide a better plan for the company and ultimately produce more successful products [19, 22].

This challenge gains a level of complexity when it is put in the context of a company that has to manage multiple products that share resources and work toward one bigger goal. To contribute to the literature this paper attempts to analyse and answer the following question: *What are the affordances and challenges when designing an approach for product managers in multi-product tech companies to facilitate user-centred cross product planning?*

The research will be carried out in collaboration with Teledyne Flir, an example of a multi-product tech company. The application of the method is catered to fit this company and the findings are validated in the context of this company. However, the research and methodology should offer replicability in other analogous companies.

## 2 BACKGROUND

The theoretical background putting the research in context is laid out in this section. Terms such as multi-product, user centred design, design thinking and product planning are defined. Typologies of roadmaps are discussed and a state of the art analysis of some current product planning tools is executed.

### 2.1 Multi-product Technology Companies

Multi-product technology companies are defined as companies that produce and/or manage multiple, often interconnected, product lines [30]. The products developed at these companies are of technological nature, varying from software, hardware and a combination thereof. These products are often interrelated and share resources and elements, and can be combined to shape a solution. A solution, for the purpose of this research, is defined as a combination of products working together in solving a user problem [31, 32]. A various number, if not all major tech companies, can fall under this definition, for example Apple [1] and Google [2], or Adobe [3] and Garmin[4]. Multi-product companies should not be confused with multi-brand companies such as Meta [5] or Unilever[6], as these produce multiple products that are not necessarily connected with each other and each have their own separate brand [2, 28]. Figure 1 shows an example of what a multi-product company organisation could look like.

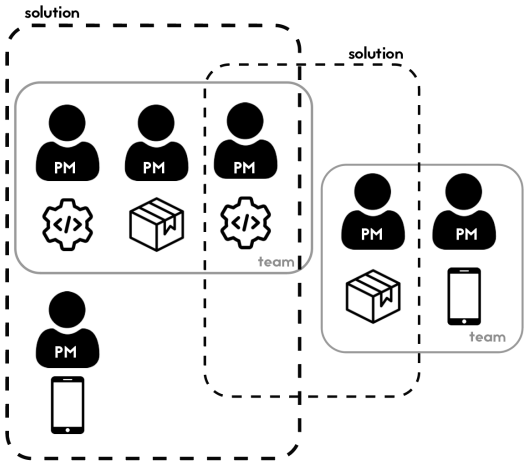


Fig. 1. Multi-Product Tech Company

### 2.2 User Centred Design

ISO [2019] [7] defines user centred design as the *"approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques"* [14]. The terms user centred design and human centred design are often interchanged, where human centred design implies a broader, more inclusive perspective [14]. In this thesis the term user centred design is preferred over human as the focus is put on consumer products with end users.

In recent years the focus on integrating user centred design in business processes has started growing, as it has been demonstrated that this approach is beneficial and improves revenue for a company [10]. The shift from a technology-centric way of working to a user-centric one is of interest in tech companies and different approaches have been researched [15]. In order to obtain the full benefits of user-centred approaches these must be implemented very rigorously, made an integral

[1] https://www.apple.com
[2] https://www.google.com/
[3] https://www.adobe.com
[4] https://www.garmin.com/
[5] https://about.facebook.com/meta/
[6] https://www.unilever.com
[7] International Organisation for Standardization https://www.iso.org/home.html

part of the company culture and from early on in the product workflow process [15, 16]. Despite that, although some companies have shown that using these methodologies can bring benefit to the company, the majority of tech companies are still struggling to do so [26].

### 2.3 Design Thinking

A commonly used user centred approach within companies is design thinking. Design thinking is an approach that takes inspiration from the thought process of designers [9]. This thought process integrates user needs, technology and business, and is not limited to a specific industry or area [29]. The core of design thinking is understanding the users and the problems that they are facing [9]. It's an iterative process where problems are solved while trying to understand the users and identifying alternative solutions that might not be apparent initially. One of the pioneers in using and implementing design thinking in multi-product tech companies is IBM, who developed their own approach to design thinking [16]. Tim Brown [5], CEO of Ideo[8], further explores how, by employing design thinking principles in organisations, more people can cross-collaborate in developing novel solutions, leading to more innovation and business opportunities. Brown [5] further highlights the importance of applying design thinking being applied to innovative strategies, organisation structures and processes in a company - and not just in the core design activities.

### 2.4 Product Planning

A professional often found in tech companies is the product manager (PM). A PM's job description may differ within firm - for instance a PM may manage one or many products, report to other managers or engineers [11]. Nevertheless, the PM is always the person that ensures that the choices made for a product and its development are the ones that will ensure its success, delivering superior customer satisfaction and providing long term value for the company [11]. Product planning entails several steps within a company and each PM and company has their own specific way of working and preferred tools [19]. Planning is oftentimes done through a roadmap, helping to put the product on a time frame - both long term and short term. Applying a design thinking approach when long term product planning can help stimulate innovation and creativity in tech companies [27].

*2.4.1 Roadmaps.* When looking into product planning within tech firms, a variety of different types, definitions and approaches to roadmapping can be found in literature [12, 13, 20, 23]. Overall, roadmaps can be used to facilitate internal communication across teams, technology management and to collect information about potential innovations [12, 24]. For the most part, PMs use roadmaps to plan a product and visualise and prioritise the steps that must be undertaken, describing how the product vision is going to be achieved and aligning business and technology development [13, 20]. When looking into incorporating user centred planning practices within tech companies, oftentimes the differentiation is made between technology and design roadmaps [18].

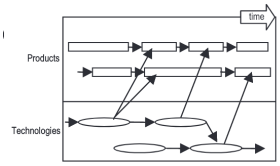


Fig. 2. Technology Roadmap [23]

Traditionally, technology roadmaps are widely used within tech companies as they have - as the name suggests - a focus on technology and its evolution and development over time with respect to existing products [23]. There are several approaches to technology roadmaps to be found in literature, applied to different contexts and sizes [7] [23]. An example of a technology roadmap aimed at product planning can be found in Figure 2. As it can be

[8] https://www.ideo.com/eu

seen in Figure 2, the focus of technology roadmaps is not laid on the user - rather on mapping products and technologies over time.

When looking into a user-focused roadmap the less used approach of design roadmaps tends to fit that image. In design roadmapping an attempt is made at including design and user experience within a product roadmap [17].

A simplified version of a design roadmap generated by Kim et. Al [2022] can be found in Figure 3. The approach of this design roadmap is to align core experiences with primary user needs and the total outcome, rather than focusing on features. The design roadmap approach has shown positive results in moving the focus in tech companies from tech-driven to user-centred [17]. Oftentimes, design roadmaps are owned and used solely by designers rather than product managers. However it is argued that, throughout the planning process, there must be an increase of designer's inclusion in order to increase presence of design elements in the product roadmap and shift the roadmap from being feature-driven to experience-driven [19].

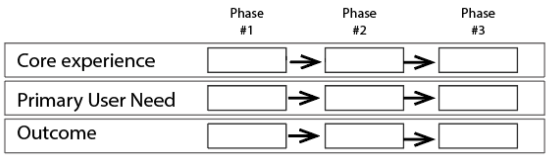


Fig. 3. Simplified Design Roadmap [18]

## 2.5 State of the Art of Planning tools

Some examples of the most popular existing tools that are being used in product planning are outlined and compared below. These tools all focus on roadmapping.

*2.5.1 Productboard.* Productboard [9] (Figure 4) claims to help PMs to understand what their customer needs and prioritise what to build when. It allows to prioritise for either features, user feedback or objectives. It allows for roadmap customisation as it has a number of templates to chose from, allowing the user to pick the one that fits their product best. For a cross-product plan multiple swim lanes are allowed. Productboard has different types of subscription packages that give you access to different functionalities. The *essentials* subscription allows you to draw a simple roadmap, the *pro* subscription has a way of incorporating user feedback into the roadmap and the *scale* subscription allows the user to input also strategic data and planning, allowing for objectives to be set and evaluate each feature with respect to the objective.

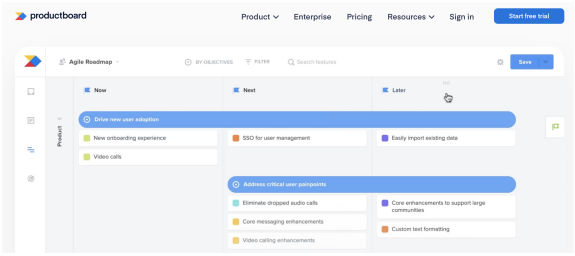


Fig. 4. Product Board Screenshot

*2.5.2 Productplan.* Productplan [10] (Figure 5) is a subscription-based roadmapping tool. In terms of functionalities it is quite simple. It provides a number of templates that can be used for different roadmaps, from an ux-roadmap, a multi-product roadmap or a software roadmap. An integration of all is not available. The roadmaps tend to be short term based, as most of the templates stretch out for a time period of 6 to 12 months.

[9] https://www.productboard.com
[10] https://www.productplan.com

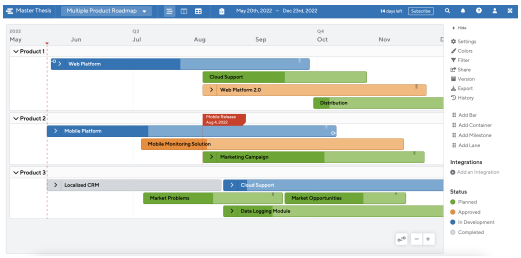

Fig. 5. Screenshot from Product Plan's Multi-Product Roadmap.

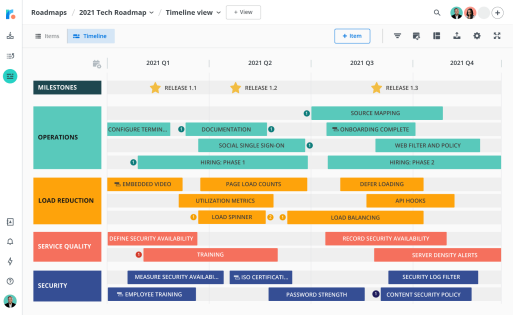

Fig. 6. Roadmunk Screenshot

*2.5.3 Roadmunk.* Roadmunk [11] (Figure 6) claims to be a customer-driven roadmap. It includes templates or allows to create a roadmap from scratch. The customer-driven aspect is that it allows to gather customer feedback within it and create new features based on it. It allows for integration with other development management software like Azure[12] and Jira [13]. It allows for the roadmap to be visualised in different ways and with different timelines. Although it allows to add long-term milestones, the focus of the roadmap is still relatively short term. Furthermore, the focus in the roadmap is put on building features. From a multi-product point of view it allows to align the roadmaps from the whole company.

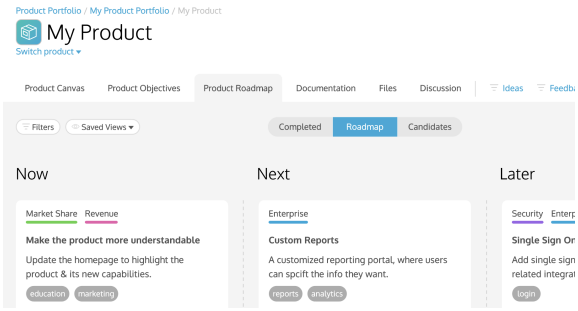


Fig. 7. Propad Screenshot

*2.5.4 Prodpad.* Prodpad [14] (Figure 7) is a (paid) product management tool aimed at both PMs as well as a product team as a whole. Prodpad aids at prioritising incoming ideas and what must go in the product backlog. It is problem/feature based, meaning that it focuses on building features and checking if these have solved a problem. It is single-product focused as it mainly provides single-product overviews for roadmaps, goals and features to be built. It does not offer a clear timeline, rather what needs to be built in the immediate future, near future and far future (*Now, Next, Later*). It has a backlog view where all the incoming ideas can be organised as well as a feedback view, gathering all user feedback.

[11] https://roadmunk.com
[12] https://azure.microsoft.com/en-us/services/devops/
[13] https://www.atlassian.com/software/jira
[14] https://www.prodpad.com

| | **Long Term vs Short Term** | **Feature vs Experience** | **Multi-Product** |
|---|---|---|---|
| **Productboard** | Short term | Feature.<br>Can integrate user feedback in extra subscription | Yes, if you buy extra subscription |
| **Productplan** | Short term | Depending on template | Depending on template |
| **Roadmunk** | Short term<br>Allows for long term milestones | Feature<br>Allows to create features based on customer feedback. | Allows alignment of roadmaps from whole company |
| **Prodpad** | Short term | Feature<br>Allows to create features based on customer feedback | Single product |

Table 1. Summary of State of The Art Analysis of Planning Software

*2.5.5 Conclusions of State of The Art Analysis.* As of right now the tools that are available offer a variety of functionalities, scalability and adaptability that can be of interest. In Table 1 an overview of the tools is made and their functionalities related to the literature discussed. Overall no focus is put on long term, and when products talk about user centred planning most of the times this involves only including customer feedback in the roadmap. However the way that multiple roadmaps can be aligned against a time frame is an interesting way to visualise relationship between products in the context of multi-product tech companies.

## 3 METHOD AND IMPLEMENTATION

In this section the method chosen to answer the research question will be outlined as well as how it has been implemented in the context of the research.

### 3.1 Method - Design Thinking

The method that is applied is Design Thinking. This methodology has been chosen because, as mentioned in the related work, it is a widely-applicable, user centred methodology that allows to solve ill-defined problems [9]. Design Thinking differentiates from other methodologies as it specifically allows for feedback loops, which is beneficial as the problem to be tackled is not straightforward and iterations might be needed based on the results from previous phases. Furthermore, in traditional design methods such as a waterfall approach, the same data is oftentimes the starting point of the design, plan and execution making no space for iteration - thus not allowing for user insights to be gained and incorporated throughout the process [1].

For the purpose of this thesis the five-steps Design Thinking model defined by the Stanford d.School [8] is chosen. The steps identified by are: *empathise*, *define*, *ideate*, *prototype* and *test* [8, 9] (Figure 8).

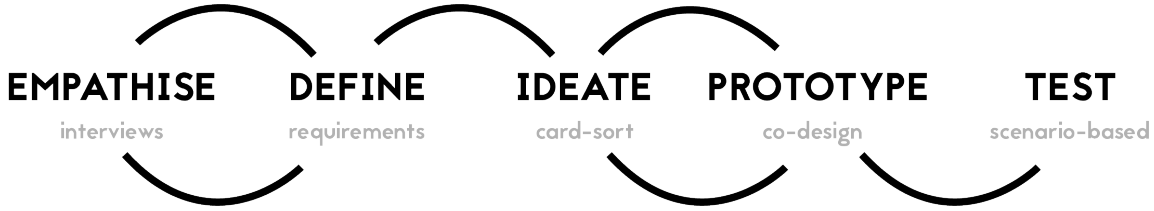


Fig. 8. Design Thinking Methodology In Context

For the development of this approach we consider the end users to be the product managers (PMs) but take into account and involve the view of the design team (UX) too. As argued in Chapter 2, the inclusion of designers in the planning process can aid towards a switch in focus from feature centred to experience centred.

### 3.2 Empathise - Interviews

The core of the *empathise* phase is to understand the user. Thus, in this phase, a number of interviews are carried out with PMs. These findings are combined with the literature study results and will help define the problem and understand the needs of the PMs. Interviews are carried out in a semi-structured way, recorded, and, depending on availability, are done either online or in person [4]. Due to the nature of the project, convenience sampling is used - and thus four PMs are identified within Teledyne Flir that are currently collaborating with each other on a solution and are executing cross-product planning.

The goal of these interviews is to understand how PMs work today, their background and what their view on product planning is. Furthermore to have a view on their work and what tools they use right now. Lastly how they think users are involved at the moment in product planning and how they collaborate with other PMs.

### 3.3 Define - Requirements

The goal of the *define* phase is to define user's needs and problems. This is done by gathering the results of the interviews. The interviews are coded using top-down deductive structural coding. This allows to divide the findings according to the prompts asked. Afterwards a thematic analysis is done, where themes are identified.

Using the themes identified, a list of MoSCoW requirements is generated. MoSCoW requirements are requirements divided in four categories: *Must Do, Should Do, Could Do and Won't Do* [25]. Dividing requirements in these categories allows to gather and prioritise what to build according to the research [25].

While defining the user's needs and problems there is a chance to *re-iterate* to the *empathise* phase to gather missing data, by for instance asking further questions and joining a number of internal meetings to gathering a better view of internal communication dynamics and roles.

### 3.4 Ideation - Card Sort

In the *ideation* phase the goal is to generate new ideas that fit the found problems and needs. In order to think outside the box and to gain and involve the users, a first first focus group session is organised with two PMs as users and two members of the UX team as support. The PMs have also been taken part in the interviews. Members of the UX team are invited as they can offer their insight on user-centred planning and can help create a conversation with the PMs. The activity is held online using Microsoft Teams to accommodate any participant that cannot be available in person [15]. Microsoft Teams allows for the session to be recorded too. The activity is organised with the aid of a Miro board [16] board, a co-working whiteboard that allows for collaboration. The setup of the first focus group is represented in Figure 9. The focus group

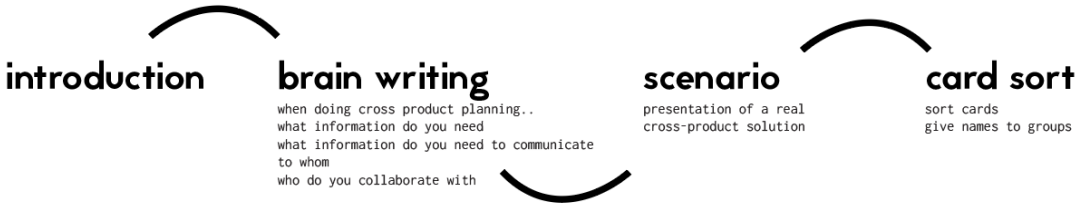


Fig. 9. Set-up Focus Group with Card Sort

takes approximately 45 minutes. The data analysed is both the outcome from the activities recorded in Miro as well as the supporting audio recording. The goal of the focus group is to gather the information that is needed when visualising and planning a product; generating thus a first information architecture to be used in the approach. This is done through a *card sorting* exercise, as card sorting helps understand the user's mental models that are associated with information [3]. The input of the card sorting is open, meaning that only prompts to generate the cards are provided. The prompts are as follows: *when doing cross product planning what information do you need?*, *when doing cross product planning who do you collaborate with?*, *when doing cross product planning what do you communicate and to whom?*. Afterwards, in order to give more context and generate more cards, a scenario is introduced. The scenario serves also as priming towards user centred thinking as it presented as a final goal to solve customer needs rather than implement features.

[15] After the COVID-19 pandemic, remote and hybrid work became a lot more common, meaning that not everyone is at all times available in person at the office.
[16] https://miro.com

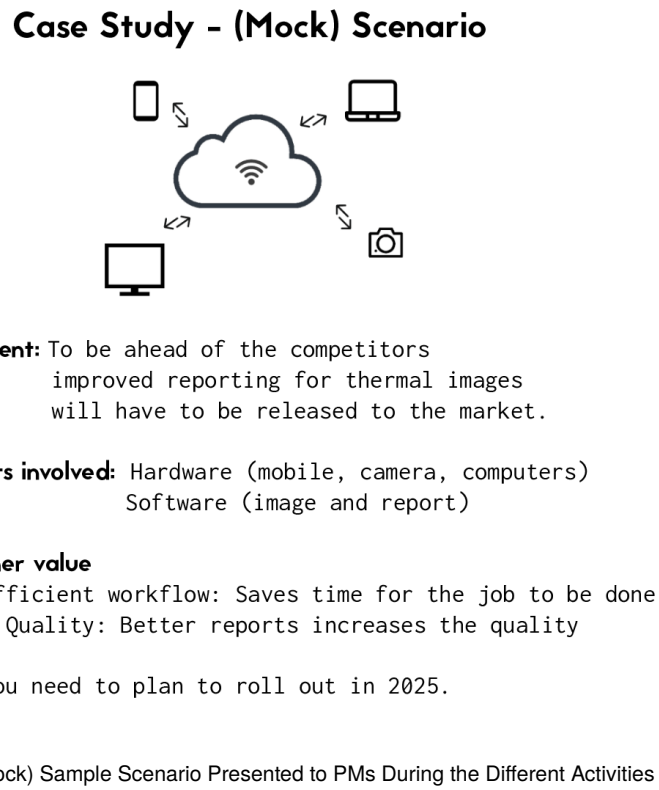


Fig. 10. (Mock) Sample Scenario Presented to PMs During the Different Activities

The scenario used [17] can be found in Figure 10. The scenario fits the current work of the PMs and fits their own product and expertise, so to minimise cognitive load on the PMs.

### 3.5 Prototype

In the *prototype* phase the aim is to develop a final lo-fi prototype that is testable in a scenario-based setting. The ideation activities will have provided a number of focus areas and information needed when long term product planning, as well as what kind of information is crucial to communicate and to whom. In the prototype phase it is important to use the generated information architecture as a base for co-design with PMs - and then, if needed, further refine the design based on the co-design activity.

*3.5.1 Co-Design.* The co-design session was organised as shown in Figure 11.

The co-design session involves a group of five PMs, two of which lead groups of PMs themselves within cross-product planning. Four of them had participated in the interviews and two of them in the first activity. As support two members of the UX team were present too.

[17] As the research was executed at a specific company it was beneficial to discuss the research in the lens of real future products present in the long-term roadmap. These are unreleased and highly confidential, therefore the scenarios presented in the research cannot be published. Instead this is a scenario that is analogous to the ones that were presented in the testing sessions.

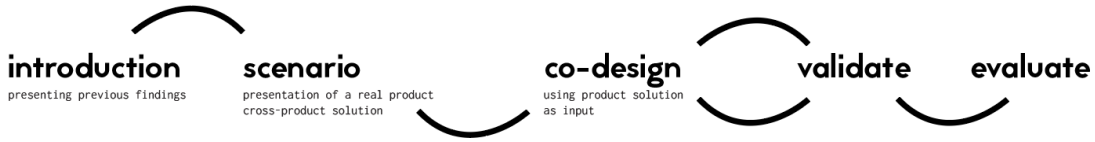


Fig. 11. Set-up Co-design Session

The activity is held online using Microsoft Teams, is recorded and takes approximately 95 minutes. A Miro board will enable the co-design activity and enable collaboration. The data analysed is both the outcome from the Miro board and the recordings.

After having introduced the findings from the previous sessions to make sure that everyone is up to date and on the same page, a scenario based on a real product is presented. This scenario is analogous to the one used in the card sorting activity (Figure 10).

Afterwards the information architecture generated in the card sorting activity is presented with some input already filled out in order to provide context. The participants are instructed to start visualising the information in a way that makes sense to them, by reorganising visually the information and adding further information. Afterwards there is a short evaluation.

*3.5.2 Further Prototyping.* The result of the co-design focus group is used to further refine and create a final lo-fi prototype. This is done through further design iterations based on the input given in the co-design sessions. In these design iteration some support was received by the design team as well. If needed, there is a chance to *reiterate* and go back to the ideation phase.

### 3.6 Evaluation - Scenario-based

The last phase is the *evaluation* phase, where the final prototype is evaluated by the end-users, the PMs. They will help re-define and finalise the solution. The *evaluation* aims at understanding a number of factors: whether the desired approach is usable, if it satisfies the requirements set and ultimately answering the research question. The evaluation is in the form


Fig. 12. Evaluation Setup

of a scenario-based evaluation (Figure 12), where the PMs have to use the prototype and communicate to each other while planning and afterwards sell their plan to higher management, played by a UX manager. The PMs are invited to think aloud while executing the task. Afterwards the users are asked to fill out a small survey that is then used as input for a discussion afterwards. The evaluation is done by two PMs. This scenario is analogous to the one used in the card sorting activity (Figure 10). The evaluation takes 95 minutes.

## 4 RESULTS

In this section the results of each step in the method outlined are discussed.

### 4.1 Exploratory Interviews

The interviews have been transcribed and coded using top-down deductive structural coding. The codes were based on the following interview prompts: *how are products planned, what is the user involvement in planning, use of planning tools right now*. A thematic analysis was afterwards conducted to organise the findings further and identify common themes. The themes identified are as follows: *ecosystem of tools used, main purpose of planning tools, pre-planning, internal selling and communication, zoom levels, needs, roadmaps, products and services and time horizons*.

From the interviews it became clear that in terms of short-term planning the current used tools are redeemed good. Also, it was evinced that implementing a solution in the early stage long-term planning (2-5 years) would be most beneficial as it would automatically influence the efficiency and focus of the short-term planning. This is in line with what discussed in the literature. All of the PMs mentioned roadmaps as being their main mean to organise planning for their product and to communicate their ideas both internally within the team and externally to other teams. Two PMs highlighted the importance of having a good roadmap as it can help with internal selling and communication. In terms of tools used the two most used tools are Confluence [18] and Microsoft Powerpoint. Currently Confluence is considered satisfactory when it comes to short-term planning. However when looking into long-term planning Microsoft Powerpoint is preferred as it makes it easier to create graphs and illustrate things than than in a wiki-tool like Confluence. Furthermore Confluence does not allow restrictions on who gets to see what, thus everyone in the organisation would have access to the long term plan. Furthermore, it was clear that whatever should be built should be easy to use and need little training from the PMs.

Every interviewed PM showed a different approach to tracking incoming early-stage ideas, however all showed the need to have that defined and of easy access. Overall all PMs showed need for flexibility and expressed concern with the fact that plans change all the time and that communicating and collaborating with each other can work but there is no unified structure at the moment. When asked about users and their involvement in the planning all of the managers seemed to be aware of the importance of the user, however all had different ways of integrating users in their planning due to the nature of the product - whereas a software product has a more direct line with users a more complex hardware one does not. Lastly from the interviews it was highlighted this aspect of the collaboration and fine balance between business technology and users, highlighting that the solution needed has to be user centred but does not have to ignore the technology and business aspects of product planning as ultimately those are just as important and valuable.

[18] https://www.atlassian.com/software/confluence

### 4.2 MoSCoW Requirements

The MoSCow requirements can be found in Figure 13. These have been generated using the findings of the interviews

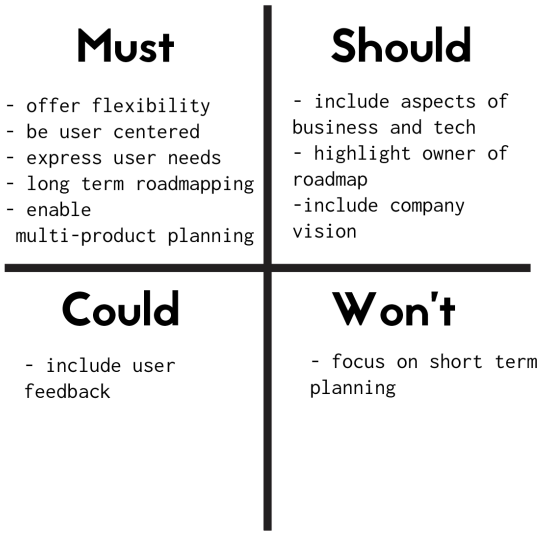


Fig. 13. MoSCoW Requirements

described above together with observing a number of meetings that involved product planning. What is important to highlight is that the tool *must* allow for long-term roadmapping and *must* be flexible as projects change all the time. Furthermore it *must* allow for seamless collaboration between managers towards a common solution. It *must* be user-centred, but *should* not forget aspects of technology and business related to planning.

### 4.3 Card Sort

A selection of the results from the card sort activity can be found in Figure 14.

Four main themes were generated, namely: *voice of customer (input and validation), big picture stuff, internal alignment and timing*. These themes were connected as well, as the voice of customer is the top of the hierarchy and timing is at the bottom. Under voice of customer the information input that is communicated by the user experience team is found, such as target groups, who are the customers, user value etc. Big picture stuff represents things such as a global vision, goals, objectives and information that comes from higher up management and that is directly related to the company's vision. Internal alignment includes information that is specific to the solution that is being planned for, such as the resources available and the core of cross product working. Timing lastly includes all of the information that is tied to a timeline.

This workshop served at gaining an understanding of what kind of information is crucial to communicate within a cross-product team and what user input is needed to be visualised and clearly communicated by the user team in order to shift the focus of the planning towards the user.

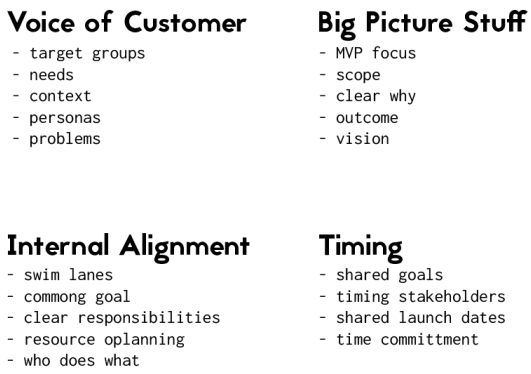


Fig. 14. Card Sorting Results

### 4.4 Co-design sessions

The information was quickly organised in a timeline form, where the different products owned by the PMs were aligned with the cross-product solution. There were clear "goal" releases that must be visualised in this timeline, however, there was other information that did not belong in the timeline but needed to be visible at all times and be agreed upon by everyone. For instance the owner of the solution, target group and global goals. In the reflection session it was both mentioned that there is a lack of ownership over a decision. Furthermore the visualisation should allow for constant changes and flexibility.

In conclusion the co-design session provided a base for the lo-fi prototype. It showed the need for a timeline/roadmap approach, however that the solution should not just be a roadmap, but include information about ownership and users, to keep the focus while planning. The tool should be aiding planning and when the plan is defined it has to be inputted into the used tools, for instance confluence. The solution created presented a roadmap with a clear timeline, where the products and solutions are visible. The time frames within the timeline must be flexible and editable by the PMs. An overview of the combination of risk factors within UX, tech and business must be visualised as well.

### 4.5 Refining the Prototype

After the co-design sessions the prototype was refined further in order to create a prototype that could be tested, fit the requirements and followed the input from the co-design session. A few versions of the prototype were sketched out both on a whiteboard together with the help of the UX team (Figure 15 as well as in Balsamiq 16, a wireframing and prototyping tool. During the refinement of the prototype, a *reiteration* to the *ideate* phase took place, by involving the UX team in the whiteboard sketching.

### 4.6 Final Prototype

The final prototype has been developed in Miro. The final empty prototype design that is presented to the PMs can be found in Figure 17. The prototype presents on the left side a toolbox where a number of post it notes can be used to insert information on the right side. A timeline marker is also included, allowing the user to create their own timeline. On the right side the actual interface is presented. On the top a number of text boxes are included, putting the focus on the overall application being built, the users, problems addressed, products involved and risks and limitations. Below a timeline/roadmap is created with on top the solution view and below the chance to split it into products. The PMs are

Fig. 15. Ideation Activities on Whiteboard with UX Team

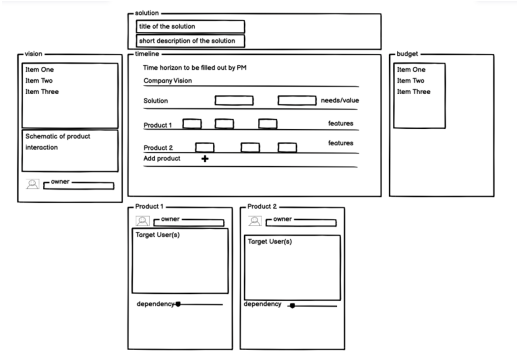


Fig. 16. Refining the Prototype Digitally

prompted to fill out needs solved in the solution timeline and map those to global product features to be built in the separate products. The goal is that this timeline is shared both by PMs as well as members of the design, tech and business team.

### 4.7 Evaluating the Interactive Visualisation Prototype

The final prototype is evaluated in a scenario based test. The first, primary scenario, is the planning scenario - where PMs are asked to plan a product based on the scenario used in the previous activities. During the concurrent think aloud it was clear that the PMs were following the template presented step by step, filling out the tabs at the top and subsequently filling out the timeline. Some of the words used were seen as ambiguous, for instance *business plan* and *application*. The PMs were lenient to use the toolkit available on the left as well as Miro functionalities- this strengthens the need for a simple tool where the PMs are not required to use colours or visual tools, but just one that allows to fill, add and remove information in a logical, non limiting way. When the PMs were asked evaluation questions the answers were overall positive. The template seemed to provide a good workflow, it was easy to use, and enabled solution-based thinking. The template was valuated as neither flexible or unflexible, and the user-centerdeness of the template was sometimes unclear, but satisfactory. The PMs suggested both that some fields needed more clarifications (*business plan and known limitations*) but that no fields were necessarily missing. It fulfils the need to use this within different teams, and it fulfilled the need of what UX must communicate to PMs. Some items can benefit from a connection with the confluence platform including extra information about, for instance, user personas and business models. In the second part of the scenario the PMs were asked to use the model to sell it to a higher manager (played by a UX manager). The template seemed to fulfil the needs of using it for internal selling too, it helped focus on the solution that's being sold and how each product connected. Overall the PMs felt that they were aided in thinking long term and in terms of user needs to be satisfied rather than technical functions to be executed.

A mock version of the filled out prototype can be found in Figure 18.

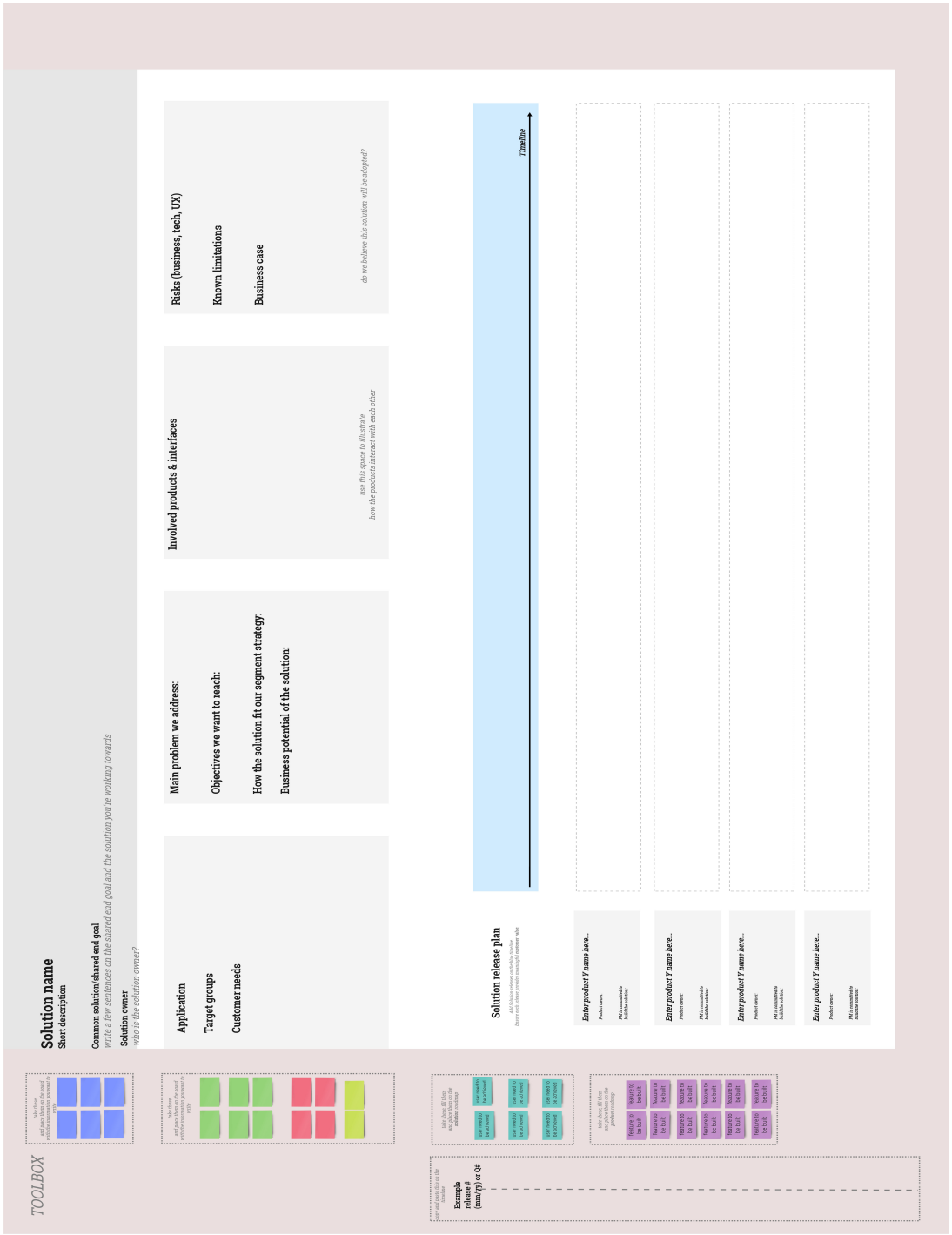


Fig. 17. Final Prototype (Empty)

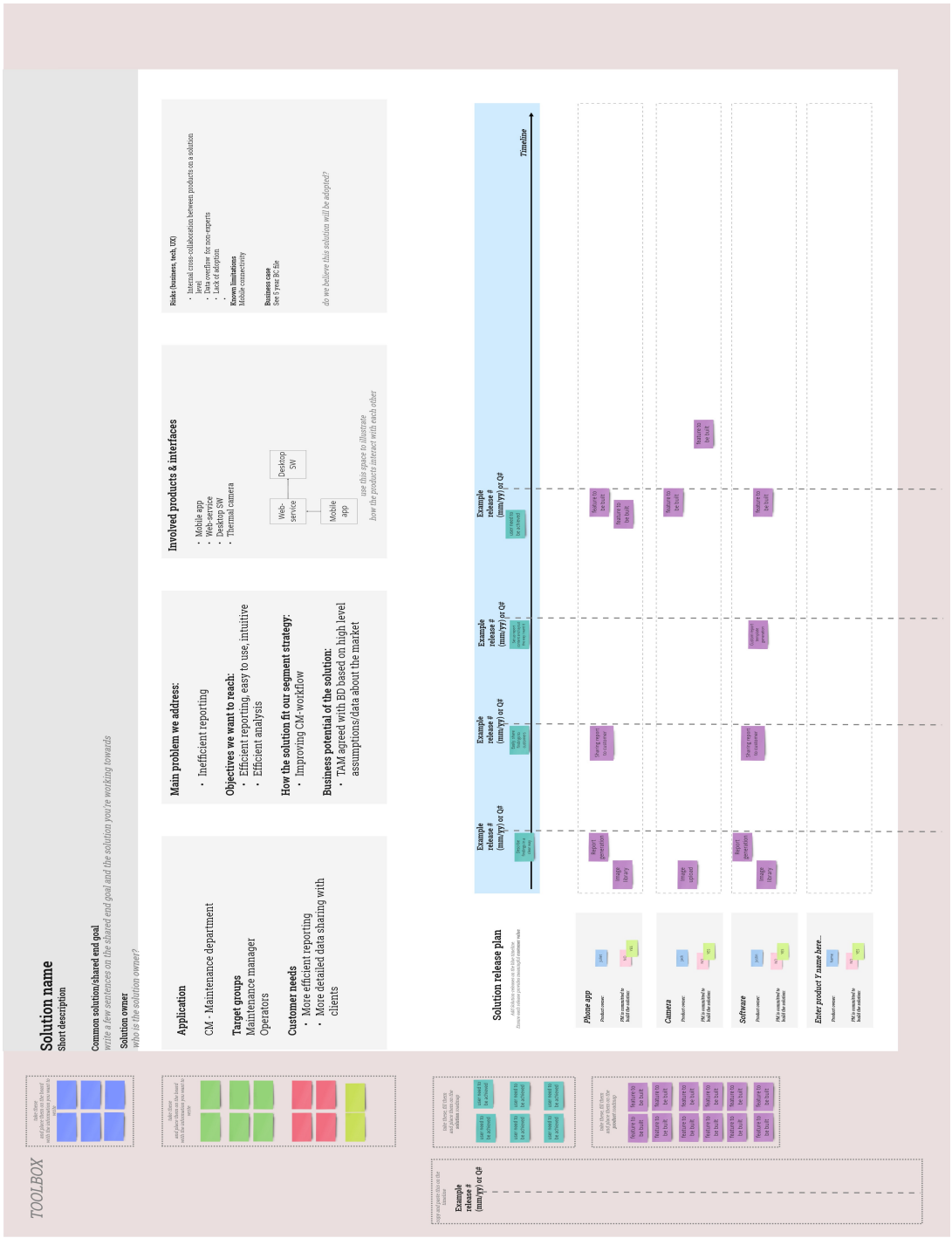


Fig. 18. Final Prototype (Filled Out with Dummy Data)

## 5 DISCUSSION

In this section the research question will be answered. A global overarching answer will first be drawn up, and afterwards going deeper into what it means to design for product managers as your users, discussing the actual approach developed, how the shift from feature-centred to user-centred has been obtained and by discussing the multi-product and cross-team complexity of the project. Also, a set of general guidelines are laid out that can be used in the context of any multi-product tech company.

Lastly, method criticism is laid out and suggested future work is discussed, both from a research standpoint as well as laying out the next steps specific for the company this thesis is written at.

### 5.1 Answering the Research Question

The research question that this research attempted to answer is: *What are the affordances and challenges when designing an approach for product managers in multi-product tech companies to facilitate user-centred cross-product planning?* When designing an approach for product managers it is important to involve the product managers throughout the process and listen to their needs. Product planning is only one part of their jobs, meaning that the approach must be easy to use, efficient and easily integrated in their daily work tools. The focus cannot only be on the user, as ultimately a company also needs to take into account revenue and technological developments and limitations. Thus a good combination of business, tech and design should be achieved. Initiating co-design sessions with product managers and designers can aid to achieve a setup that follows the product managers mental model yet includes the design perspective. Combining roadmap elements that are familiar to product managers together with space to discuss other dependencies can allow for this to happen. Lastly, visualising multiple products in one line from a solution point of view helps analyse the layers in multi-product planning in an uncluttered and surveyable way.

*5.1.1 Designing for Product Managers.* As argued in Chapter 2.2, when designing for a specific user, user centred methodologies are preferred. The design thinking methodology was chosen as it allowed for flexibility and is ideal in answering ill-defined problems. The PMs were involved in the design process through co-design activities and actively providing input throughout. After the initial interviews, PMs were involved in the definition of the information architecture and were involved in a co-design session where they could define the initial shape of the approach needed. This helped designing an approach that fulfilled the needs of the PMs and fit the context of their work. Furthermore, this allowed the result to be fitted to their needs and thus more likely to be applied.

*5.1.2 Final Approach.* The research question purposefully uses the word approach when defining what is being designed, as identifying exactly what is needed is an integral part of the process. Furthermore each company might need the approach to take a different shape or be implemented in a specific software, however the methodology used and the core of the final prototype can be adapted in whichever form is most fit to the company. The aim of the final approach is to guide the PMs through the product planning process, involving tech architects, higher management and user researchers throughout their process and when needed. It gives a structure to go through the product planning process by putting user needs at the centre of the creation instances and visualising a holistic view of the product with user needs mapping features from parts of the product. In the case of Teledyne Flir, a lo-fi prototype of a template made in Miro was developed. This is because Miro is a widely used software within the company to collaborate on projects and it allows for collaboration online.

*5.1.3 Shift from Feature Centred to User Centred.* The shift that the approach needed to facilitate was from a feature/technology centred product planning towards a design/user centred product planning. Although, as found in the interviews, the PMs are aware of the importance of this shift, co-design alone is not sufficient to execute this shift. Therefore the UX team has been involved in some of the co-design activities. The UX team acted as subject expert in advising the type of information that they need to communicate to the PMs and information that is crucial to product planning. A focus shift is achieved by putting the user needs to be fulfilled at the top of the roadmap and mapping those to features. Furthermore, by offering a space to define user groups and needs, the approach allows PMs to shift their focus early on towards the user they are building for. Thus, it can be argued that the approach developed attempts at shifting the focus from feature to design, without losing focus and balance of the technical features and business aspects of product planning that is just as vital and important.

*5.1.4 Multi-Product and Cross-Team.* One of the challenges in this research was aligning multiple products and cross-collaboration. The final approach identified is designed to allow and facilitate collaboration between business, tech and user experience departments when doing long term planning. Furthermore the timeline developed allows to view multiple products together with a global holistic view, in the case of this prototype a solution and a number of products. Lastly the approach serves itself at being adapted to different layers that are found in multi-product tech companies, where products are connected with each other and together create global solutions. As mentioned in the co-design session, a best approach would not be to try and fit everything in one - but create something adaptable at a smaller scale. Such a design allows that as it can be applied to different zoom levels within the product architecture of multi-product tech companies.

*5.1.5 Guidelines for User-Centred Cross-Product Planning in Multi-Product Tech Companies.* The findings of this paper can provide a good starting point for multi-product companies that want to adapt user-centred cross-product planning. There are two ways this can be achieved; by using the results of this paper as a starting point or following through the methodology used. In both cases, an analysis of the tools used within the company is needed to understand in which platform it is best to develop the approach. Furthermore, organising co-design sessions with product managers and designers can aid in aligning thought processes and understanding the important information that needs to be transferred through and within teams. The inclusion of designers can aid in shifting the focus from feature-centred to user centred. It is important to offer a good balance between features and needs, as both share a place in planning.

### 5.2 Method Criticism

The user centred approach in designing for a specific company proved itself to be successful within the context of the research, however the final prototype is only tested within one company. This means that the results from the final prototype and evaluation cannot be generalised to other multi-product tech companies yet. Furthermore, within the company, the tests and activities were limited by the availability of the participants. This meant that, as not all the potential participants identified were available at the same time, some were not able to participate to all the activities. The research should be thus expanded to more teams and more team members. Due to internal deadlines at the company, the final test could only be executed with two PMs.

Furthermore the scenario-based test was planned to take 95 minutes. Ideally, such a planning activity would take more than a day and thus, to get more accurate results, the testing should have been done over the same amount of time to potentially provide more accurate results.

The co-design activities were held online due to participants availability. It was clear that the PMs were not fully comfortable with using Miro as a creative tool, as much as it can replicate using pen and paper. Carrying out ideation

activities in person using more tangible and usable tools could have made the PMs feel more comfortable and be more creative.

Lastly, although this has been prevented through creating a setup following literature guidelines, this research included a high number of group activities, including the final prototype evaluation. This could have potentially led to groupthink, thus indicating that in the future more individual activities could be implemented together with the group ones, for example following up with individual evaluation after a group one.

### 5.3 Future Work

This thesis was concluded with the evaluation of a lo-fi prototype, thus the next step would be to develop a hi-fi prototype. Furthermore research must be done in the implementation, expansion and adoption of this tool within more multi-product tech companies. Also, further research must be done in how the organisation must change and start adapting this tool, to have every PM on board. Lastly, measuring the long term impact of this approach on revenue and user satisfaction would also be a next step.

### 5.4 Next Steps at Teledyne Flir

The prototype produced is, as of right now, still in the lo-fi phase. Meaning that there is little to no interactivity, for instance when adding a product in one field it does not automatically get added in another respective field. Developing an interactive hi-fi prototype would be the next step, taking also into account the results from the user tests. Furthermore, the adaptability and expendability to other teams should be taken into account as well. This prototype should also look into possibility for data from other used software to be imported and viceversa. Teledyne Flir has shown interest in wanting to continue to develop and integrate this tool further. It is clear that everyone sees and understands the need for a user-centred approach within the company and that, using a tool like this, is just the first of many steps in order to build products that truly satisfy user needs and create long term value for the user.

## ACKNOWLEDGMENTS

This work could have not been possible without a number of people which I would like to personally thank, in no particular order. A word of thank to my supervisor Björn Thuresson, for helping me to stay on track and see this thesis work from different angles throughout the whole process - guiding me towards new insights in my research. Also thank you to my two Teledyne Flir supervisors Mikael Erlandsson and Torsten Sandback, for offering me the opportunity to conduct this research at Teledyne Flir and providing support and guidance through this complex project - as well as everyone else at Teledyne Flir that participated to my activities and answered my questions. Thank you to my critical observer from the University of Twente, Kasia Zalewska, for the additional and precious feedback and words of reassurance. A word of thank to Nikki Arendse and her precious academic experience for helping me polish the abstract and final presentation. Also thank you to Stijn Wolters and Hester Van de Ven for proofreading this paper and being a constant I can always fall back to - both throughout my studies as well as in day-to-day life. And lastly to my close friends and family that have in one way or another provided support when needed the most in these past few months.

## REFERENCES


[1] Geanie Asante. 2018. Effective Design Methodologies. *Design Management Review* 29, 2 (2018), 10–15. https://doi.org/10.1111/drev.12122 _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/drev.12122.

[2] Samuel Bacharach. 2014. How to Go From a Product Company to a 'Solution' Company. https://www.inc.com/samuel-bacharach/five-steps-creating-solution-company.html

[3] Kathy Baxter. 2015. Card Sorting. In *Understanding Your Users - A Practical Guide to User Research Methods*. https://doi.org/10.1016/B978-0-12-800232-2.00011-0

[4] Kathy Baxter. 2015. Interviews. In *Understanding Your Users - A Practical Guide to User Research Methods*. https://doi.org/10.1016/B978-0-12-800232-2.00009-2

[5] Tim Brown. 2019. *Change By Design: How Design Thinking Transforms Organisations and Inspires Innovation*.

[6] Robert Cooper and Scott Edgett. 2010. Developing a Product Innovation and Technology Strategy for Your Business. *Research-Technology Management* 53 (May 2010), 33–40. https://doi.org/10.1109/EMR.2010.5645762

[7] Douglas Pedro de Alcantara and Mauro Luiz Martens. 2019. Technology Roadmapping (TRM): a Systematic Review of the Literature Focusing on Models. *Technological Forecasting and Social Change* 138 (Jan. 2019), 127–138. https://doi.org/10.1016/j.techfore.2018.08.014

[8] Scott Doorley, Sarah Holcomb, Perry Klebahn, Kathryn Sergovia, and Jeremy Utley. 2018. Design Thinking Bootleg - Stanford d.school. https://dschool.stanford.edu/resources/design-thinking-bootleg

[9] Interaction Design Foundation. 2002. *The Basics of User Experience Design*.

[10] Joseph Giacomin. 2014. What Is Human Centred Design? *The Design Journal* 17, 4 (Dec. 2014), 606–623. https://doi.org/10.2752/175630614X14056185480186

[11] Linda Gorchels. 2012. The Multifaceted Nature of Product Management Jobs And Structure. In *The Product Manager's Handbook* (4 ed.). 978-0-07-177298-3 https://learning.oreilly.com/library/view/the-product-managers/9780071772983/ch01.html

[12] Linda Gorchels. 2012. Road Maps, Innovation, and the Fuzzy Front End. In *The Product Manager's Handbook*. 978-0-07-177298-3 https://learning.oreilly.com/library/view/the-product-managers/9780071772983/ch06.html

[13] Pieter Groenveld. 2007. Roadmapping Integrates Business and Technology. *Research Technology Management* 50, 6 (2007), 49–58. http://www.jstor.org/stable/24135253 Publisher: Temporary Publisher.

[14] ISO. 2019. 9241-210:2019(en), Ergonomics of Human-System interaction — Part 210: Human-Centred Design for Interactive Systems. https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-2:v1:en

[15] Ernst Kesseler and Ed G. Knapen. 2006. Towards Human-Centred Design: Two Case Studies. *Journal of Systems and Software* 79, 3 (March 2006), 301–313. https://doi.org/10.1016/j.jss.2005.05.012

[16] Amir Kfir. 2021. The Key to Success: What is User-Centered Design Really Worth? https://forbes.co.il/e/user-centered-deisgn-contributors/

[17] Euiyoung Kim, Jaewoo Chung, Sara Beckman, and Alice M. Agogino. 2016. Design Roadmapping: A Framework and Case Study on Planning Development of High-Tech Products in Silicon Valley. *Journal of Mechanical Design* 138, 10 (Oct. 2016), 101106. https://doi.org/10.1115/1.4034221

[18] Euiyoung Kim, Lianne W. L. Simonse, Sara L. Beckman, Melissa M. Appleyard, Herb Velazquez, Antonio Suarez Madrigal, and Alice M. Agogino. 2022. User-Centered Design Roadmapping: Anchoring Roadmapping in Customer Value Before Technology Selection. *IEEE Transactions on Engineering Management* 69, 1 (Feb. 2022), 109–126. https://doi.org/10.1109/TEM.2020.3030172

[19] Euiyoung Kim, Shun Yao, and Alice Agogino. 2015. Design Roadmapping: Challenges and Opportunities.

[20] C. Todd Lombardo, Bruce McCarthy, and Michael Connors. 2017. Relaunching Roadmaps. In *Product Roadmaps Relaunched*. 978-1-4919-7171-0 https://learning.oreilly.com/library/view/product-roadmaps-relaunched/9781491971710/ch01.html

[21] Sihem Ben Mahmoud-Jouini, Sebastian K. Fixson, and Didier Boulet. 2019. Making Design Thinking Work: Adapting an Innovation Approach to Fit a Large Technology-Driven Firm. *Research-Technology Management* 62, 5 (Sept. 2019), 50–58. https://doi.org/10.1080/08956308.2019.1638485

[22] Jürgen Münch, Stefan Trieflinger, and Dominic Lang. 2018. Why Feature-Based Roadmaps Fail in Rapidly Changing Markets: A Qualitative Survey. (2018), 17.

[23] Robert Phaal, Clare J.P. Farrukh, and David R. Probert. 2004. Technology roadmapping—A Planning Framework for Evolution and Revolution. *Technological Forecasting and Social Change* 71, 1-2 (Jan. 2004), 5–26. https://doi.org/10.1016/S0040-1625(03)00072-6

[24] Robert Phaal, Lianne Simonse, and Elke Den Ouden. 2008. Next generation roadmapping for innovation planning. *International Journal of Technology Intelligence and Planning* 4, 2 (2008), 135. https://doi.org/10.1504/IJTIP.2008.018313

[25] Eva Schicker. 2020. How to use MoSCoW in UX Research and Avoid Featuritis. https://medium.com/usabilitygeek/how-to-use-moscow-in-ux-research-and-avoid-featuritis-b19b8b46734d

[26] Benedict Sheppard, Hugo Sarrazin, Garen Kouyoumjian, and Fabricio Dore. 2018. The business value of design | McKinsey. https://www.mckinsey.com/business-functions/mckinsey-design/our-insights/the-business-value-of-design

[27] Shamit Shrivastav and Rahul Joshi. 2021. Design Thinking for Long-Term Product Planning. In *Design for Tomorrow—Volume 3 (Smart Innovation, Systems and Technologies)*, Amaresh Chakrabarti, Ravi Poovaiah, Prasad Bokil, and Vivek Kant (Eds.). Springer, Singapore, 387–398. 9789811600845 https://doi.org/10.1007/978-981-16-0084-5_31

[28] Raul Tiru. 2020. What is a Multi-Brand Strategy? (+ Examples). https://raultiru.medium.com/what-is-a-multi-brand-strategy-examples-ef0a0a2fbab1

[29] Kaan Turnali. 2015. What Is Design Thinking? https://www.forbes.com/sites/sap/2015/05/10/what-is-design-thinking/ Section: Business.

[30] Mirriam Webster. 2022. Definition of Multiproduct. https://www.merriam-webster.com/dictionary/multiproduct
[31] Mirriam Webster. 2022. Definition of Product. https://www.merriam-webster.com/dictionary/product
[32] Mirriam Webster. 2022. Definition of Solution. https://www.merriam-webster.com/dictionary/solution
[33] Robert B. Woodruff. 1997. Customer value: The next source for competitive advantage. *Journal of the Academy of Marketing Science* 25, 2 (March 1997), 139–153. https://doi.org/10.1007/BF02894350

# A INTRODUCTION TO THE APPENDIX

The aim of this appendix is to support the above paper with additional information regarding the research process, data analysis and execution of the master thesis. The appendix is structured similarly to the main report, starting by giving extra background on the company at which the assignment is done at, additional literature and includes the integral interview/focus group guides and additional results from research activities. The appendix includes also all of the prototype sketches that were not included in the main report.

# B RESEARCH CONTEXT

The assignment was carried out at Teledyne FLIR, leading company in the development and production of thermal imaging cameras and sensors [19]. Teledyne FLIR is a multi-technology and multi-product company; meaning that there are multiple product lines running parallel, where products are dependent from each other. This adds a complexity in product planning, where decisions have to be optimally coordinated in the whole ecosystem of products. The PMs at Teledyne Flir want to increase the focus on customer value creation even further, thereby reducing the emphasis on feature growth. The company aims at shifting the focus to a more user centred one as it can improve user satisfaction, can aid decision making and ultimately allow the company to be even more competitive in the market.

The research is applied to a product line within Teledyne Flir called *Condition Monitoring* [20] This product line is the perfect example of a multiple technology/multiple product approach, where a variety of hardware and software products co-exist as their development is interconnected.

# C ADDITIONAL LITERATURE

## C.1 Further Definitions

There are a number of terms that need further definitions in the context of user centred design and product planning. These are the definitions that are used in the context of this research based from the studied literature, although a number of definitions can be made depending on the context.

*C.1.1 User Needs.* ISO [2013] defines user needs as:*"a prerequisite identified as necessary for an user, or a set of users, to achieve an intended outcome, implied or stated within a specific context of use"* [21]. Historically user needs can be connected to *Maslow's Hierarchy of Needs* [22], where Maslow states that the most basic human needs must be met before higher level ones can be achieved. He categorises them from the lowest being *physiological needs*, and highest being *self-actualisation*. Bradley [2010] proposes a new modern approach to Maslow's user needs - connecting it to design. Bottom-up the items found in Bradley's [2010] pyramid are *safety, utility, effectiveness, efficiency, satisfaction* and *self-fulfilment* [23] [24].

[19] 2021. About FLIR | Teledyne FLIR.https://www.flir.eu/about/about-flir/
[20] 2021. Condition Monitoring | Teledyne FLIR. https://www.flir.com/instruments/condition-monitoring-solutions/
[21] ISO, 'User Needs', 2013. https://www.iso.org/obp/ui/ (accessed Apr. 08, 2022).
[22] Maslow, A. H. (1943). A theory of human motivation. Psychological Review, 50(4), 370–396. https://doi.org/10.1037/h0054346
[23] S. Bradley, 'Designing For A Hierarchy Of Needs', Smashing Magazine, 2010. https://www.smashingmagazine.com/2010/04/designing-for-a-hierarchy-of-needs/ (accessed Mar. 20, 2022)
[24] [Interaction Design Foundation, 'Needs Before Wants in User Experiences – Maslow and the Hierarchy of Needs', The Interaction Design Foundation, 2017. https://www.interaction-design.org/literature/article/needs-before-wants-in-user-experiences-maslow-and-the-hierarchy-of-needs (accessed Apr. 08, 2022).

*C.1.2 User Requirements.* ISO [2010] defines user requirements as *"requirements for use that provide the basis for design and evaluation of interactive systems to meet identified user needs"* [25]. User requirements describe properties that must be provided in any way in order to satisfy the user need [26] and can be seen their tangible representation [27].

*C.1.3 User Value.* There are a number of definitions in literature when looking into user value. Boztepe [2007] splits user value into four different categories: *utility*, *social significance*, *emotional* and *spiritual* [28]. When looking into the utility category this is strictly related to how much a product helps to achieve a task, social significance value is more related to social benefits that a product provides, emotional is connected to the emotional benefits and lastly spiritual are even deeper value that is created by the end product. The definition given by Boztepe [2007] is analogous to the scale seen in Mazlow's hierarchy of needs. Furthermore, it is argued that in order to create user value user needs must be met, thus there is a difference between these but they are strictly correlated. Lastly, in the design and product planning stage, user value is just a proposed value - as weather this becomes a real value for the user can only be defined and decided by the user themselves, how they use and perceive the product or service designed and thus how it brings value to them [29] [30].

## C.2 State of the Art: Tools used by PMs

Confluence [31] is a team workspace where everyone in a team can collaborate and share their knowledge, documentations and plans with each other. Confluence allows to also integrate with third party applications. Confluence provides templates that can be used as well. This is a tool that is commonly used within companies and it is used at the company that the research is held at.

[25] ISO, 'User Requirements', 2010 https://www.iso.org/obp/ui/ (accessed Apr. 08, 2022)
[26] Abbott, R. J. An Integrated Approach to Software Development. Wiley, New York, 1986.
[27] S. Kujala, M. Kauppinen, and S. Rekola, 'Bridging the Gap between User Needs and User Requirements', p. 7.
[28] S. Boztepe, 'User Value: Competing Theories and Models', International Journal of Design, vol. 1, no. 2, 2007, Accessed: Apr. 12, 2022. [Online]. Available: http://www.ijdesign.org/index.php/IJDesign/article/view/61/29
[29] S. Sandström, B. Edvardsson, P. Kristensson, and P. Magnusson, 'Value in use through service experience', Managing Service Quality: An International Journal, vol. 18, no. 2, pp. 112–126, Jan. 2008, doi: 10.1108/09604520810859184.
[30] Grönroos, Christian. 2008. "Service Logic Revisited: Who Creates Value? And Who Co-Creates?" European Business Review 20 (4): 298–314.
[31] https://www.atlassian.com/software/confluence

## D STAKEHOLDERS ANALYSIS

A number of stakeholders are identified and a high-level stakeholders analysis is performed (Figure 19). This analysis

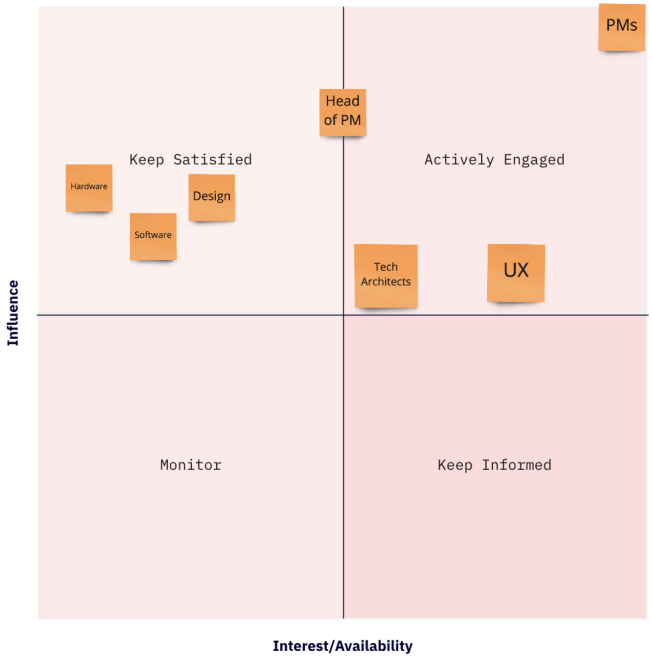


Fig. 19. Stakeholder Analysis

serves at understanding which stakeholders would be involved in which moments of the research. As the problem identified directly involves PMs as they are the main end uses to the approach the focus is put on keeping PMs at the centre of the design process by involving them in interviews and all of the focus groups and co-design activities. Furthermore the UX team is involved in a number of activities where their design expertise is needed. Meetings where Head of PM, Tech Architects, UX and PMs are present are also attended to gather extra insights. The stakeholder analysis also shows the need for the solution to be a good balance between Business, Tech and UX.

# E ADDITIONAL METHODOLOGY

## E.1 Tools

These are the tools that have been used throughout this research.

- **Microsoft Teams** [32] - Microsoft Teams is a collaboration platform that allows for content sharing, chatting and video calling with members of the same team. Microsoft Teams has been used during all of the remote-test sessions, as it allowed for calling with multiple users, screen sharing and audio/screen recording.
- **Miro** [33] - Miro is an online collaborative whiteboarding platform. It allows multiple people remotely to work on one big canvas and add visual and textual elements. It is ideal for online focus groups and workshops as it allows to time tasks, users to add in input on the board and prepare a visually clear presentation to use as guideline. In Figure 20 a screenshot from a part of the setup made for one of the workshops is shown.

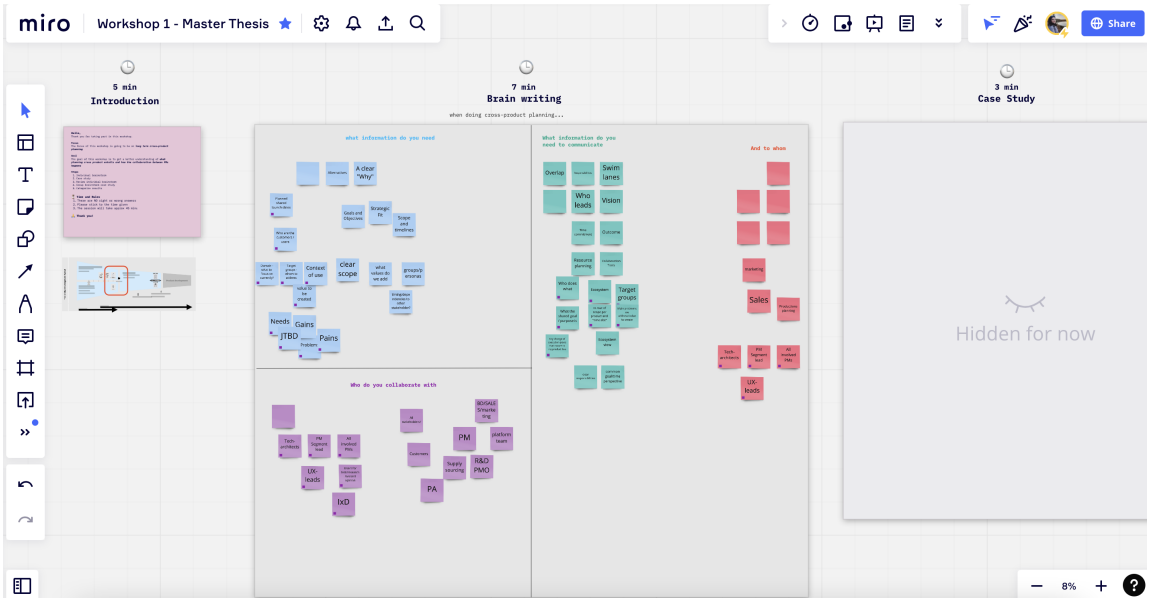


Fig. 20. Screenshot Workshop Miro

- **Balsamiq** [34] - Balsamiq is a rapid prototyping software that facilitates the design of wireframes. The wireframes generated do not include a lot of visual characteristics and they simulate a paper prototype. It allows for a focus on the information and placement rather than look of the prototype. It also allows for designs to be shared and stored in a cloud. In Figure 21 a screenshot from the Balsamiq interface is shown.

[32] https://www.microsoft.com/en-us/microsoft-365/blog/2022/03/16/3-ways-to-meet-new-hybrid-expectations-with-microsoft-teams-and-microsoft-365/?culture=en-us&country=US
[33] https://www.miro.com
[34] https://balsamiq.com

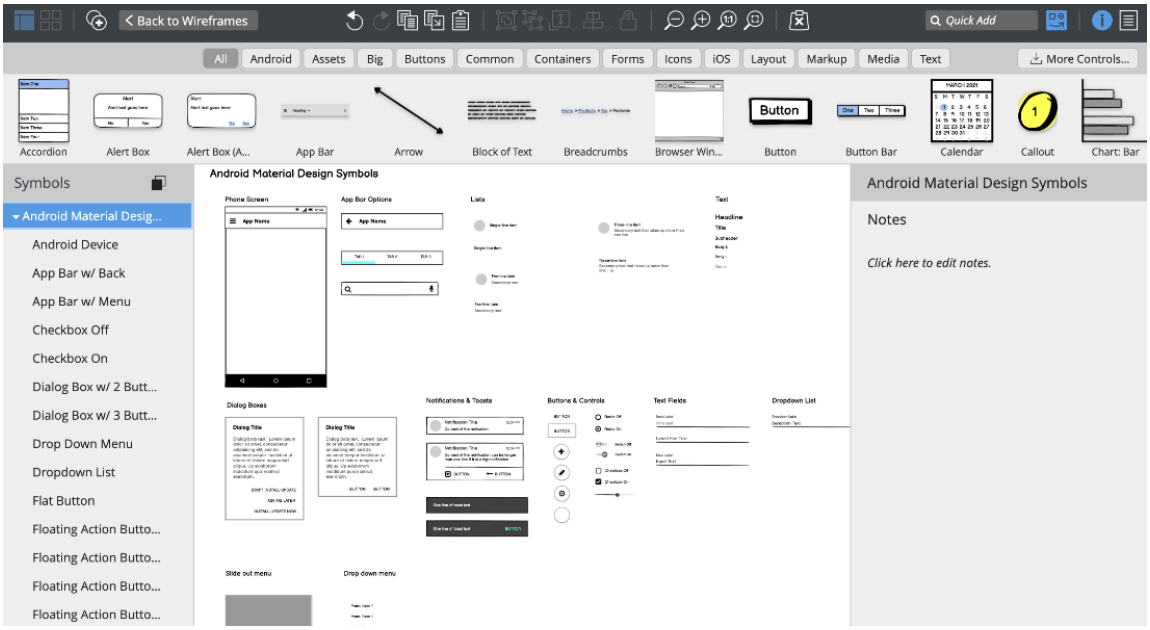


Fig. 21. Screenshot Balsamiq

## E.2 Interviews

*E.2.1 Interview Guide.* The interview guide (Table 2) has been based from the method outlined by Baxter [35]. The interviews were semi-structured, meaning that the prompts present in the interview guide helped to guide the conversation, but were not leading. The interviews took approximately 45 minutes. The interviews were carried out with 4 participants, one of them was carried out online. The participants were recruited using convenience sampling, as they were all PMs at the company that were involved in multi-product planning within the same team. Interviewees were briefed beforehand, the interviews were recorded with permission and transcribed afterwards [36]. A pilot interview was executed in order to check whether the time limit was met and if other questions were needed. A question was added about asking to actually show and run through some tools that are being used at the moment.

[35] Kathy Baxter. 2015. Interviews. In Understanding Your Users - A Practical Guide to User Research Methods. www.doi.org/10.1016/B978-0-12- 800232-2.00009-2

[36] Due to confidentiality, the transcriptions are not available for the public

| | |
|---|---|
| **Introduction** | *My name is Benedetta, I am a HCID student and I am currently writing my master thesis here at Flir. I am interested in understanding the work of you as a PM and the tools that you use in your job. I also want to grasp a better understanding at how you view Product Management at Flir and how you communicate and collaborate with other product managers.* |
| **Background of the PM** | - Could you introduce yourself, what is your background and role in the organisation?<br>- How do you define new products/road map them<br>- Describe how ideas are transformed into products (focus on roadmaps, framing/scoping) |
| **Work of the PM and Tools Used** | - How do you work today with (long/mid-term) product planning & roadmaps?<br>- Can you share your current material describing your product plans<br>(What factors were involved in choosing this tool/pros and cons)<br>- How do you collaborate and agree on your product plans with other PM:s? |
| **User Centred Approaches** | How do you ensure that the features you build are for the user |
| **Conclusion** | - Brief summary of what we talked about<br>- Is there anything I didn't understand correctly?<br>- Is there anything you'd like to add<br>- Who else should I speak to? |

Table 2. Interview Guide

### E.3 Scenario-based Evaluation

The interview guide used in the final evaluation can be found in Figure 22. This was in the shape of a survey, however it served as a guide to discuss the opinion of the PMs in a structured way.

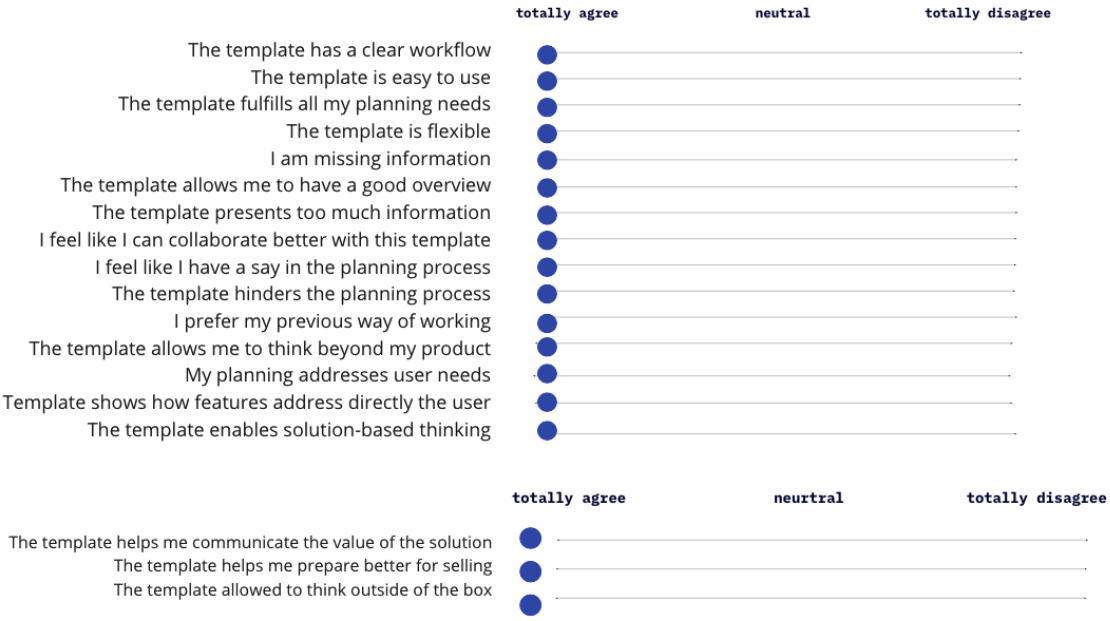


Fig. 22. Question guide used in the final prototype evaluation

## F ADDITIONAL RESULTS

### F.1 Thematic Analysis

The themes that came from the thematic analysis can be found in Figure 23.

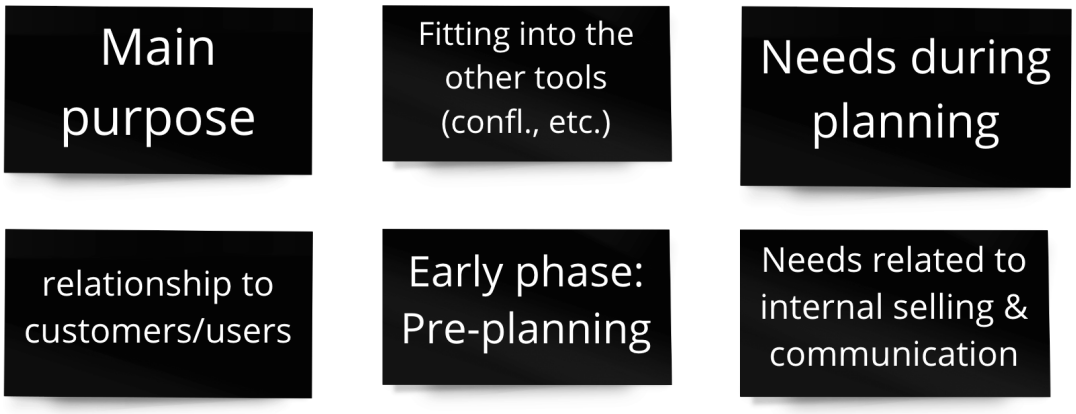


Fig. 23. Thematic Analysis

### F.2 Card Sort

The integral results of the card sort can be found in Figure 24.

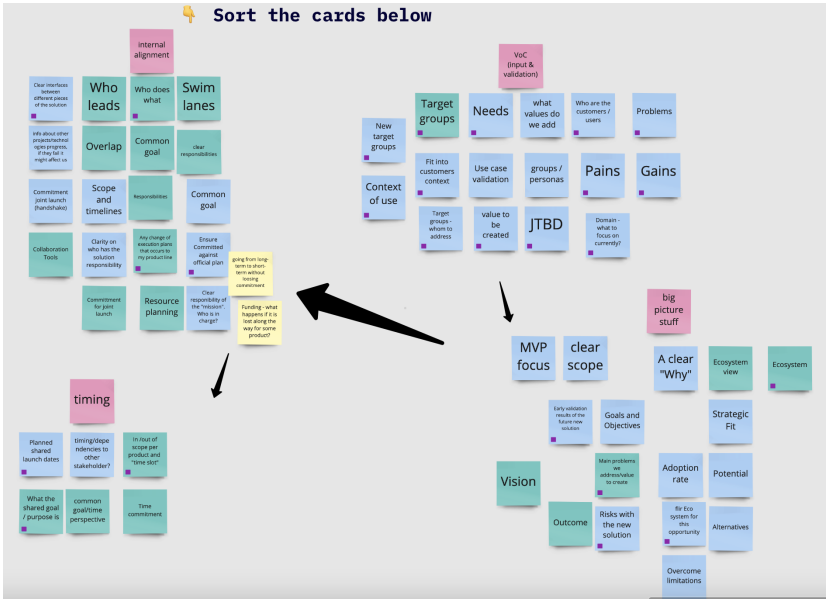


Fig. 24. Card Sorting Results

### F.3 Co-Design Result

The results from the co design session can be found in Figure 25.

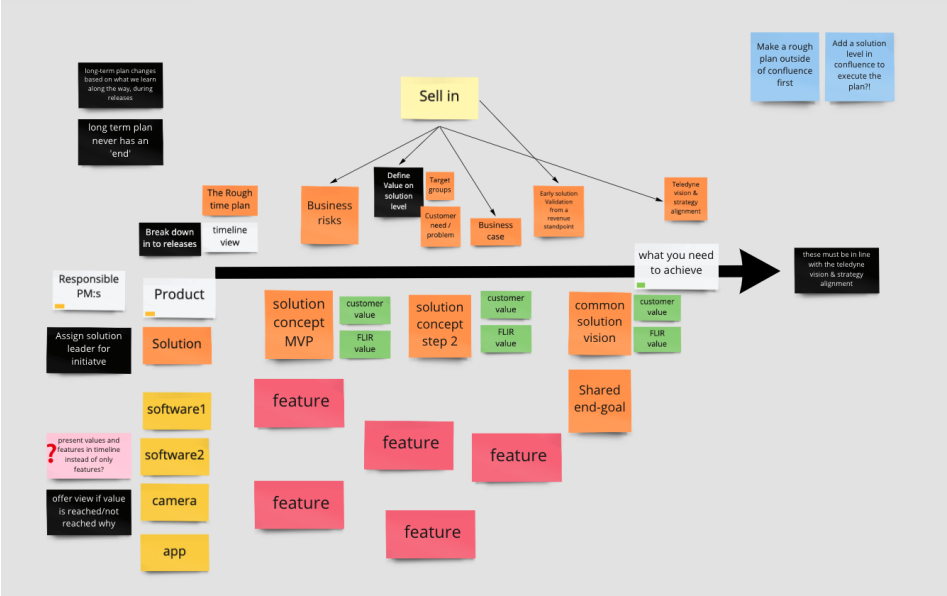


Fig. 25. Result from Co Design session with PMs

## G FURTHER PROTOTYPING SKETCHES

### G.1 Paper and Balsamiq

Starting from the co-design result, a number of sketches and prototypes were created that lead to the final prototype evaluated. These are as follows in chronological order here below. After the co-design session a number of whiteboard sketches and paper sketches were done. During these rough sketches and brainstorming an attempt was made at finding distinction in visualising the elements needed about user needs and the relation between the visualisation of solutions vs products. It was also brainstormed and visualised whether the tool was going to be one panel or multiple information panels. After the whiteboard session it was clear that all of the information was going to be visible on one big panel. Some of the most promising sketches were then translated over to Balsamiq (Figure 26 and Figure 27). . Where the first Balsamiq sketch showed on the side panels broader information, in the second Balsamiq sketch the side panels included more detailed information. However the focus in these seemed to be lost and the eye was not guided through the design. Another sketch was then done on Balsamiq attempting at centring the roadmapping element. This sketch can be found in Figure 26. In this sketch some post-it notes information is hidden due to confidentiality reasons. The rest of the information panels is analogous to the previous sketch, however now the risks are listed at the bottom and everything else to the left. This seemed like a good approach to then translate to Miro in order for the prototype to be usable and testable. This is also similar in construction to the co-design solution and includes all of the elements that are presented in there.

### G.2 Miro

The final prototype had to resemble a paper prototype that could be tested and the choice was made to do this using Miro. When doing paper prototyping when the user has to input information this is often done using simple tools such as post it notes and pens. In Miro this had to be simulated as well thus a number of options were explored in order to make sure that

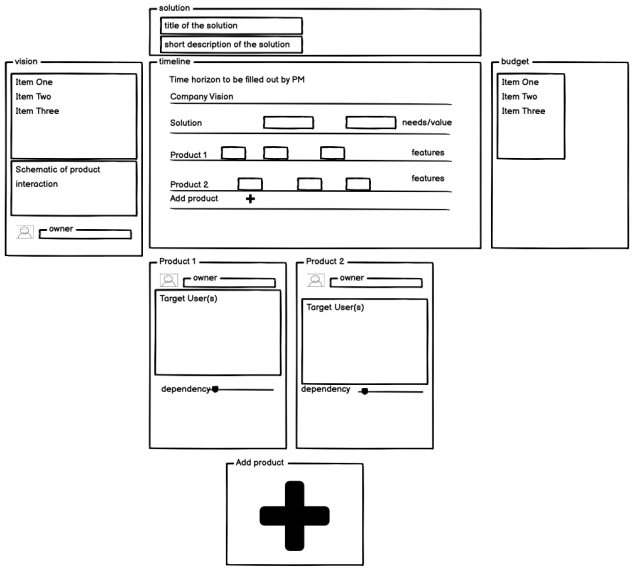


Fig. 26. Balsamiq Sketch 1

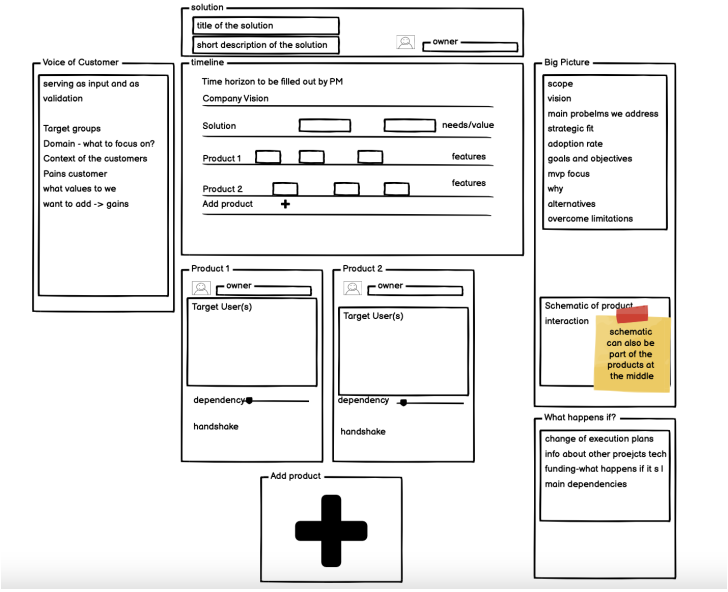


Fig. 27. Balsamiq Sketch 2

the interaction with Miro would be just as seamless and clear as using a physical paper prototype. A small brainstorm was done in order to lay out a number of information inputting options. This can be found in Figure 29. The option that felt

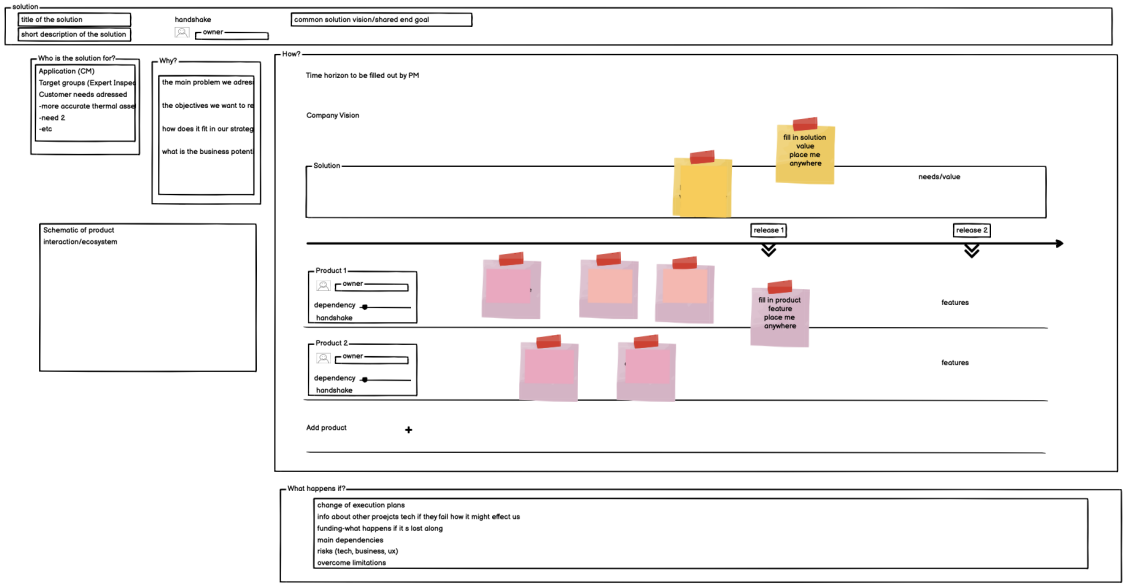


Fig. 28. Balsamiq Sketch 3

most resembling a real life situation was option 1, where the post its were already laying on the canvas, combined with the other two options where some information or hint was already written in the post it.

After this, the intermediate prototype was designed in Miro and this can be found in Figure 30. On the right side there is a toolbox that includes the post-its that can be transferred onto the main board and the little pencils inside the board also show that the data can be edited. This version was reviewed together with members of the design team that felt that the eye was still not drawn enough through the design and that the distinction between products and solution was not clear enough. Furthermore it felt that the information that had to be inputted was too structured, leaving not enough freedom for the PMs to input what they needed depending on the situation. After more adjustments the final version that can be found in the main report was generated.

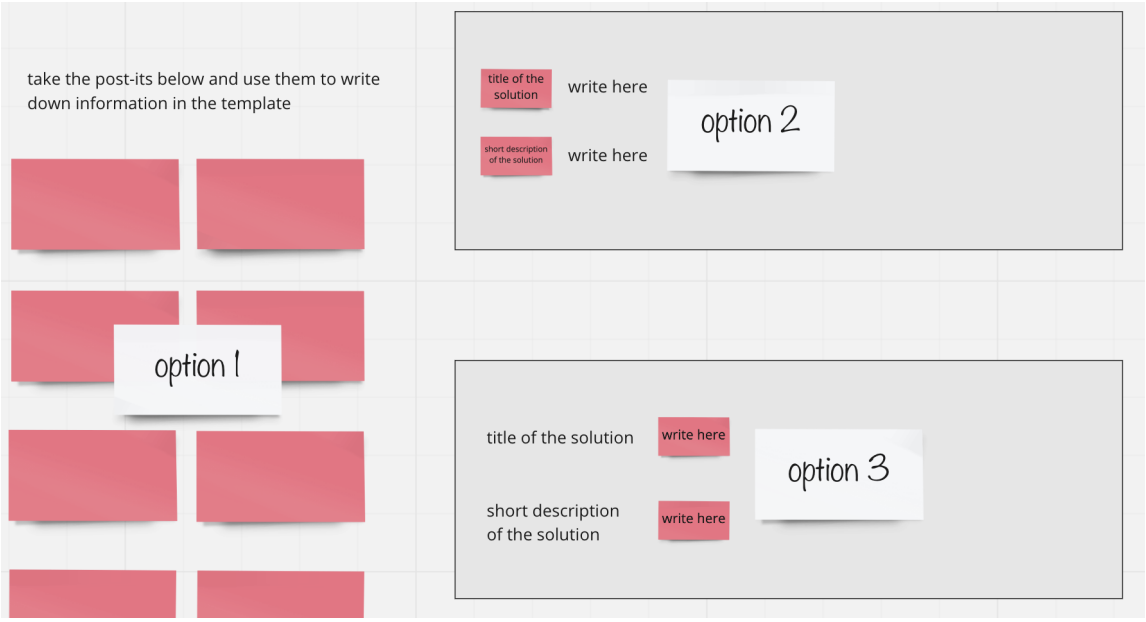


Fig. 29. Information input options

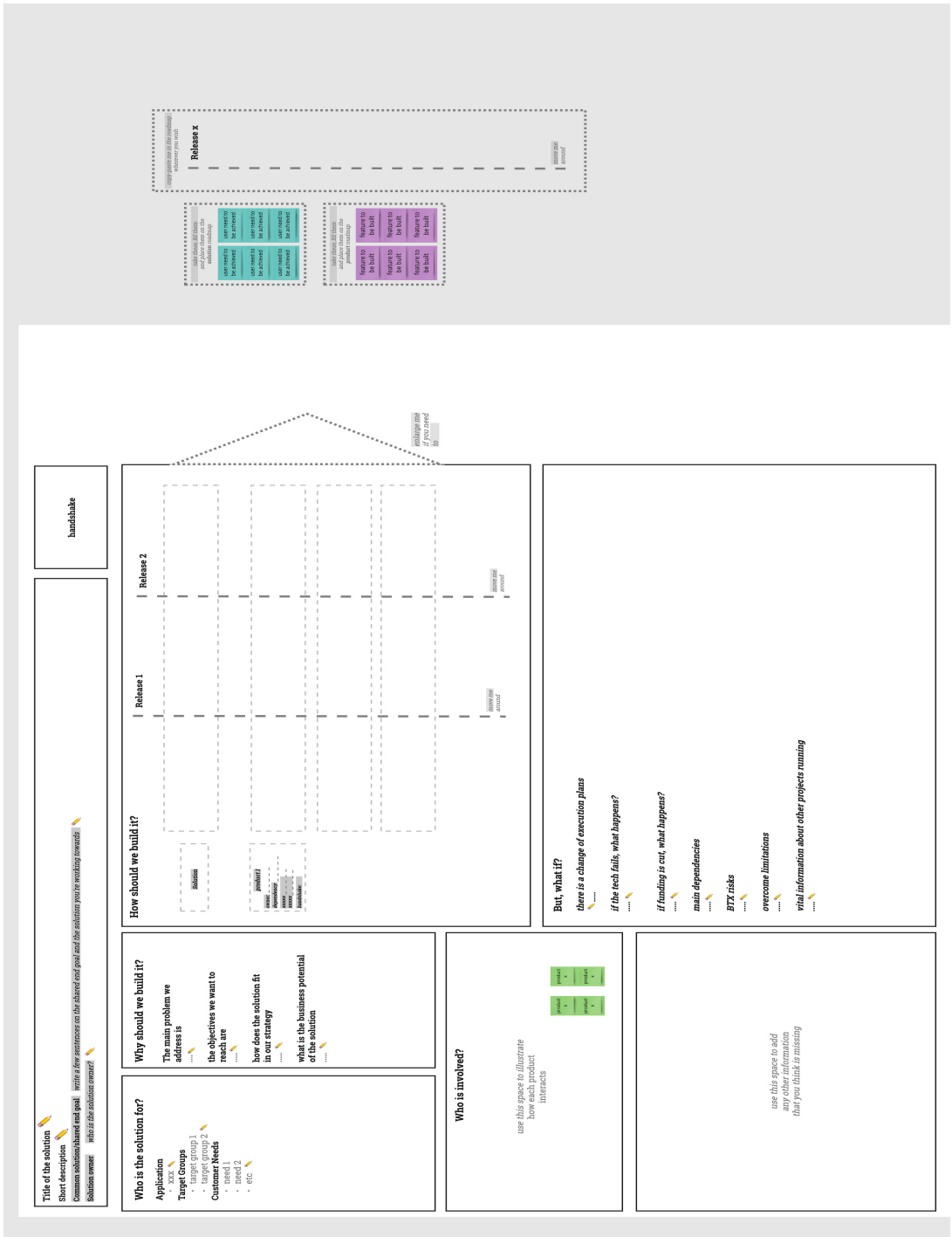


Fig. 30. Intermediate prototype transferred onto Miro