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Finding generic user needs of a non-professional LCA tool

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Abstract

There is a lack of knowledge about the end-users needs and goals of the non-professional LCA tool GaBi Envision. It is found that stakeholders visions and ideas about the tool does not match the reality. They wish to have a tool where the user can do quick calculations for product configuration, but they experience that users rarely use the tool and only use it for internal documentation. The purpose of the project is to apply qualitative UX research methods through the double-diamond process of design to define and identify generic user needs and problems across different industries and clearly communicate these to stakeholders and developers. Four semi-structured user interviews are conducted with four end-user from four different industries. The user interviews are transcribed and analysed through a Thematic Analysis. The results from the Thematic Analysis are used to identify the generic user needs. The findings are communicated through four individual Empathy Maps and three need cards representing the generic needs and relating problems. These are presented to one stakeholder and one developer. A mini-workshop is conducted to include stakeholders and developers in the process. The workshop includes ideas for solutions for each problem created in a brainstorm by the researcher. Each idea is discussed and ranked in a NUF test to evaluate the usefulness and feasibility of the ideas. Three generic user needs are identified: Access to background data, 2) Exporting key impacts and 3) Clear overview of used input fields. Generic user needs are defined as needs that exist with all four users. The results are successfully communicated.

Abstract in Danish

Der mangler viden om slutbrugerens behov og mål med det ikke-professionelle LCA-værktøj GaBi Envision. Det konstateres, at interessenters visioner og ideer om værktøjet ikke stemmer overens med virkeligheden. De ønsker at have et værktøj, hvor brugeren kan foretage hurtige beregninger til produkt konfiguration, men de oplever, at brugerne sjældent bruger værktøjet og kun bruger det til intern dokumentation. Formålet med projektet er at anvende kvalitative UX forskningsmetoder gennem double diamond processen for design til at definere og identificere generiske brugerbehov og problemer på tværs af forskellige industrier og klart kommunikere disse til interessenter og udviklere. Fire semistrukturerede brugerinterviews udføres med fire slutbruger fra fire forskellige industrier. Brugerinterviews transkriberes og analyseres ved hjælp af en tematisk analyse. Resultaterne fra den tematiske analyse bruges til at identificere de generiske brugerbehov. Resultaterne formidles gennem fire individuelle empatikort og tre behovskort, der repræsenterer de generiske behov og relaterede problemer. Disse præsenteres for en interessent og en udvikler. Der udføres en mini-workshop for at inkludere interessenter og udviklere i processen. Workshoppen indeholder ideer til løsninger til hvert problem, lavet i en brainstorm af forskeren. Hver ide diskuteres og rangeres i en NUF-test for at vurdere nytten og udførligheden af ideerne. Tre generiske brugerbehov er identificeret: 1) Adgang til baggrundsdata, 2) Eksportering af nøgletal og 3) Oversigt over anvendte input felter. Generiske brugerbehov defineres som behov, der findes hos alle fire brugere. Resultaterne er successfuldt videreformidlet.

Preface

This is a 10th semester thesis project in Engineering Psychology in Aalborg University, conducted in the period from February to August 2020.

I would like to thank the users who participated in this research project. I could not have done it without them. Also a big thank you to all stakeholders participating from Thinkstep, taking their time, listening and appreciating all the hard work I have done. Special thanks to my supervisor through this project, who have been very supportive in all the ups and downs, discussions, giving as his insightful advice and listening to all my ideas that never came to life. Finally a big thank you to my primary contact person at Thinkstep who rooted for me, gave me responsibility, helped start the whole thing and helped getting in contact with end-users.

Reading guide

The Harvard format is used for citations. Sources are cited in the report with [Surname, year]. Source that appear throughout the report are gathered in the back in a bibliography. Figures and tables appear in the report, these are numbered by chapter. This means that the first figure in Chapter 1 is called 1.1, the second is called 1.2 and so on. The same goes for tables. Under figures and tables there is caption text.

At the back, additional content is divided in an appendix and an annex. These are referred to throughout the report. Appendices are included in the report, while annexes are attached in the ZIP file.

Rikke L. Mortensen

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A Second Design Iteration

1.1 Envision Packaging Calculator

This study is a 2nd User Experience (UX) research iteration of the Life Cycle Assessment (LCA)[1] tool GaBi Envision (Envision) for non-LCA-professionals provided by Thinkstep.

Envision is used to calculate, compare and document environmental impacts of a product or material in different scenarios. Scenarios are calculated from data sets and the data inputted by the user in specific parameters. The available parameters depend on the data sets. There are many different Envision models built from these data sets. The models are built by Thinkstep consultants or users of the professional LCA tool. [Sphera, 2020] An example is the Envision model called Packaging Calculator, investigated in the 1st design iteration. This is a generic model used to compare different scenarios of packaging e.g. for a milk carton. For example the user could compare 3 different design scenarios of this milk carton. In this case the user will typically define the different raw materials that are used (data from the data sets), where the raw materials comes from in the world, how far the raw materials are transported to a production site, and how the packaging can be handled when the consumer throws it away. [Mortensen, 2020]

The user can input data for 2-4 different scenarios and calculate the environmental impacts.[2] 15 different impact categories are calculated and presented in graphs and tables for the user to assess and compare which scenario has better or worse environmental impacts in the different areas of the product's life cycle as illustrated in figure 1.1. Envision also generates a report with all input and output data that the user can use as documentation for further assessment. The results and the report are typically used in decision making processes, to making recommendations and for third party documentation. [Sphera, 2020]

1.2 The 1st design iteration

The 1st iteration is an internship project with an exploratory approach. The report is attached in annex 8.24. The primary interest of the study insights into the users of the Envision Packaging Calcula-

[1] LCA is a standardized comprehensive methodology used to assess environmental impacts and sustainability for a wide range of industries in product manufacturing and development and raw materials and services. [Curran, 2015]

[2] The most recognized environmental impact is the Carbon Footprint, also referred to as CO_2 Equivalent, Greenhouse Gas Emissions (GHG) and Global Warming Potential (GWP). [Curran, 2015]

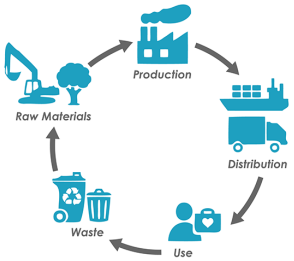

Figure 1.1: Typical areas in a products life cycle assessed in a LCA. [Sphera, 2020, Curran, 2015]

tor due to an increase in negative feedback from customers. A recap of the methods applied in the 1st iteration is presented in a time line figure 1.2.

The 1st iteration resulted in an interactive prototype of a redesign of all pages in the Packaging Calculator. The prototype was usability tested with three users, who had an overall positive attitude towards the proposed design. The test results showed a need for further UX research both regarding the Packaging Calculator and how the design would fit other Envision models. [3] The final results were presented to the stakeholders, who were also positive about the prototype and new user insights, but expressed an interest in having a generic design and understanding users from other industries using different Envision models than the Packaging Calculator. [Mortensen, 2020]

None of the proposed design ideas are implemented or under development post the 1st iteration, even though the design is also based on best design practices and the LCA methodology and does not necessarily relate to the Packaging Calculator users. Several reason for this are assumed:

- It is not possible to redesign all pages in the tool.
- If individual design elements were to be developed one at a time, it is not clear were one should start.
- Stakeholders and developers were not part of the decision making processes.
- The redesign is based on research from the packaging calculator user segment.

To scope the focus of the project and understand what is important, stakeholders are included in the preliminary phase of the project in a listening tour.[4] This is also ensures that goal of the project is framed to fit what is possible in practice. [Buley, 2013, Kumar, 2013, Farrell, 2017]

1.3 *Listening tour*

The desired outcome of the listening tour is to gain knowledge about the team working with Envision, and to find out what relating and relevant projects they are currently working on, if any. The goal is also to investigate possibilities for team collaboration, understand the stakeholders interests, the visions and goals for Envision and to gather information about relevant user segments, in order to be able to better plan the upcoming research. [Buley, 2013] The listening tour includes the following topics and questions:

- Team: What is your role in the organization, and how does it relate to Envision?
- Goals: What are your goals and objectives in your role? What are your top priorities?
- Success measures: How do you know if you are successful? How do you measure success?

[3] The interactive LoFi prototype is created in Adobe XD and can be found online **here**. *Note: The interactions are created specifically for the tasks in the usability test. It is possible to scroll trough the pages via the arrows at the bottom.*

Figure 1.2: Overview of the process and methods used in the 1st iteration. The process was not as linear as this timeline, as much of the research and prototyping processes was done in parallel.

[4] The listening tour is a lighter version of a stakeholder interview. [Buley, 2013]

- Users: How does your work impact customers? Who do you consider to be your primary customer? Can you describe them? What are their priorities and goals? Why do they use your product? What prevents them from using your product, if anything? What questions do you have about your users that you don't currently have answers to?
- Strategy: Who are your competitors, and how well are you doing compared to them? What do you do well? What could be improved? What differentiates your company and your products in the market?
- Key dates and milestones: Are there any specific project underway that you are involved in? What are your goals for this project? Do you see any risks or red flags?

In annex 8.27 all questions are listed with some supplementary ones as well. The listening tour is planned as an online meeting and three stakeholders are participating: Nordic Director, Research and Development (RnD) lead and Envision Product Owner (PO). One hour is allocated for the meeting.

Results

An overview of the stakeholders roles and responsibilities is presented in table 1.1. In the following a short discussion of the meeting structure is mentioned, followed by the main topics discussed in the meeting, which forms the basis of the proceeding project scope and design.

	Role	Responsibility
S1	RnD	All Thinkstep software tools DevOps and hosting Future development How to build software tools
S2	PO	Envision Product management Customers What to build Collecting requirements Road maps
S3	Nordic Director	Finding customers Sales

Table 1.1: Overview of stakeholders, their roles and responsibilities. S1's role is Research and Development (RnD) regarding all Thinkstep software. S2's role is Product Owner (PO) regarding Envision and S3's role is directing the Nordic customers and making sure to find new clients and sell the products.

Initially the meeting is planned as three individual one-on-one meetings and the questions are designed for this type of dialogue. The stakeholders did not recognize this, which meant they joined the same online meeting, and a group meeting is held instead, which resulted in not covering all questions prepared and the structure of the interview was slightly irregular, because the questions are not designed for discussion. In the field notes in annex 8.26, a full overview

of questions and answers can be found, as well as a list of questions that were not answered. Minutes from the interview can be found in appendix 8.1. After the meeting the Nordic Director (S3) pointed out that it was a good opportunity for the different team members to listen to each others perspectives and priorities, as they rarely have time for this in their regular schedule. This is taken into account when planning for future meetings. The following three paragraphs cover the main topics from the meeting.

Organizational changes

Currently, Thinkstep is undergoing organizational changes since being bought by Sphera, which affects the team and reduces possibilities for collaboration. There are no current projects regarding Envision.

Goals

All three stakeholders wish to improve the user experience, have a more intuitive user interface and a self-explanatory tool. They also agree on focusing on having a more informal tool which is easy to use and see this as one of the advantage for Envision. Another critical topic is the temporal performance level of the calculation.

Use of Envision

The stakeholders express that the main advantages of Envision are that the users can quickly and easily compare different scenarios. In relation to this, S2 states that the advantages for using Envision over competitors are that Envision is more flexible and configurable regarding the opportunities for comparing scenarios, but also expresses concern about user adoption, and why it is only used for internal reporting:

> S2: *"Other tools are very static, you get a report or a diagram. For Envision you can configure the calculation routines and calculate the impacts (...) I would like to understand what is missing and why they are not using it for product configuration"*

These findings express a lack of knowledge about how and why the users use the tool. It seems the stakeholders have a clear idea about what kind of tool they would like Envision to be: Informal, self-explanatory, user friendly, flexible, configurable, able to quickly compare scenarios and used for product comparison. But there seems to be problems related to these ideas e.g. long calculation times, user adoption, users only using the tool for internal reporting and that the configurability is done on behalf of Thinkstep consultants.

This knowledge sets the context and creates a basis for the scope and goal of the 2nd UX research iteration presented in the next chapter.

2
Project Scope

The project is conducted as a qualitative UX research project. The UX research methods applied, depend on the project and team, which means that attention must be focused on the setting, which requires a clear project scope to ensure the UX research is framed on the right problem [Norman, 2013]. When the scope and goal is defined, the process and methods can be chosen [Buley, 2013]. In the following sections a clear scope and goal is defined, after which the setting for the project is outlined in the delimination section.

The scope is to investigate users from different industries to see if they have generic needs, understand what these are and define them in such a way that they can be communicated more clearly to stakeholders and developers.

The goal is to find problems that are related to generic user needs, for the purpose of finding solutions that meet the users needs, that eventually can help improve the user experience.

2.1 Deliminations

The deliminations presented in the following paragraphs are based on the listening tour and the scope and goal. These will help guide the choice of research methods and form the project plan presented afterwards.

Team collaboration

It is clear from the listening tour that there is not, resources for a team collaboration. This is taken into account by planning research and activities that does not rely on stakeholders and developers participating. As such, the UX research is planned and conducted independently as a UX team of one.

Involving stakeholders and developers

The goal is to communicate user needs and problems to stakeholders and developers. The project plan must include the creation of content for this purpose.

Remote research

Users, stakeholders and developers are cross-located and it is not possible to conduct research on site. The project plan needs to be planned accordingly, which in most cases translates to online meetings and research.

Envision end-users

The user sample included in the research must be end-users, as these are the non-professional users. There are also professional Envision users, but as expressed in the listening tour, the stakeholders want a tool for non-professionals. Non-professional users are defined as users that have not used the professional LCA tool.

Users from different industries

The user sample must be from different industries, meaning working in different companies and not using the same Envision models.

Not continuing with the prototype

The prototype from the 1st iteration is not included in the 2nd iteration because it is based on research on how Envision packaging calculator users interact with the model, and not their needs. Further it is a complete design not illustrating which needs are generic and which are not. It is of interest to gather new insight and take a step back and identify individual problems relating to user needs, that can be solved one step at a time.

2.2 *Project plan*

The project is planned from the desired goal of finding generic user needs, identifying possible problems and communicating these to stakeholders and developers. It follows the double diamond model of design processes illustrated in figure 2.1, and includes the first two steps: Discover and Define and the middle step Brief. [Norman, 2013] The first part of the two diamonds is about finding the right problem and fulfilling user needs [Norman, 2013] by applying UX research methods [Cooper et al., 2014], that fit for the goal and setting of the study.

Discover, Define & Brief

The first phase in the double diamond in figure 2.1 is discovering and understanding the right problems. This includes the listening tour conducted in the previous chapter, section 1.3. The UX research method applied to collect data about the users' needs is user interviews. User interviews are good for capturing the user experience [Norman and Nielsen]. [Rosala, 2020] The 1st iteration focused on observing the users, that provided data about how they interacted with Envision, and did not provide data about what they needed, how they worked with the tool daily, what types of different tasks

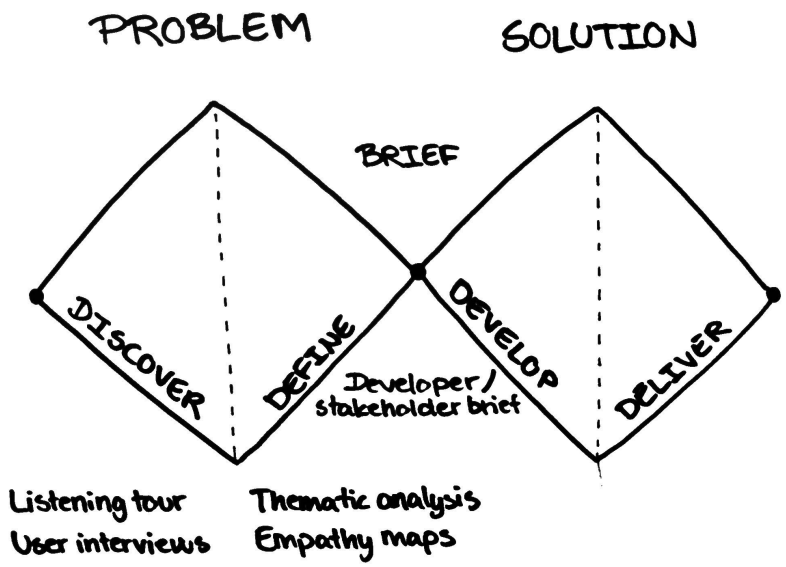

Figure 2.1: The double diamond model illustrating the phases and methods used in this project.

they needed to accomplish and what outside impacts had a factor of their use of Envision, which interviews can provide. [Cooper et al., 2014]

The second part of the first phase is to define needs and problems. [Norman, 2013]. This is done through Thematic Analysis. Thematic analysis is a framework that works well in combination with interviews to find themes in the data that eventually can help define the generic user needs and potential problems related to these. [Braun and Clarke, 2006]

After discovering and defining, a brief with stakeholders and developers is planned, to present the findings and ensure involvement in the process as stated in the project scope and goal. The structure of the brief is planned when the definition process is completed.

From the project plan the following is hypothesized:

> *Generic user needs and relating problems can be identified through user interviews and thematic analysis, and defined in such a way that they can be communicated clearly to stakeholders and developers.*

In relation to this it is of interest to define generic user needs by also defining what the term generic means in this context, thus the following two research questions:

- How can a generic need be defined?
- What are the generic needs?

The presented methods used for this UX research project are further defined as the project moves along and they are applied. The first chapter following from here, is User Interviews.

3
User Interviews

In this chapter it is described how the user interviews are planned, conducted, how the interview guide is created, users are recruited, the data is prepared for analysis and finally a section presenting the raw data with an overview of who participated. The interviews are analyzed through Thematic Analysis resented in chapter 4.

3.1 The interview method

Semi structured interviews are planned for the purpose of collecting data about the users that is more generic in relation to the use of Envision and the context and that allows the researcher to be exploratory leaving space for follow-up or detailed questions in interesting areas. The structure of the interview guide is framed according to the following itemize: [Kuniavsky et al., 2012]

- Introductory, opening questions
- Warm up questions
- General issues
- Deeper focus on the research topic
- Retrospective questions
- Wrap-up

Additionally follow-up questions are prepared, in case the user cannot answer e.g. "Can you elaborate that?" or "I want to make sure I understand this correct, can you tell me more?" [Pernice, 2018]

When conducting interviews there are biases the researcher pays attention to, both when preparing the interview guide and conducting the interviews. The questions in the interview guide should be open-ended and not yes/no questions, one question is asked at a time, focusing on one topic at a time. This is also kept in mind during the interviews, including making sure to listen to the user and avoid leading the user when interviewing and asking follow up questions. [Kuniavsky et al., 2012]

Before preparing the interview questions a research question is stated to guide the forming of the questions. This is based on the scope and goal of the project in the previous chapter, section 2.

> *How is Envision used across different industries and what are the users needs?*

The structure and the research question makes base for the interview guide presented in the following section.

Interview guide

In the following paragraphs the main topics of the interview guide that are of interest relating to the research question, goal and scope is summarized following the structure itemized above.

INTRODUCTORY, OPENING QUESTIONS are about the users, what they do, their education, daily work and how Envision is part of this. The users are asked to describe the last time they used Envision, like a story telling.

WARM UP QUESTIONS are more specific on how long they have used Envision, how often they use it, the typical use situation and the model they are using.

GENERAL ISSUES are questions about what value Envision gives the user, if there are any advantages or disadvantages, if the user feels safe using the tool, if they need help to use the tool, and what they do if they need help.

DEEPER FOCUS ON THE RESEARCH TOPIC contains questions about the users knowledge about LCA, how LCA is part of Envision, which results the users use and for what purposes, what they do with the results, if they use the report, and if there are any parts they can say they always or never use.

RETROSPECTIVE QUESTIONS are about the users experience with Envision, if there is something in the tool they could be without or distracting, if it could be improved, if they know about or have used other LCA tools and how Envision is compared to other tools.

WRAP-UP is one questions encouraging the user to add further comments they think the researcher should know.

The interview guide is prepared in both Danish and English version, as it is expected users are cross-located around Europe. First they are prepared in Danish and then translated to English. The English interview guide with all questions is included in appendix 8.2 and the Danish version is attached in annex 8.32.

Execution plan

The interviews are conducted online using Microsoft Teams and are audio recorded with OBS Studio. One hour is allocated for the interview. The full execution plan is included in appendix 8.3.

Summary of the execution plan:

- Meet and greet
- Start audio recorder
- Conduct interview
- Inform the user when the interview is coming to an end
- Wrap-up and thank the user
- Stop and check audio recording

Recruiting users

Convenience sampling is used for recruiting users, as recruitment and initial contact is done by the Nordic Director, at his request. The Nordic Director is instructed that the user sample has to be using other models than the packaging calculator and from different industries and preferably using different Envision models. Also it is emphasised that the users are end-users and a sample of at least five users is needed. The procedure is that The Nordic Director introduce the purpose of the project and the interview to the user. When initial contact is made and the user agrees to participate the Nordic Director forwards the e-mail conversation and contact information to the researcher, who then takes over the conversation. The researcher replies the user with a selection of time slots for the user to choose between for the interview. One hour is allocated. When a time slot is agreed upon the researcher creates a meeting invite in Microsoft Teams attached with the statement of consent, which the user is instructed to read, sign and send back with questions about the procedure before the interview takes place.

Statement of consent

A statement of consent is created and includes an introduction to the project, how the users data is used, and how it will help the research project, the form of the interview, that it will be audio recorded and the user will be anonymized and finally the date and signature to document the consent. The statement of consent is also prepared in both Danish and English can be found in annex 8.30. The consent must be signed by the interviewer and the user before the interview takes place.

Transcribing

For the purpose of the Thematic Analysis that is used to analyse the interview data, the audio recordings are transcribed according to the guideline of transcribing for Thematic Analysis. This means that all spoken language and sounds are transcribed and attention is paid to make punctuation when the speaker pauses to capture the context. [Braun and Clarke, 2006]

Translating

The interviews can be either Danish or English, if both languages are used, Danish interview transcripts will be translated to English, in consideration of the further analysis, easing the collaborative aspects with Thinkstep and easing the process of communicating results further down in the process. Translation is done in Google Translate by copy pasting paragraphs of text, reading the translation and correcting smaller sentences and words to ensure the content in the translated transcript is similar to the original.

Test of the interview guide

The interview guide is tested with a person with a communications degree for the purpose of testing the wording, asking open-ended questions and asking one question at a time. Also the interviewer practices reading questions out loud and asking follow up questions.

3.2 *Raw data*

5 users participated in the interviews. Participant 1 (P1) is discarded for three reasons. The first is that the audio file failed. The second is that P1 does not meet the requirements of being an end-user of Envision, but uses the professional LCA tool provided by Thinkstep. The third reason is that P1 is from the same industry and company as the second participant (P2), who is an Envision end-user. The other 4 participants meets all sample requirements.

For P2 the first half of the interview was conducted in Danish at the request of the participant, whereafter the participant switched to English for easier explanation. The remaining 3 interviews are all conducted in English. All interviews are transcribed and the participants names, names of colleagues, company names and product descriptions are anonymized. To ensure the participants anonymity it is necessary to anonymize company names and products as the Envision user group is quite small, and it would be easy to track back to the participants identity. The Danish part of P2's transcript is translated to English and both the Danish and English transcript can be found in annex 8.28 together with the transcripts from participant 3, 4 and 5 and the signed consents.

Overview of the 4 participants

To shortly introduce the users who participated in the interviews an overview of their roles, industry and Envision model they use is presented in table 3.1.

PARTICIPANT 2 (P2) is P1's colleague. P2 has a couple of colleagues who also use Envision. The company P2's is working at produce complete product and assess the whole product life cycle. The models that are used are developed internally in the company by P1 and are very specific for the company's products.

PARTICIPANT 3 (P3) is the only one using Envision, though some of P3's colleagues also have the tool installed. P3's company provides only raw materials, meaning they do not have any production. Envision is used to calculate impacts from these raw materials, and sometimes to include customers specifications about transportation to production sites or conversion processes. The model P3 is using is based on a standardized bio plastic model developed by Thinksteps consultant, but it has been through a fitting process and several modeled data sets are included. P3 took part in this process of fitting the

tool.

	User role	Industry	Envision model
P2	Assisting user	Product development	Customized models Customized internally in the company by P1
P3	Only user	Raw material provider	Customized model Took part in customization
P4	Only user	Single use products	Customized model Took part in customization
P5	Primary user	Raw material provider Product development	Customized model Took part in customization

Table 3.1: Overview of the participating users from user interviews. The data is from the introductory questions from the interviews where the users are asked to tell about their backgrounds and work areas.

PARTICIPANT 4 (P4) is also the only Envision user at P4's company, who mainly produces single use items, which means there is a lot of focus on end-of-life as well as raw materials from retail partners around the world. P4 also took part in fitting the Envision model, which is based on the Packaging Calculator.

PARTICIPANT 5 (P5) is the primary Envision user at P5's company. P5 has both professional LCA colleagues and has trained a sales team to use Envision, who attends to P5 for support. P5's company is both in providing raw materials and has product developments. Like P3 and P4, P5 took part in the process of fitting the model, which is based on the bio plastic tool.

Next the interview data is analyzed through Thematic Analysis for the purpose of finding generic user needs and problems related to these. The method and procedure of Thematic Analysis is presented in the next chapter.

4
Thematic Analysis

Thematic Analysis is the defining phase in the Double Diamond presented in figure 2.1, described in the project plan in chapter 2. The Thematic Analysis framework is used to analyse and structure the qualitative interview data into meaningful themes that are used to identify what the users need and potential problems related to these. Further the purpose is to identify generic needs that relate to problems that can be communicated to stakeholders and developers. Thematic analysis is a framework that follows a strict structure but has a lot of flexibility to it. Because of its flexibility it is necessary to consider which research approach to take before starting the analysis. [Braun and Clarke, 2006] First the phases of the analysis are explained, then the research approach of the analysis for this project is defined.

4.1 Six phases of a Thematic Analysis

Braun and Clarke [2006] defines a 6 phase approach that is applied in this project. In summary they consists of 1) familiarizing with the data, 2) coding all data in initial codes, 3) search for themes throughout these codes, 4) review the themes, 5) define and name the final themes and finally 6) present the data in a meaningful report. Throughout the whole process it is important the researcher make a research diary to take notes during each phase and writes down all thoughts and ideas.

Phase 1: The researcher familiarizes with the data that is analyzed by transcribing, reading, re-reading and taking notes of initial thoughts and ideas to understand what the data consists of.

Phase 2: The initial codes are made. All data is coded in interesting codes. Data can be coded in different codes, they can overlap, and codes can contain many different pieces of data fitting into that feature. Codes are named in longer sentences that captures the content of the data and the features. Nothing can be left un-coded.

PHASE 3: In this phase themes are created by searching through all the codes that have been created, analyzing, grouping and sorting them into potential themes. Analyzing consist of reviewing the codes to see if they fit together and if they fit in the same theme or if new themes should be created. The codes can be placed in more than one theme, as well as themes can be fitted into other themes, creating sub-themes. These themes are not final.

PHASE 4 has 2 levels. In level 1 each theme is reviewed independently to ensure the themes and their codes fit together. Also the hierarchy of potential sub-themes is reviewed. They are described and analyzed to see what is interesting about them and what story they tell about the data. This can be supported by making theme-maps and / or tables to get a clearer overview. In level 2 the themes are related to each other and the research question(s). This is also to make sure the themes do not overlap too much and they each tell their own story. After this phase the themes are final.

PHASE 5: All themes are further refined, clearly defined and given meaningful names.

PHASE 6: The final phase consist of telling the story of each theme in writing supported by statements from the data set.

4.2 Research approach

Three important topics are to be considered when starting a Thematic Analysis. The approach of creating themes (bottom-up or top-down), the level of analysis (latent or semantic) and the method of interpreting and reporting relationships between themes (realist or constructionist). [Braun and Clarke, 2006] The approach for this project is defined in the following.

THE APPROACH IS DONE BOTTOM-UP. This means that the themes are created from the interview data, and not theorized beforehand as in a top-down approach. This also means that the research question can be formed and modified during the analysis. [Braun and Clarke, 2006]

THE ANALYSIS IS DONE ON A SEMANTIC LEVEL. This means looking into the meaning of the data on a surface level, and not analysing for deeper underlying ideas that might be behind the users statements, as done in a latent analysis. [Braun and Clarke, 2006]

THE REPORTING METHOD IS REALISTIC meaning that what is reported from the themes are related to reality and relationships are assumed in a straightforward and simple way. Contrary to a constructionist method which examines objective and social meanings in the themes and their relationships. [Braun and Clarke, 2006]

Another important part of the thematic analysis is the questions guiding it, which includes the following three categories of qualitative questions: [Braun and Clarke, 2006]

1. The research question: *How is Envision used across different industries and what are the users needs?*
2. Interview questions, appendix 8.2[1]
3. Questions guiding the analysis

The questions guiding the analysis are presented in the next section where the procedure of how the Thematic Analysis is done in this project is explained.

[1] The research question and interview questions are defined in the User Interviews in chapter 3

4.3 Procedure

The analysis is conducted in Nvivo, an analytical tool used to collect and code different kinds of qualitative data, and also recommended for Thematic Analysis [Nvivo, 2020]. All data files, codes, themes and memos are collected and created in Nvivo. These files are attached in annex 8.46. Mind maps and theme maps that are created during the analysis are made on paper until the themes are final, and then made in Adobe XD.

The questions guiding the analysis stems from the research question and the interview questions. They illustrate the researchers interest, thoughts and ideas and are used as a guidance for analysing the data, to guide what to look for. They are itemized in the following.

- Who are the users? What differences and similarities are there between them?
- For what purposes do the user use Envision? How is it typically used, how did they use it the last time?
- What are the users' experiences with Envision and LCA?
- What impact does Envision have in their daily work? What value does it bring?
- What are the users needs and goals?
- Which needs and goals are more generic and which are more individual?
- Are the needs being met in the tool, or are there any problems related to them?

In the following sections the procedure of phase 1-6 is described. Additional notes taken during the analysis are included in appendix 8.4.

Phase 1

Familiarizing with the data is done by conducting the interviews, listening to audio files while transcribing them, read through transcript to correct misreadings and anonymizing, read through the transcripts and note down individual codes to get a feeling of the content in each transcript and between the participants. These codes

are not used further on. The researcher feels confident about the familiarizing phase and moves forward to phase 2.

Phase 2

Generating the initial codes is done by starting coding the transcript for P2 followed by P3, P4 and P5. All codes are created on the basis of the data. All statements from the participants are coded. The codes that are made are coded by taking most of the surrounding context to be able to understand the code when it is revisited. Many similar codes are created, but it is better to produce all codes necessary, than restricting in this phase. The codes are refined in the following phases.

In this phase attention is paid to the amount of time spent, as coding can go on for quite some time, and it is reasonable to set a limited time schedule [Braun and Clarke, 2006]. P2 is the shortest transcript, and took two hours to code. A maximum of four hours is allocated to code for each of the remaining three transcripts.

Phase 3

All codes are sorted in potential themes. In this phase attention is paid to not restrict anything yet, as the themes are reviewed in the next phase. Some codes are placed several different themes, some themes have sub-themes, some of them are very meaningful, while others are not. Several themes are created based on knowing that several other codes would fit into that theme. Some themes are more general than others and contain several sub-themes. To themes that seem too general are for example "advantages" and "disadvantages", the content is very mixed and does not relate to any specific needs or problems, but in this phase they do not fit into any of the other themes created. In total 37 themes are created. These they are exported to an Microsoft Excel file, attached in annex 8.48 (column A).

Phase 4

In level 1 of phase 4 the content in each theme is reviewed to see if the codes and themes fit together. Some themes are merged together, others are deleted and the codes are sorted into other themes, resulting in a total of 20 themes. This process is documented and commented in column B and C in the excel sheet for phase 3 in annex 8.48. To get a better view of what the content is in each of these 20 themes, mind maps are created. This resulted in merging two themes, resulting in 18 mind maps. These are included in annex 8.49.

In level 2 of phase 4 the 18 themes and mind maps are reviewed again to see if the codes in each theme still fit, and also start describing the content of each of them. This is done in parallel with theme mapping. Three themes maps are created and are illustrated in figure 4.1.

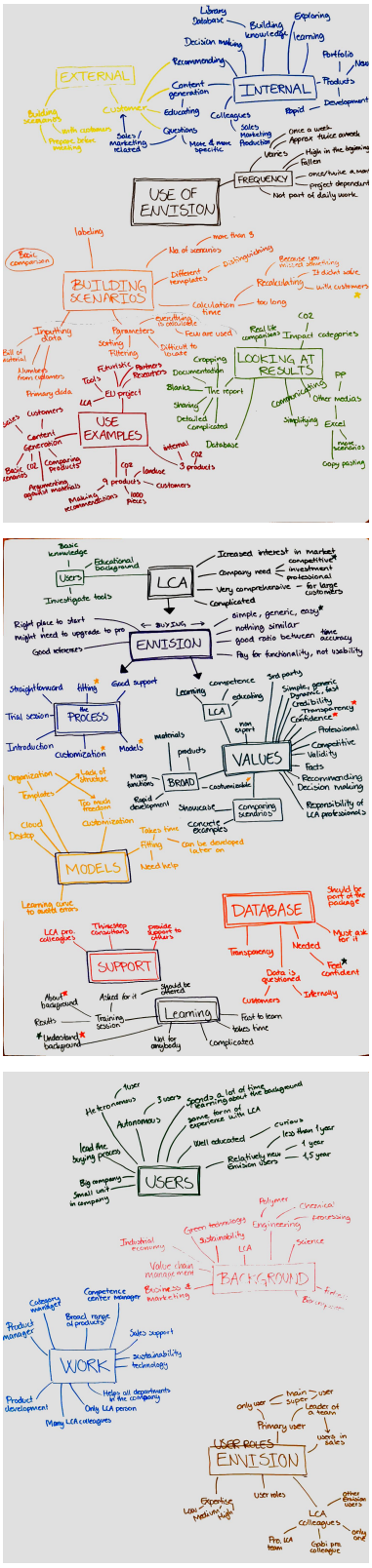

Figure 4.1: Three theme maps created in level 2 of phase 4 in the Thematic analysis. The figures are included in annex 8.50.

Phase 5 & 6

Phase 5 and 6 are conducted in parallel and includes the final step of refining, naming, describing, show casing and reporting the final themes together with data points that represents the theme. In the following section the final themes are briefly presented.

Three main themes are created. These are: USERS, LCA and ENVISION. The content in the themes differentiate in their relation to Envision. USERS contains information about who the users are in relation to the work they are doing, their education, experience with sustainability and LCA. LCA is about why the users are using Envision, what value it gives them, aspects of buying and learning to use the tool and getting help and support. ENVISION is the largest theme about all different aspects of interacting with Envision. This is how the data results are used, getting internal and external inquiries, work related and personal interest in using Envision, building knowledge, inputting data, using the output data and the results from the report.

All main themes and their sub-themes are described in detail in appendix 8.5 together with their theme maps. There is a difference in how the main-themes are presented because they differ in size and content as described above. USERS, appendix 8.5, have 4 sub-themes and LCA, appendix 8.8, have six sub-themes. These sub-themes are quite related, thus some of them are grouped and described together. ENVISION has 12 sub-themes. It is necessary to describe each of these individually and keep them separated to give each of them equal attention and make clear distinction between them. Each sub-theme in ENVISION follows the structure described in the introduction to the theme, appendix 8.14.

Seven of the 12 sub-themes in ENVISION are included in appendix. The remaining five sub-themes are included in the main report because they are primary support for and directly relate to the generic user needs identified and represented in the following chapter 5. These are DATA SOURCE, section 5.2, EXPORTING, section 5.3, COMMUNICATING RESULTS, section 5.3, DATA INPUT, section 5.4 and THE REPORT, section 5.4. Several of the remaining themes, that are included in appendix, relate to the generic needs as well, and these are referred to a long the way, as each need is described.

5
Generic User Needs

Before presenting the generic needs it is necessary to describe how generic needs are defined and how they distinguish from the problems that are related to them and the themes they are based on, although they are all still related and overlaps are unavoidable. This chapter answers the two research questions from the project plan, section 2:

- How can a generic need be defined?
- What are the generic needs?

First the definition of needs is presented and then the generic needs identified.

5.1 Defining generic needs

It has been identified in the Thematic Analysis that some needs exists among all four users participating in the user interviews. These are defined as generic needs. These generic needs represents an overall need, that stems from needs equivalent to that and is present with all four users, or other individual needs relating to the generic need.

The problems that are identified in the Thematic Analysis are findings that relate directly with the generic needs and something that is expressed by the users that they would like to be easier to do or is causing problems for them.

Themes can contain both needs and problems and other topics. Themes are used to support the relevance of the needs and problems identified. A generic need can be compared to a main theme: It has a primary need and contains secondary needs that relate back to the main need.

Based on the Thematic Analysis three generic needs causing problems for the user are identified. The three generic needs are: 1) ACCESS TO BACKGROUND DATA section 5.2, 2) EXPORTING KEY IMPACTS section 5.3 and 3) CLEAR OVERVIEW OF USED INPUT FIELDS 5.4. These are presented in the following sections. Each generic need is presented with primary themes and a section explaining the needs with references to other relating themes. The themes primarily supporting the needs are included in text boxes, while other relating themes are included in appendix and referenced continuously.

5.2 *Generic need 1: Access to background data*

This need is primarily supported by the sub-theme DATA SOURCE. The description of this theme is taken out from results section of the Thematic Analysis in appendix 8.14 and presented in the following.[1]

[1] DATA SOURCE is a sub-theme to the main theme ENVISION described in appendix 8.14 created in the Thematic Analysis in chapter 4.3.

Needs

All four users need the background data, for different reasons. P2 needs to answer questions from others about where the data is coming from and appreciates transparency. P3 needs to distinguish between primary and modeled data sets. P3 was part of fitting the model and is aware that some of the modeled data sets were created because none existed that matched their needs. P3 compares the data with literature and other research which is related to one of P3's use scenarios in the sub-theme USE SCENARIOS, appendix 8.21, which is discussing tools and data with other researchers. P4 also has primary and modeled data sets and needs to link where data is coming from. P5 needs to feel secure and confident towards customers and prove that the numbers and results are relevant for the company. P3, P4 and P5 primarily express the need for their modeled data sets. P4 and P5 were also part of building their Envision models, which is described in the sub-theme CUSTOMIZING, section 8.11, and in sub-theme VALUES OF ENVISION. They express that the data is a key part Envision and one of the reason for why they use it.

Problems

The problems are related to the fact that the data is not easy to find, the users are missing links for the modeled data, such as the primary data linked in the report, they have to ask for the modeled data sets each time they need them, and the terminology is inconsistent between the naming in Envision and in the data sets.

Primay theme relating to need 1: Data Source

SUMMARY

This theme is about the users data sources in their Envision models and needing to know where their data is coming from. P2 talks about the database that is behind the numbers and uses bill of material for the products and then defines where the materials are coming from e.g. completely raw materials. P3 talks about having primary and modeled data sets, and having multiple raw material, end of life and conversion data sets in which they play with different combinations and making scenarios. P3 also request and input data from customers because they are only raw material manufacturers, for example about what kind of conversion the customer does, and uses this knowledge when building the scenarios and to aid customer communications. P4 refers to generic data sets and individual data sets, which is assumed to be equivalent to P3 referring to primary data sets and modeled data sets respectively. P4 only has the generic data set links in the reports, not the individual ones.

FINDINGS

All users would like more transparency about where their numbers and results are coming from. For P3 it is about being critical about the results and documenting whether the data is primary or modeled, because the modeled data is more uncertain. For P2 it is about being able to answer questions from others who asks where the numbers are coming from. P4 states that they always links to the data sets the results are coming from, but have to ask Thinkstep for the individuals ones, as they are not provided automatically like the generic ones. For P5 having the data sets is about feeling secure and confident towards the customers and being able to say that it is relevant for their products because the data sets are generic.

DATA POINTS

P2 *"a bit more transparency about the database, the numbers that lie behind the results, that would be nice, because it's always something that is asked from my clients, 'what kind of database?', 'where is it coming from?' and of course that's really the key part of it. (...) You have to click a bit in the columns to see where its coming from"*

P3 *"there were no existing data sets found, so there was some modeling done and sometimes it's not easy to say if it's correct or equivalent to what is happening in the real life (Thinkstep) asked us like what-if scenarios or best estimations. When we compare to literature or interesting knowledge, we acknowledge that's it's not always quite right. (...) there's a risk that you take out report and consider it to be absolutely right and sometimes there's a chance that it is not."*

P4 *"in the report we always have the link of the data sets that we refer to, and for the individual data sets that Thinkstep created for us, I could think of that these links are also included there. Because it's only the generic dataset that are included in the reports but not the ones that are created specifically for us, and for that, I need to ask every time if I want to know in a bit more detail."*

P5 *"I was starting to feel a bit uncertain about the data that was the background for the results and I wanted to feel more secure, so that I could be confident towards the customers, and saying that this data is reliable, and more important it is relevant to what we are doing here. Because it is kind of generic data, so it is important that we also are looking at it and say, is this a match to what we are actually doing."*

5.3 *Generic need 2: Exporting key impacts*

This need is primarily supported by the two sub-themes EXPORTING and COMMUNICATING RESULTS. The descriptions of these themes are taken out from results section of the Thematic Analysis in appendix 8.14 and presented in the following.[2]

[2] Both themes are sub-themes to the main theme ENVISION, described in appendix 8.14 created in the Thematic Analysis in chapter 4.3.

Needs

All four users need to export data and key impact categories, for different reasons. In Envision, the user is presented for all impact categories when they calculate, but all four users needs to focus on key environmental impacts, which is primarily Carbon Footprint identified in the theme IMPACT CATEGORIES, described in appendix 8.18, and other key impacts due to internal interest or customer needs. Relating to exporting key impacts is that P2 needs to visualize results in a nicer way with graphs, and P4 needs to add images and real life comparisons, and both P4 and P5 need to add explanations to communicate the results to others. Besides this, P4 and P5 also need to compare more scenarios than available in Envision as identified in the theme SCENARIOS, in appendix 8.19, and also need to create downloadable content for their companies websites as described in the theme EXPORTING.

Problems

Users have many different reasons for exporting, but it is found that exporting, is not an easy task as there is no functionality directly for this purpose. The users mention that they have to sort through all the lines and blanks, and they would like a more integrated experience. P2 has made a macro to help export into Microsoft Excel and P3 suggest the possibility of exporting .csv files.

Primary theme relating to need 2: Exporting

SUMMARY

All users export their data to something else. Both for personal and external use. One reason for exporting that count for all users is for communicating results, as seen in the previous sub-theme, the users typically need to simplify and add content (images, real life comparisons, company style, graphs) and making more simple and easy explanations. Another reason is to compare more scenarios than the available in Envision. This is mentioned by P3 and P4. For example P4 has a personal excel file for fast mapping out results and comparing 9 different products. The third reason for exporting is to create personal knowledge bases and libraries for back tracking and looking up products and materials. A fourth reason is to get a clearer overview and representation of data and avoid making errors. Regarding this P3 also mentions that it can be hard to back to old reports because of the many numbers. This might also support the need for exporting.

FINDINGS

All users exports their data, P2, P3 and P4 to excel and P5 to power point, while also P4 and P5 implements their numbers in online content. two users mentioned it would be nice if it was easier to export the data. The reason for this are that they struggle with all the empty fields they have to sort out and the data they don't need. Further it is not a possibility to export files for excel or .csv files. It makes the job hard for them. P2 has also made this macro in excel to make it easier and faster to export. Being able to export relevant numbers in an easy way is a key part for four users.

DATA POINTS

P2 *"we take the results and copy into in excel and make graphs. I'm taking the last row, which is global warming potential and copy into excel and afterwards just a slightly nicer way of ranking numbers. (...) I wasn't happy with the way data came out when looking at results. (...) And it would be best if it was in a very user-friendly way that it would sort the empty fields for example so it is just one step on Ctrl C and Ctrl V into excel and that it is all at once, what is relevant."*

P3 *"it's quite hard work (to export data) because Envision creates this grid text format or word files and there are a lot of separate tables and I have to go through them. (...) would be nice if you can somehow select the features more precisely. (...) Possibility to have excel or csv. file format or similar for output impact data"*

Primary theme relating to need 2: Communicating Results

SUMMARY

This theme is about how the results are communicated to others when the users get questions and inquiries, mainly outside the company. All users primarily emphasize on Carbon footprint, in some cases they use other impacts, but mostly for the purpose of their own assessment, not for the purpose of communicating with others and only if the client is interested in other impacts. In most cases the users takes out their numbers from Envision and puts them in other medias with similar contexts that are easier to understand, together with easy explanations why the numbers looks like they do. This is for example done in Excel (all four users), Power Point presentations (P5) and online content (P4 and P5). The users mentions that they like to make graphs (P2), add company style and logo's (P3), compare with illustrations and real life scenarios (P4) and have executive summaries (P5).

FINDINGS

The reason for only focusing on Carbon footprint is because that this is the most recognized and understood in public. It is because that it needs to be easy to understand, and the users experience that everyone understands Carbon footprint and sustainability. The users statements about this topic is that they are not happy about the way data is presented in Envision (P2), they only need e.g. one out of 16 impacts (P4) and others don't understand the full scope of the LCA (P3). For all users applies that they want to make easy explanations.

DATA POINTS

P3 *"sometimes we edit because the report format its quite long, (...) so we might take only some crops or some tables from there, it depends on the level of knowledge of the partner we are discussing with, (...) on what they want to know or what is the level of understanding"*

P4 *"real life comparisons that are in the report e.g. with the car or how long you can charge your laptop, that is normally when it clicks at the customers"*

P4 *"it needs an easier way e.g. product comparison, where you have four different (products) and a picture of it, because the customer knows, 'okay this is product we buy, cool', also for the sales. And then you can for example in a PP presentation, put the numbers next to it, explaining why and how it is like that."*

P4 *"We have an online shop, and there we have included some of the numbers, in order to make it visible and easy to understand also for the sales, and for the customers"*

P5 *"I think often we just try to make it very simple. Basically draw a direct correlation between the CO2 emissions and the sustainability. Everyone understands sustainability and they understand often CO2 emissions, so those are things that we kind of highlight and we often remove from the report in order to put it in a simplified context."*

5.4 Generic need 3: Overview of used input fields

This need primarily comes from the two themes DATA INPUT and THE REPORT. The themes are included in text boxes in the next pages.

Needs

Three of the four users directly express the importance of having a clear overview of the data they have inputted and alternated. The users have many parameters available but rarely use them all. Sometimes they need to return to old calculations and reports, and need to know which numbers they have inputted. The reason that this need is related to the theme THE REPORT is that the report includes all parameters even though the user have not used the parameters when they inputtet their data. In the input sections P3 typically only need two of the three available product parts, sometimes only one. P4 doesn't need packaging and filling. P5 needs to see which parameters are relevant when switching between templates. It is also seen in the theme USE SCENARIOS, appendix 8.21, that all users have different scenarios for assessing. Sometimes they assess only a material, which means they need less parameters, and other times they assess more complex scenarios e.g. a product with two product parts.

Problems

For P5 it is a source of error not to be able to clearly see which inputs are relevant. Also P5 complains about all the blanks in the report, and that, for quick assessments it is not convenient to go through all lines. The users express that they use the report when they look at their numbers, but that the report is filled with blanks. P3 would like to hide the features that are not needed, so that it is easier to the reports check later. This theme may also relate to the theme EXPORTING related to the need of exporting in the previous section. The reason for this relationship is that the reason for exporting data may be because the users do not have a a clear overview of the data that are of primary interest directly in the tool. But as explained in the need, exporting is also done for other reasons.

Primary theme relating to need 3: Data Input

SUMMARY

As mentioned in the previous sub-theme the users have more parameters available than they often need for example P3 can input three product parts per scenario but only needs 2. There is also a parameters section called packaging and filling which P4 mentions not using. P5 mentions struggling with switching between templates. It differs which parameters are relevant depending on which template is used, but this is not signified. There is also a difference in what kind of assessment the user is making. For example P5 mentions two cases. One case is basic scenarios with only raw material input parameters, while another case is more comprehensive where transportation, raw materials and end-of-life is compared. P4 also mentions both types of cases, which means that it differs which parameters the users needs. P2 also mentions both cases, explaining that Envision is both used as a library to calculate CO2 on a single material, and also for more complex products assessing and comparing hot spots.

FINDINGS

P3, P4 and P5 are struggling with the amount of input fields, both because it varies which input fields they need, and the relevant ones also varies depending on which template they use. P2 does not mention anything about struggling with input parameters but has also mentioned that the GaBi pro colleague made a huge work to make a specific model which is very complete in terms of that company's products and it makes it very easy for P2 in terms of doing a quick calculation, relating to only having the most necessary parameters available, which on the other means that P2 has less freedom than the other users.

DATA POINTS

P3 *"we are a raw material manufacturer, so sometimes or rarely we use some (of the) dataset options and you can build the scenario from multiple dead product parts and sometimes we use just one product part. That's enough for our recipe."*

P3 *"sometimes you have to build a more complicated product and sometimes you don't, (...) the inputs are always still following you even though you don't use them, so sometimes it's confusing if you go back to an old report and check the numbers"*

P5 *"when we are inputting information, it's a lot of blank stuff to sort through"*

P5 *"you can do more changes than we often need to and I think that leads to also a bit more source of error sometimes."*

Primary theme relating to need 3: The Report

SUMMARY

This theme is about the report that is provided in Envision and how it is used. P2 does not have access to a report only tables with the results, but shows interest in the advantages of having one that could be configured beforehand with the desired numbers and graphs and easily provided with a press on a button. P3 and P4 have the report but it is never shared and is only for personal use. P3 mentions that it is not send unless it is totally necessary and if that is the case it is only discussed face to face. P5 uses the report approximately half of the time and mainly use it attached with other medias as documentation and states that they try to use it when possible but it is quite detailed.

FINDINGS

As described in the themes COMMUNICATING RESULTS and EXPORTING included in the previous theme about exporting, section 5.3, numbers, crops and tables are taken out of the report. One of the reasons for this is related to the report presenting all parameters, all three product parts, all 16 impact categories, even though the user might only use two products parts and 1 impact category. P3 states that the report is quite long, only share significant impacts e.g. CO_2, primary energy use and water, takes out crops and tables, only need two of three product parts and wants to hide unused features. P4 also states that it is too complicated for customers.

DATA POINTS

P3 *"it would be nice to have a possibility so you can hide the features you don't need, so that they don't appear in the report (...) then its more clear to check it out later, (...) there are numbers they don't make any meaning there."*

P5 *"it would be valuable to be actually able to generate specific parts of the report only (...) having all of the blank information in the report is really annoying"*

Next steps

After defining these generic needs the first phase of the double diamond is completed, illustrated in figure 2.1 chapter 2. The next task is to brief stakeholders and start thinking about solutions together with developers.

6
Stakeholder & Developer Meeting

A brief is planned with Envision developers and stakeholders. The overall purpose is to clearly communicate the generic needs as stated in the project plan chapter 2.

To communicate this it is necessary to create understanding of the users and their needs and which problems exist relating to these needs. It is important that the stakeholders and developers understand that the problems stems from the users. If the problems are presented without context the developers might easier discard them, ask questions about who states that these are actually problems and ask question about the underlying data. Thus it is decided that a meeting is planned as part of the brief to 1) create empathy and understanding of the users and their needs and 2) present the three generic needs, defining the problems related to these and presenting findings and statements supporting them.

The project follows the Double Diamond presented in figure 2.1, chapter 2. The first phases of discovering and defining are completed through the User Interviews, Thematic Analysis and defining the generic user needs. The next phase is to start developing solutions. Another purpose of this project is also to include stakeholders and developers more and be able to solve individual problems in the tool. Therefore it is desired that the brief also help prepare for the next phase of developing by dicussing ideas that could help solve the problems presented.

Combined the goal of the brief is thus: 1) EMPATHIZE WITH THE USER, 2) PRESENT GENERIC NEEDS AND PROBLEMS, and 3) DISCUSS IDEAS ON HOW PROBLEMS COULD BE SOLVED. From this a sequence of activities to achieve this goal is developed. [Kaplan, 2020b]

Before planning it is necessary to outline the settings according to time frame, participants and location as these factors affect the choice of method and procedure. 1 hour is allocated for the brief. The participants are cross-located and the brief is planned accordingly. The Envision Product Owner participates and is responsible for inviting the relevant developers. Experiences from the stakeholder interview are that even though the importance of participating is made clear to those invited, it is still uncertain how many will participate. This means that the number of participants can be from one to five participants.

6.1 *Empathy Maps*

To meet the first goal it is decided to use Empathy maps. The Empathy maps are used to increase the stakeholders understanding and knowledge about their end-users.

Individual empathy maps are created. An empathy map captures subjects about the user, what the user says, thinks, does and feels, as illustrated in figures 6.1. Empathy maps are a great tool for the purpose of communicating the users, creating empathy, presenting key findings and user needs. They have the advantage that they can easily be developed, new findings can be added and they can be compared and collected to support the creation of aggregated empathy maps or qualitative personas representing whole user groups when enough data is collected. Finally they can be created individually meaning containing only one user. [Gibbons, 2019]

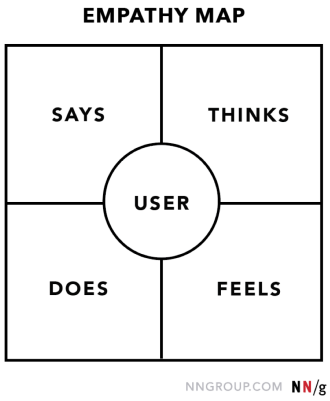

Figure 6.1: Empathy map example of typical categories included [Gibbons, 2019]

Individual Empathy maps

The process of creating empathy maps is to define the scope, goal and purpose. [Gibbons, 2019] The scope is to create 4 individual user maps, the goal is to communicate their needs and the purpose is presenting them to stakeholders and developers. The process of making the empathy maps is itemized as follows:

- Make a paper draft where data can be inputtet in empathy map categories[1]
- Start reading through transcript for P2
- Ask guiding questions from templates when reading through the transcriptions [Gray, 2017, Gibbons, 2019]
- Take out and input all relevant statements and findings in the template with minimum filtering
- Refine the paper draft[2] by going trough each category and input data to Adobe XD Empathy map template
- Scope the categories around the final content
- The same procedure for P3, P4 and P5, minus the paper template.

[1] The categories used in the paper prototype are from the Gamestorming template [Gray, 2017]

[2] The paper draft for P2 is included in appendix in figure 8.4

The final categories used in the maps are who & need, which is content about the user. who describes the users educational background, their user role in relation to others, experiences with sustainability and how they came to use Envision. need describes what they need to use Envision for in their work, what kinds of tasks they need to fulfill. thinks & feels, that contains data about what motivates the user to act and use Envision, what they value and what problems they encounter, and how that makes them feel. sees, hears & says, where sees & hears is about what they see and hear in their surroundings, from colleagues, customers and in the market. says contains statements that support the process of emphasizing with the users and represents concrete examples as explained by the users of what they experience when using Envision. does is concrete examples of how they use and interact with the tool. [Gray,

2017, Gibbons, 2019].

The final complete empathy maps can be found in appendix 8.22. They are processed in a second iteration for the purpose of scoping them down to the content that supports the generic needs to reduce the content that is presented in the meeting. The compressed versions are presented in figure 6.3 for P2, figure 6.4 for P3, figure 6.5 for P4 and figure 6.6 for P5.

6.2 *Need cards*

To meet the second goal of presenting the generic needs and problems a card for each need is created based on the generic needs presented in chapter 5. The cards contains a headline, a summary explaining what the need is about, findings presenting the problems related to the need and a section of data points from the users to support the needs. [Krause, 2020] The cards are presented in figure 6.2, 6.7 and 6.8.

Figure 6.2: Need card summarizing the generic need ACCESS TO BACKGROUND DATA described in section 5.2.

Figure 6.3: Compressed version of the empathy map for P2. The complete map can be found online following this **link** or in appendix 8.22.

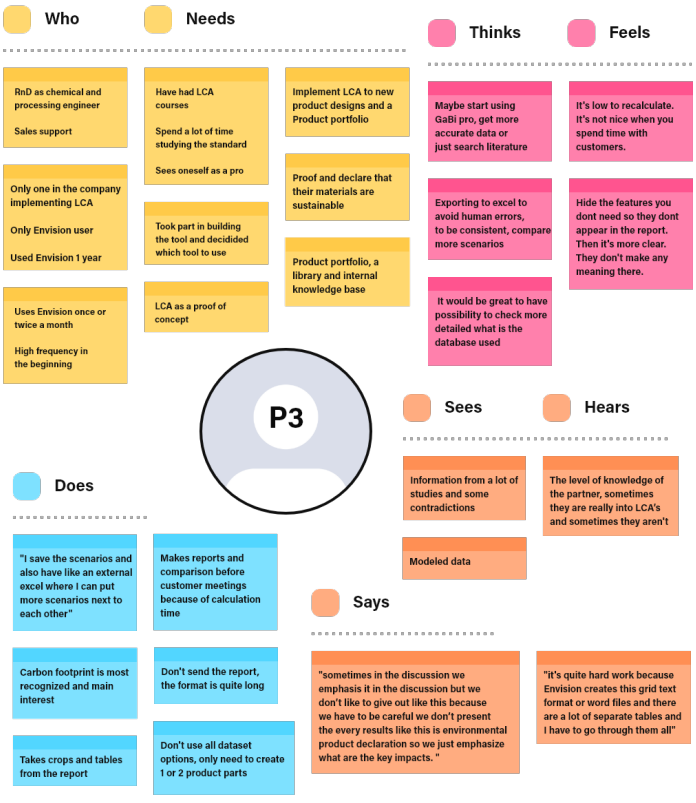

Figure 6.4: Compressed version of the empathy map for P3. The complete map can be found online following this **link** or in appendix 8.22.

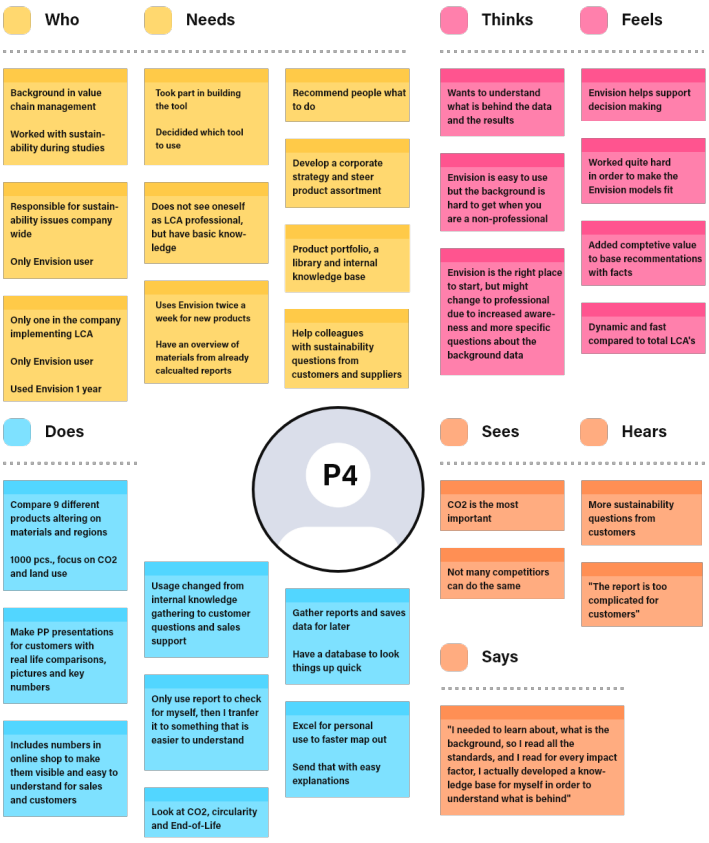

Figure 6.5: Compressed version of the empathy map for P4. The complete map can be found online following this **link** or in appendix 8.22.

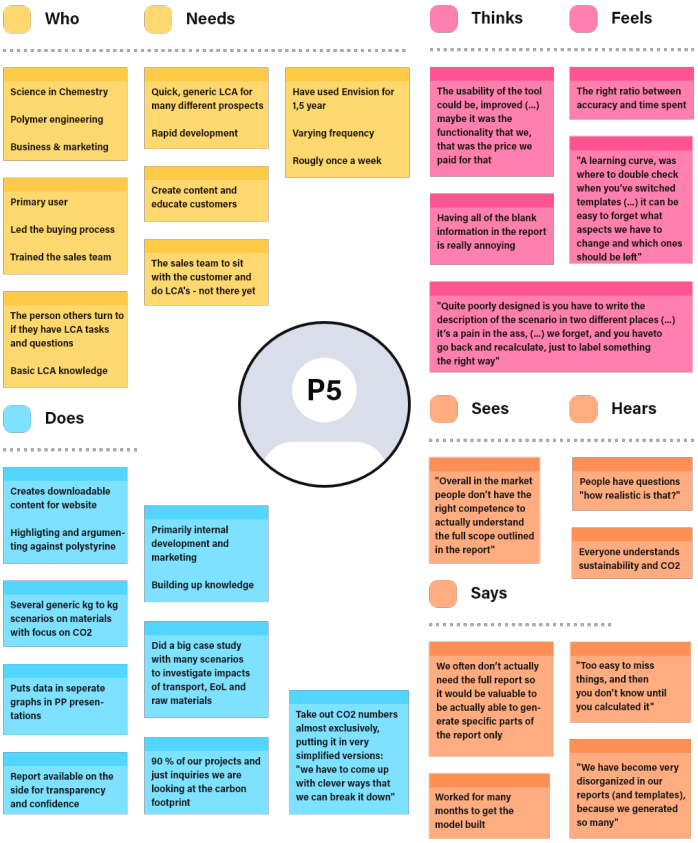

Figure 6.6: Compressed version of the empathy map for P5. The complete map can be found online following this **link** or in appendix 8.22.

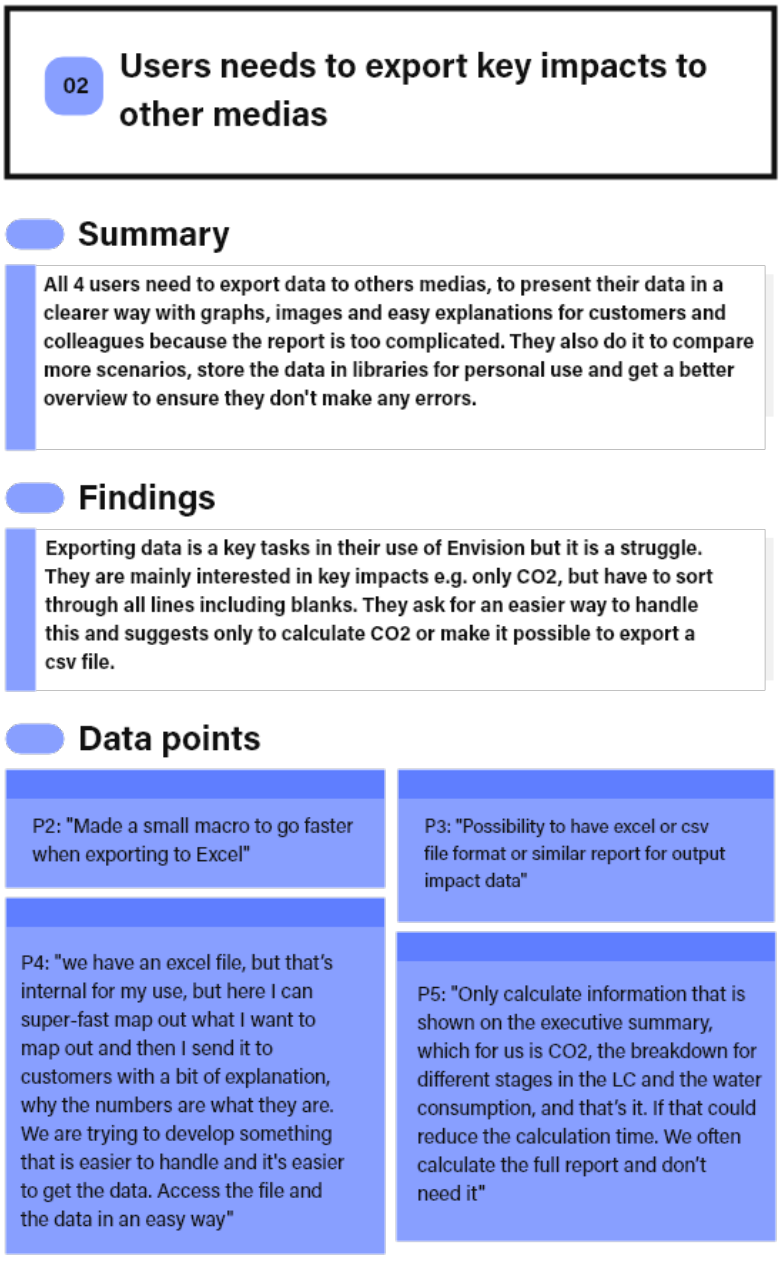

Figure 6.7: Need card presenting the generic need EXPORTING KEY IMPACTS described in section 5.3.

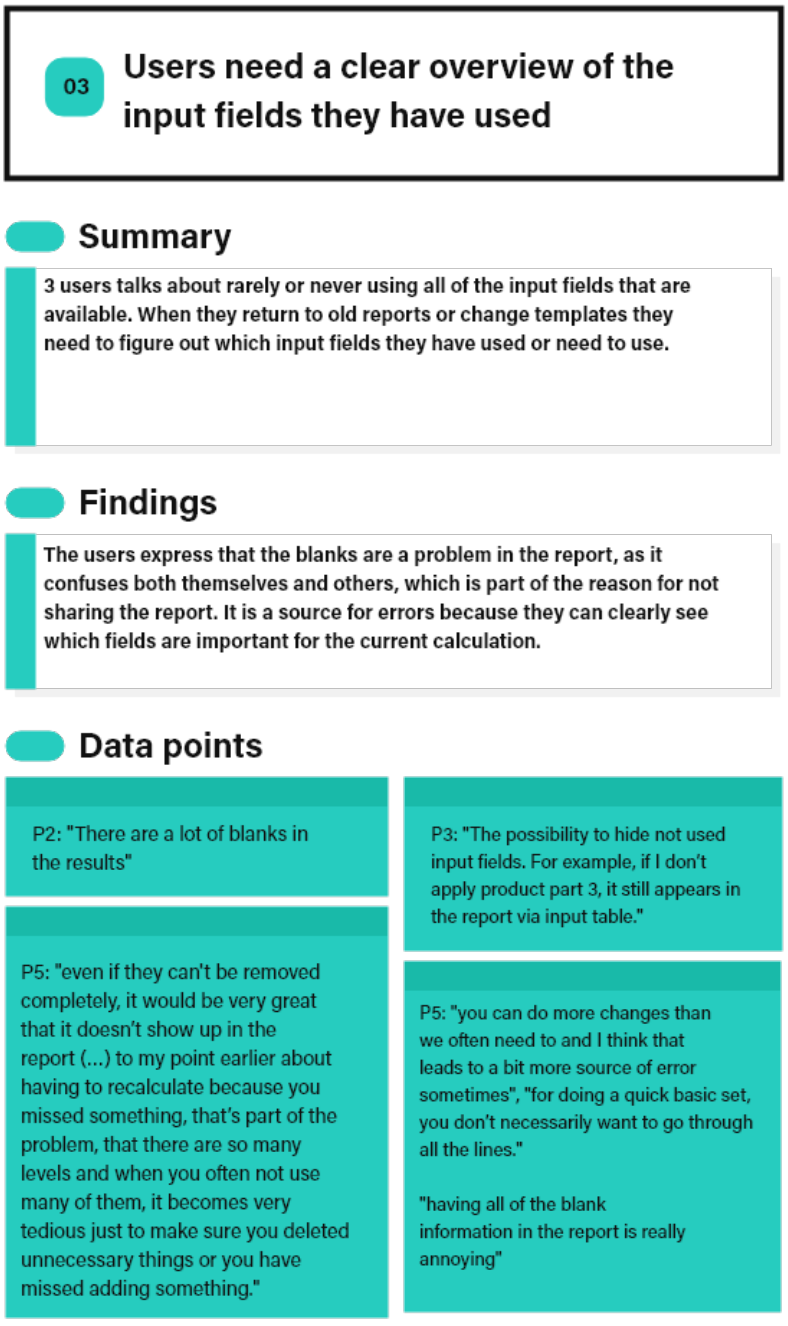

Figure 6.8: Need card presenting the generic need OVERVIEW OF USED INPUT FIELDS described in section 5.4.

6.3 *Mini-workshop*

To meet the third goal of the brief, of discussing ideas for how the problems can be solved, a mini-workshop is planned. It is decided to present suggestions for how the problems can be solved and get the stakeholder and developers insights on these ideas.

Ideas for solutions

The ideas that are presented for each problem are based on a short brainstorm on which possible solutions could solve the given problem. They are based on general knowledge from both 1st and 2nd design iteration, the researchers existing knowledge about how the tool works. There were many meetings in the beginning of 1st iteration with consultants explained how the different interfaces in the tool were made, how the different models were made. Also 1st iteration consisted of concrete design ideas on how to solve the problems from best design practices, which also are making base for these ideas. They are only meant as ideas and the participants are encouraged to add their take on the ideas. Part of the mini-workshop is to start thinking about how the problems might be solved. It is decided to make three ideas for each problem. In the following paragraphs are the ideas are presented.

PROBLEM: FINDING BACKGROUND DATA

IDEA 1: Make a search function where the users can search for database references that are used in their model. IDEA 2: Make info boxes next to the results with short explanation of the data used and a link to easily find the database if they want to read more. IDEA 3: Provide a folder with all databases used in the users models with explanation of how and where they are used.

Ideas for finding background data

1. Search function
2. Info boxes
3. Database folder

PROBLEM: EXPORTING RESULTS

IDEA 1: Make it possible for the user to choose what they want to calculate e.g. only CO_2, when they press the calculate button, so that the complete report is not calculated unless they need it and chooses to do it. IDEA 2: Make it possible to export each impact factor individually as .csv files. So that the user can pick and choose exactly the ones most relevant for their project. IDEA 3: Make a second calculation button for only calculating CO_2.

Ideas for exporting results

1. Calculation filter
2. Export impact factors individually
3. Only calculate CO_2

PROBLEM: SORTING OUT UNUSED FIELDS

IDEA 1: Make it possible for the user to filter out the input fields they don't need. IDEA 2: Make a more clearly divided parameter section to get better overview, a redesign of the parameter section, not necessarily without removing anything. IDEA 3: Remove unused fields from the calculated report so the user can easily see which input fields they have used. A filter in the software that only shows the fields the user have interacted with.

Ideas for sorting out unused fields

1. UI parameter filter
2. Redesign of parameter section
3. I/O software filter

Prioritization workshop

The mini-workshop is planned as a prioritization workshop [Kaplan, 2019]. The prioritization is done using the NUF test, a workshop activity under the forced ranking category. Forced ranking is a collaborative activity where the participants rank a set of items to order them in a strict way, for example each participant gets an equal amount of artificial of money assigned, which must be allocated between the items. In the NUF test scores are used to rank the ideas for each problem. [Gibbons, 2020]

NUF IS A RANKING TECHNIQUE to make a fast evaluation and prioritisation after brainstorming a set of ideas. [Wallace, 2013] It can be done individually or in a group. [Gray, 2011, Kaplan, 2020a] This fits the settings of the allocated time and number of participants. If there is one participant the ranking is done individually, if there is more than one it is done in as a group activity. In both cases the UX practitioner is the facilitator. The procedure of the NUF test includes design ideas, a ranking scale from 1 to 7 and three categories in which each idea is considered and ranked. The categories and their ranks are presented in table 6.1.

New (N)	Useful (U)	Feasible (F)
Has it been tried before?	Does it solve the problem?	Can it technically be implemented?
1 = yes	1 = no	1 = no
7 = no	7 = yes	7 = yes

Table 6.1: Explanation of the NUF test and the scale used to rank the ideas.

6.4 Procedure

In this section it is explained how the three activities are included in the brief and how it is conducted. After this, a results section is presented with the results from the NUF tests and comments from the participants. The brief is divided in a meeting, where the Empathy Maps and the Need Cards are presented, followed by the mini-workshop with the NUF tests. The participants are shortly introduced to the project, the user segment from the User Interviews, the purpose and the plan for the meeting. The introduction is included in appendix 8.23

Plan

1. Introduction 5 min.
2. Empathy maps 10 min.
3. User need cards 10 min.
4. NUF tests 30 min.
5. Wrap up 5 min.

IN THE MEETING the four Empathy Maps in figure 6.3, 6.4, 6.5 and 6.6 are presented by going through them one at a time starting with WHO going clockwise around the map ending with DOES. Then the participants are encouraged to comment and ask questions. After this the three generic user needs in figure 6.2, 6.7 and 6.8 are presented. They are presented one at a time, and again the participants are encouraged to comment and ask questions.

In the workshop three NUF tests are performed starting with finding background data relating to the need in figure 6.2. One idea is ranked at a time from N to F, until all ideas are ranked and the participants agree. Then the same procedure for the second problem: exporting results relating to the need in figure 6.7, and the last problem sorting out unused fields relating to the need in figure 6.8. Finally there is allocated time for a wrap up and for the participants to make final comments and ask questions.

6.5 Results

The participants are presented in table 6.2. S2 is the Envision product owner (PO) who also participated in the stakeholder interview in chapter 1.3. S4 is one of the Envision back-end developers.

	Role	Responsibility
S2	PO	Envision Team lead Product Management
S4	Developer	Envision Backend

Table 6.2: Participants in the developer meeting are the PO who also participated in the stakeholder interview in chapter 1.3 and S4, who is one the Envision backend developers.

In the following paragraphs the results from the NUF tests are presented. For each idea the total score is calculated and illustrate which ideas are more realistic than others. Pay attention to the purpose of the NUF test being a fast ranking technique on which ideas might be valuable to continue working with, and can help sort out ideas not worth looking more into or pin point missing information both in relation to the users needs and in relation to missing information for the developers to relate to the ideas.

Problem: Finding background data

In figure 6.3 the developers ranking of ideas is presented together with their total scores. All three ideas scores 4 in feasibility. Idea 1 and 2 are new and have not been tried before, while idea 3 about providing a database folder is not new, and have been tried before. Overall idea 3 has the lowest score of 9, while idea 1 with the search function has the highest score, because it is ranked 1 higher in it's usefulness about whether they think it will solve the users problem. The participants explains the low ranking of idea 3 with the number of data sets that are used is very high, e.g. as many as 1000 data sets for the packaging calculator model, and the participants are not convinced that it would solve the problem to provide all data sets.

> S2 about idea 2 *"it is useful but not feasible because of the mathematical model. It's a long list of data sets."*

In general the amount of data sets is a problem and the participant says to provide all data sets might be too much and not necessarily

solve the problem, also relating to the other two ideas, which might be why idea 1 about having a search function is ranked highest, because here the data sets can be filtered based on the search. It would seem reasonable to move forward with idea 1 and 2 and discard idea 3.

Finding background data	N	U	F	Total score
Search function	7	5	4	16
Info boxes	7	4	4	15
Database folder	1	4	4	9

Table 6.3: The NUF scores for the ideas for findings background data and their total scores.

Problem: Exporting results

In table 6.4 is the ranking of ideas suggested for helping users export the results they need. All three ideas are ranked in the lower end on whether the idea is new, with idea 3 having the lowest score of 1, meaning ideas are not new. All 3 ideas are ranked highest in usefulness with a score on 7, meaning they think the ideas are very useful in terms of solving the problem. In feasibility idea 1 and 3 have a score of 5, while idea 2 have the highest score of 7, leaving idea 2 with the highest total score of 16, while idea 1 has 14 and idea 3 has 13.

The participants comments on idea 1 and 3 are that they are somewhat similar in system requirements, and that it is not possible to calculate single impact factors such as CO2 as the system is right now, but it is not impossible to do. Idea 1 has more requirements to it, while idea 3 is something they are already looking into developing.

Idea 2 is similar to something they have already released (no further explanations), which might be the reason for the high score in feasibility. and the importance of the functionality became clear to clear them, which may have influenced them to look more into developing this functionality and making it generic.

The impression from the discussion is that idea 2 could be done easily, which means this idea could be moved forward.

Exporting results	N	U	F	Total score
Calculation filter	2	7	5	14
Export impact factors individually	2	7	7	16
Only calculate CO2	1	7	5	13

Table 6.4: The NUF scores for the ideas for exporting results and their total scores.

Problem: Sorting out unused fields

In table 6.5 is the scores for the ideas for solving the problem about having empty or unused fields. Idea 1 about providing a filter for the user to only see the parameters the need is somewhat new with a score of 6. Idea 2 about making a redesign to make a clearer overview

and making it easier visually to sort through the parameters has gotten a score of two. The reason for this is explained by the PO with the reason that this has already been done, but their might be room for improvement still. Idea 3 is scored 5, meaning the idea is also somewhat new. Idea 1 and 2 is scored 6 on usefulness, and idea 3 scored 5, meaning idea 1 and 2 would be a little bit better for solving the problem. In feasibility idea 2 has the highest score on 7, while idea 1 has the second highest on 6, and idea 3 the third highest on 5.

Idea 1 has the highest total score on 18, while idea 2 and 3 have the same total score on 15, but differing a bit in each ranking category.

The PO and developer commented on idea three that not displaying zero's (unused fields) might not be possible for all Envision models, but it could be a possibility to divide parameters into 3 categories: 1) the parameters the user have changed, 2) default parameters (parameters needed for the calculation) and 3) zeroes (parameters that doesn't impact the calculation). Overall the three ideas for sorting out unused fields to get a better overview seems relevant and could be solutions to move forward on investigating and developing.

Sorting out unused fields	N	U	F	Total score
UI parameter filter	6	6	6	18
Redesign the parameter section	2	6	7	15
I/O software filter	5	5	5	15

Table 6.5: The NUF scores for the ideas for sorting unused fields and their total scores.

Summary and comments

All ideas are very similar in their total scores ranging between 13 and 16. The lowest score is 9 given to idea 3: Database folder in table 6.3, while the highest is 18 given to idea 1: UI parameter filter in table 6.5. The impression is that even though some of these ideas are already being thought of or in the development, it helps support their decisions and moving forward and makes them feel comfortable that this is something that helps meeting the users need and improve the user experience, which the PO also mentions in the wrap up: a lot of the information is known or they have hunches about it already, but having the opportunity to move forward with the support of user research is very valuable and can also be used for the PO to convince consultants about ideas and future development of the tool. The impression is also that the workshop started some thinking processes with PO and the developer by bringing new ideas on the table. In some sense it also made them relate to the needs and problems in a more practical way by thinking about how the problems could be solved.

In general S4 expressed that it would be nice with some illustration on the ideas, as it was a little bit difficult to relate to, but with some explanation it made more sense and they managed to rank them all and understand that the ideas are not final and still

just ideas. S2 was not surprised about the results presented in the meeting, but emphasised that this concrete insight about user needs from other user segments is very valuable and supportive for them to move forward on. It strengthens S2's position in relation to colleagues to have concrete knowledge and evidence about different user groups, because many of the problems are already known, but needs evidence. S4's feedback about the feasibility score, is that it can be difficult to rank and developers can hesitate in making estimations because often you are held accountable for it. S4 also appreciates and highly value hearing the users perspectives and their needs as stated

S4 *"it has been 10 years or so since I've listened to the users."*

Further they expressed that they liked the split between the presentation of first understanding the users, their needs and problems and then afterwards think solutions. They also valued having the opportunity to listen to each other, as they do not do this very often.

Wrap up

The first phase of the Double Diamond is completed and stakeholders are briefed as according to the double diamond model of design processes. The meeting and workshop conducted in this chapter makes a good base for continuing with developing ideas in the solution phase as illustrated in figure 2.1 in the project plan, chapter 2

7
Discussion

In this chapter the results and methods applied are discussed and reflections on how things could have been done differently are included continuously.

UX team of one

This research project is conducted only by the author. Several times during this project the researcher have become aware of ideas and thoughts that are based on subjective opinions that have emerged from intensively working with this subject for a long period of time. This have especially been ideas about the users' needs. Each times an idea about the users' needs have appeared it is written down, reflected on and checked in the raw data, to ensure that the idea is actually substantiated by the data collected in this study. When reflecting on them and checking them in the data, some of the ideas have not been substantiated by the data and subjective ideas formed by research done in the 1st iteration, ideas about how an optimal design would look like, e.g. ideas from best design practices. Thus it has been of great importance to the researcher throughout the project, to document where the results in terms of the three generic needs, comes from in the Thematic Analysis.

Related to that, similar events happened during the Thematic Analysis might be biased by subjective opinions during analysis. It was the experience of the researcher that doing a thematic analysis in a team of one is quite exhausting, and may not have been able to be attentive enough of this bias. It is also the researchers opinion that the analysis would have benefited from being conducted in a team.

Documenting the Thematic Analysis

Thematic Analysis was conducted in the analytical tool Nvivo. This was a new way of analyzing data, as previous similar analyzes have been conducted on post-it notes and walls to be able to visualize and discuss the data in a team. The researcher experienced that it was quite hard to have a clear overview of the content in the themes, and at several points lost track of the content and only focused on the themes. Further it is the opinion that phase 5 in the analysis could have been more structured and that all processes could have been documented better in general.

Defining generic needs

The definition of a generic need and three generic needs that are identified are based the fact that they are causing problems for the users. Needs and problems are very related and have been difficult to distinguish during the project. It could have helped to make a clear distinction before analyzing the data and create user scenarios or journeys to illustrate the user needs, and then start identifying problems in these journeys. It is emphasized that the generic needs are based on the data collected in this project and they could benefit from being compared with the LCA methodology and also universal usability requirements. It is also unsure whether the generic needs are actually generic problems. If one of the problems were to be solve the need might not be as obvious, and other generic needs might occur instead.

The project could have benefited of mapping out the user journey with use scenarios or by doing a task analysis. This could be used to understand the whole generic user journey, and to identify in which situations the problems occur. It could also be relevant to map out the individual needs more clearly and include the data from the 1st iteration. If the goal is to improve the user experience in relation to the problems most experienced needs, then problems could be collected and related to each other to get a view on which problems and needs are the more important ones.

Validating generic needs

In this project generic needs are defined and identified, but not validated. The findings are supported by the data collected in the user interviews, meaning statements from the users. Statements can be biased in the way that they represent the users memory when answering questions. To truly validate that the needs are generic for these four users, solutions would be needed to be tested or the users should be observed while using the tool.

Choosing methods

The methods applied in this UX research project are chosen on the basis of the desired outcome, the settings and resources. Overall the methods provided the desired data and outcome. There are many UX research and design method to apply and when choosing methods the most important thing is to consider the desired outcome, where in the process the project is and the settings. UX research depends on many factors, and this project is just one way of doing it. If something should have been done differently it would be the way of analysing the data. The Thematic Analysis is a comprehensive method to do as one person and it would benefit from discussion from other researchers or team members. The level of expertise of the researcher for conducting a Thematic Analysis is also in the lower level. It could have been beneficial to have chosen a lighter method for analysing the data the researcher is more experienced with, e.g. Affinity Diagramming.

Pilot test of the interview guide

Normally pilot testing is done to test whether the research method is designed to provide the desired data. The interview guide was not pilot tested. This may also have been one of the factors leading to excluding the interview data for P1, as the equipment had not been tested. There was not resources for pilot interviews and the sample was already small so testing the interview with a communication educated seems like a fine compromise. Looking back at the interviews the structure could have been prepared better. Often in the interviews two questions were asked in one.

Empathy maps

The creation of Empathy maps happened when preparing for the stakeholder and developer meeting and directly from the interview transcripts. The content in the maps might be biased by the researchers subjective opinion of what was important to include when going through the transcripts. It would be more supporting if they were created from the themes in the Thematic Analysis. Nothing in the Empathy Maps is untrue, but it is unsure whether they truly represent the generic and individual needs. On the other hand, they served their purpose of creating empathy and explaining the different users and their needs to stakeholders and developers. Further, it was a good experience to revisit the transcripts and that time, as the focus had been on the themes for some time.

8
Conclusion

This project is conducted as a UX research project through the discovery phase and the define phase in the double diamond model of design processes. It is investigated whether Envision end-users from different industries have generic user needs and whether these needs relate to potential problems. Further, stakeholders and developers are included in the process in the preliminary discovery phase and after the define phase to be briefed about the results.

Four User Interviews are conducted with four end-users from each their different industry. The interviews are analyzed using the Thematic Analysis framework. Through user interviews and Thematic Analysis it is considered possible to identify generic user needs. The research has resulted in finding three generic user needs and a definition of what generic needs mean in this context. Generic needs are defined as needs that exist among all four users who participated in the study, and can be supported by several individual needs that strongly relate to the generic need.

The three generic user needs with associated problems identified from the four users are:

- Access to background data
- Exporting key impacts
- Overview of used input fields

The findings are successfully communicated to one stakeholder and one developer in four individual Empathy Maps and three need cards that summarize each generic need. This is concluded on the positive feedback recieved from the two participants. Further, ideas for solutions for the problems related to the generic needs have been discussed and ranked in a workshop with the same stakeholder and developer. The stakeholder and developer highly value and appreciate the findings and the way they are presented by first creating empathy and understanding and then thinking about solutions.

Bibliography

Virginia Braun and Victoria Clarke. Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2):77–101, 2006. DOI: 10.1191/1478088706qp063oa.

Leah Buley. *The User Experience Team of One*. Rosenfeld Media, 2013. ISBN 1-933820-18-7.

Alan Cooper, Robert Reimann, and David Cronin. *About Face - The Essentials of Interaction Design*. John Wiley & Sons, Incorporated, 4 edition, 2014. ISBN 9781118766576.

Mary Ann Curran. *Life Cycle Assessment Student Handbook*. John Wiley & Sons, Incorporated, Somerset, 2015. ISBN 1119083559, 9781119083559.

Susan Farrell. Ux research cheat sheet. *Nielsen Norman Group*, 2017.

Sarah Gibbons. Empathy mapping: The first step in design thinking. *Nielsen Norman Group*, 2019.

Sarah Gibbons. Foundational ux workshop activities. *Nielsen Norman Group*, 2020.

Dave Gray. NUF Test. Online, 2011. Visited 29-07-2020.

Dave Gray. Update to the Empathy Map. Online, 2017. Visited 27-07-2020.

Kate Kaplan. 5 ux workshops and when to use them: A cheat sheet. *Nielsen Norman Group*, 2019.

Kate Kaplan. How to Prioritize Ideas from UX Brainstorming Sessions. Online video, 2020a. Visited 29-07-2020.

Kate Kaplan. Ux workshops vs. meetings: What's the difference? *Nielsen Norman Group*, 2020b.

Rachel Krause. Turning complex data into compelling stories: A 5-step process. *Nielsen Norman Group*, 2020.

Vijay Kumar. *101 Design Methods - A Structured Approach for Driving Innovation in Your Organization*. John Wiley & Sons, Inc., 2013.

M Kuniavsky, E Goodman, and A Moed. *Observing the User Experience : A Practitioner's Guide to User Research*. Elsevier Science & Technology, Saint Louis, 2012.

Rikke Louise Mortensen. *A Project-Oriented Cooperation with Thinkstep Aps: Reviewing Nordic use of GaBi Envision*. Aalborg University, 2020.

Don Norman. *The Design of Everyday Things: Revised and Expanded edition*. Basic Books, 2013. ISBN 0465050654, 9780465050659.

Don Norman and Jakob Nielsen. The definition of user experience (ux). Online. https://www.nngroup.com/articles/definition-user-experience/.

Nvivo. Research Ready. Online, 2020. Visited 10-06-2020.

Kara Pernice. User interviews: How, when, and why to conduct them. *Nielsen Norman Group*, 2018.

Maria Rosala. https://www.nngroup.com/articles/discovery-phase/. *Nielsen Norman Group*, 2020.

Sphera. What is a life cycle assessment?; gabi envision flyer lca made easy. Online, 2020. https://sphera.com/insights/what-is-a-life-cycle-assessment/; https://www.gabi-software.com/uploads/media/GaBi-Envision_flyer.pdf.

Barry Matthew Kudrowitz & David Wallace. Assessing the quality of ideas from prolific, early-stage product ideation. *Engineering Design*, 24(2):120–139, 2013.

Appendix

8.1 Minutes from the listening tour

- S1 role: (How to do) Research and Development (RnD) related to Envision.
  - Software, devops, hosting. Responsible for also the Envision team.
  - (Colleague 1) is solution owner. (internal) (not participating)
  - (Colleague 2) is devops. (not participating)
  - Goal: increase throughput in RnD. Integrate Envison to Sphera cloud.
  - Top Envision priorities: na
  - Competitive advantage: comparisons/scenarios
  - Top challenge: UX (we don't have the expertise) and speed.
- S2 role: Product owner (PO). (what to do - external) Plans the road map for development of the software.
  - Feature planning release planning.
  - Goal: Make product successful and make customers happy with tool. Broaden the use, internally and externally.
  - Top Envision priorities: na
  - Competitive advantage: Can configure reports in GaBi software before visualizing it in Envision. Can do fancy math models in the background. Generic tool -that can be configured to any type of calculation. Not comparable to any LCA calculator.
  - Top challenge: Speed. Self explaining UX.
- S3 role: identify prospects, sell it to them.
  - Goal: Identify relevant developments in Nordic market. Sell as much SaaS software as possible.
  - Top Envision priorities: na
  - Competitive advantage: That it is part of GaBi which is used by our customers already. It sits on top of our data, which is already available for our users.
- Other projects:
  - Harmonizing look and feel of software across Sphera.
  - Technological integration into Sphera cloud
  - UI guide

  - API to GaBi, so no need to use Envision. Allowing the integration of GaBi to another customer interface software's.
- Primary customers:
  - Industry. B2B. Large enterprises. Product designers, marketing people. Non-lca experts. LCA people who needs to automate their work (managers). 50%.
  - The remaining 50% users ae on the packaging tool.

8.2 The user interview guide

Introductory, opening questions

- Can you start by telling a little but about who you are, your education and position at your company?
- What does your daily work include?
- How do you use Envision in your daily work?
- In which situations do you use Envision?
- Can you describe for me the last time you used Envision? Like a story telling.

Warm up questions

- For how long have you been using Envision?
- How often do you use it?
- Why dont you use it more often?
- Can you describe the typical situation in which you have the need to use Envision?
- Which Envision solution do you use?
- Do you use others or have you used others?
- What is the purpose of using this solution?

General issues

- What do you get out of using Envision in your work?
- Which advantages are there by using Envision?
- Which disadvantages are there by using Envision?
- What is your personal opinion about Envision at your company?
- Do you feel safe when using Envision?
- Are there anything about or in the tool you are unsure about when using it?
- Do you sometimes need help to use Envision?
- What do you need help for?
- What do you do when you need help?

Deeper focus on the research topic

- Can you describe to me what your overall purpose is for using Envision?

- What is your knowledge about LCA?
- How do you feel LCA is part of Envision?
- Which results from Envision do you use when you have calculated? E.g. are there some of the impacts you focus more on than others? Why?
- What do you use the results for? E.g. are they for personal use, internal team sharing or external communication?
- What do you do with the results when you are about to use them? Please describe the process.
- What do you use the report for?
- Which parts of Envision do you always use?
- Are there any parts you never use?

Retrospective questions

- How could your experience with Envision be improved?
- Is there anything in Envision that you could do without or is distracting?
- Do you know, use or have used other similar tools?
- Why do you use Envision rather than other tools?
- Is there something that these other tools have, you think Envision is lacking?

Wrap-up

- Is there anything you would like to mention or think I should know before we finish?

8.3 User interview execution plan

Sum of execution plan

- Meet and greet in Microsoft teams. Thank the user for the their time.
- Ask if the user has questions about the consent and the procedures.
- Encourage them to ask questions anytime during the interview.
- Point out the audio recording will start.
- Start audio recording.

QUERY

- Point out that if the interviewer is silent it is because of note taking.
- Ask questions from the interview guide.
- Point out by 3rd last questions that the interview is coming to an end.
- Point out when all questions have been asked.

END

- Ask if the user have anything on their mind they would like to mention.
- Point out that they are welcome to reach out afterwards.
- Thank the user for their time.
- End teams meeting
- Stop and check audio recording

8.4 Notes from the Thematic Analysis

Phase 1

The impression is that P2 differs from the other 3 participants, is noted that it seems the other 3 participants have different experiences with Envision than P2, and seem more independent and experienced in general, maybe from leading the process of both buying and fitting their Envision models, and being only or primary users. This is presented in table 3.1 in chapter 3. Also P5 seems to differ from P3 and P4. P5 is part of a bigger team, has professional LCA colleagues to ask for advice and at the same time has the responsibility of a team of 10 users in a sales department, whom P5 have trained to use the tool. P3 also differs from the others in the way that P3 use Envision a little bit different and the frequency of use have fallen since the tool was acquired. At P3's company they have exhausted the use of envision as they have calculated environmental impacts for all their materials, and as they do not make products and feel confident with their material portfolio, the need for analysis's has fallen.

Phase 2

The largest amount of codes are created for P5. During the coding of P5 there is a small urge to hold back on creating new codes, because of the amount of codes that is created. It is unsure whether this urges comes from begin exhausted from coding the previous 3 transcripts or the transcript itself, as the content of P5's transcript is more dense than the others. Despite this, it is attempted to code on the same level of detail for all 4 transcripts.

After coding all 4 transcripts the total amount of codes is 172. P2 has 95 codes, P3 137, P4 135 and P5 172. Note that some codes reoccur between participants, while others only exists for one participant. 172 is the collected amount of codes.

Phase 4

The first mind maps are created in this phase. 18 mind maps in total. These are attached in annex 8.49. In level two the first themes maps are made, which are included in annex 8.50.

8.5 Main theme: Users

This theme has 4 sub-themes which are illustrated in the theme map in figure 8.1 where each sub-themes primary content is listed. First EDUCATIONAL BACKGROUND and EXPERIENCE WITH LCA are described together. Then ROLES and WORK and then some final thoughts on these themes are presented.

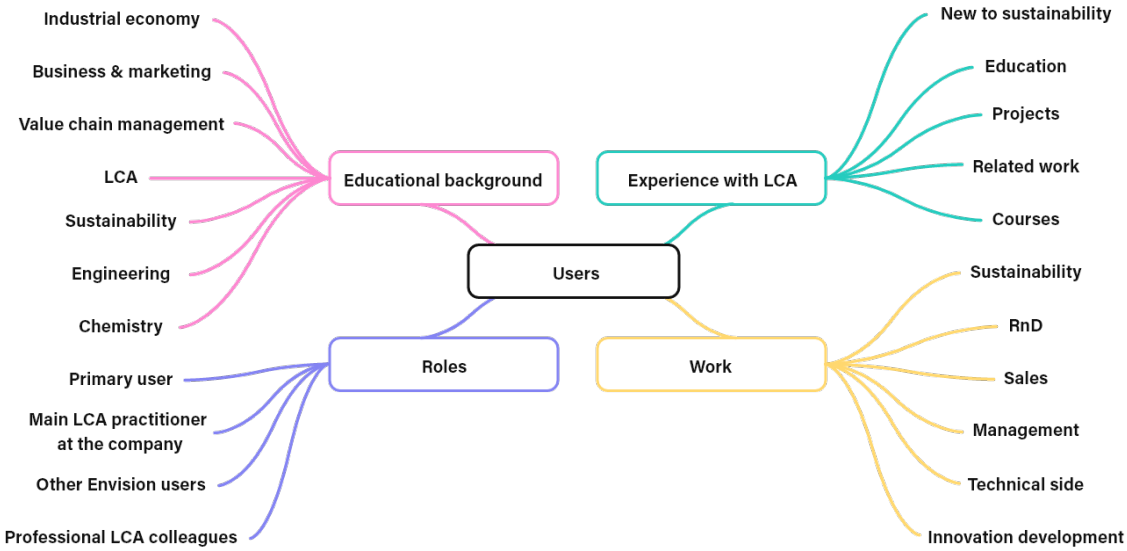

Figure 8.1: Full theme map of the main theme Users with its 4 sub-themes and their main content topics.

8.6 Educational Background & Experience with LCA

Three of the users are chemical engineers, while one has as master in value chain management whom have had courses in sustainability as well. Another have also had courses in LCA during study periods in relation to industrial economy. Besides that, one have studied business and marketing and another industrial economy. Also they have knowledge about materials, one mentions goods materials and another is more narrow on polymer.

The users are well-educated being engineers and experts in chemistry. Chemistry may relate to their primary work area and may also relate to their use of Envision, as the tool is used for assessing different compositions of materials and products. They may not be LCA professionals but they have at least some basic knowledge about LCA and sustainability and expert knowledge about the materials and products they are assessing in the tool.

Related to educational background is the users experience with LCA. P2 have not had any education in sustainability or LCA and also states being new to sustainability. The other 3 users sees themselves as more experienced in relation to LCA and sustainability. P3 and P5 appears to be the most experienced.

> P5 *"I'm quite familiar I would say, with a lot of the aspects that are important for LCA, but in terms of the LCA itself and the process of making the model I have very basic knowledge."*

The users do not only have their knowledge and experience from their studies, but also a lot from their work, and as P3 states, have spent a lot of time looking at the LCA standards.

> P3 *"I have been studying LCA's. So, I actually studied Industrial Economy and there were also LCA related courses (...). Last year when I got the tool and everything, I had to really get into it to looking for the standard, so I would already call myself a professional because I have spent a lot of studying related to it."*

8.7 Work & Roles

The users work with sustainability, sales and development. Two of them are managers, one product manager and the other competence center manager. They work with many different tasks and help many of their colleagues with sustainability questions. P3 and P4 are the only Envision users at their company and also does not have any LCA professional colleagues. They carry the responsibility of answering questions and helping colleagues company wide.

> P4 *"the other half is sustainability topics across the company (...), to recommend people what to do, but also to help them with sustainability questions they get from customers and they get from suppliers and also developing a corporate strategy for us."*

P5 is primary user and has trained a sales team in using it. The role of being a primary user includes answering questions and helping the sales team, and having contact with Thinkstep. This primary user also has a whole team of LCA professionals that helps with questions if needed, but is the primary go-to person in the company.

> P5 *"I am the primary user, so if someone has something they would like to understand about the LC (Life Cycle) I'm usually the one doing that work for them and operating it."*

P2's role is a bit different from the others. P2 has both a colleague also using Envision and another colleague using GaBi pro (the professional LCA tool from Thinkstep), who is also the one making the models P2 uses. P2's role is more about helping his GaBi pro colleague with specific tasks.

8.8 *Main theme: LCA*

This theme has 6 sub-themes illustrated in the theme map in figure 8.2 together with main subjects of the content in each sub-theme.

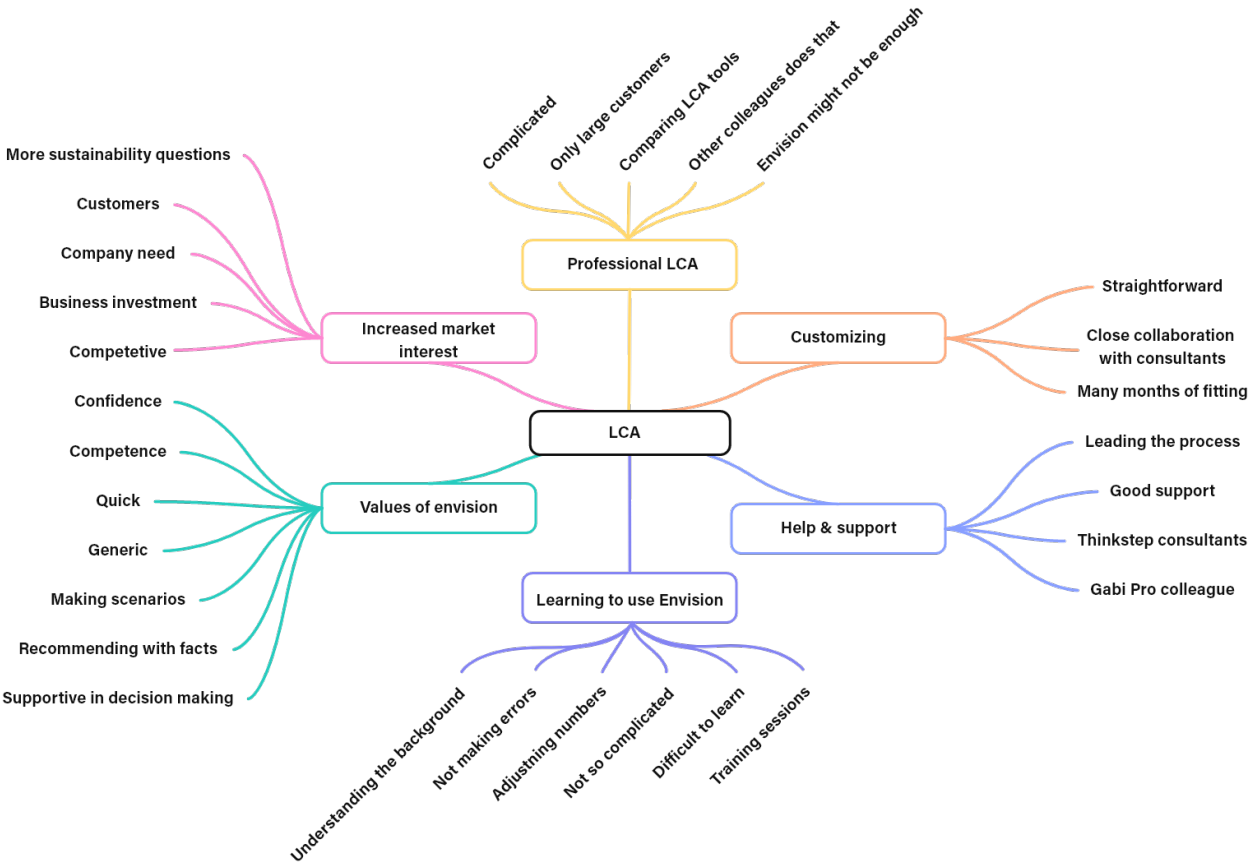

Figure 8.2: Full theme map of the main theme Users with its 6 sub-themes and their main content topics.

The first two sub-themes described in the following sections are about how the users experiences an Increased Market Interest and a need to do LCA's at their companies and for their customers, because it becomes more and more part of business. In relation to that is the sub-theme Professional LCA with information on why the users don't do comprehensive LCA's leading to the process of getting Envision that meets their own, their company's and their customers needs. Which leads to the content of the sub-theme where users explain the Values of Envision in relation to be able to do quick LCA's in contrast to the comprehensive and difficult professional LCA's and also how Envision helps the users feeling confident when making recommendations and in decision making. The last three sub-themes are about how the users are Customizing their models together with Thinkstep and the process of this, leading to Learning to use Envision, what they needed to understand, which problems they encountered and the training sessions provided from Thinkstep. In relation to this is a bit about the Help & Support from Thinkstep and from colleagues.

8.9 Increased Market Interest & Professional LCA

The users explain that there is an increased market interest in sustainability and LCA and experience an increase in sustainability questions internally and from customers as well. This has lead to the process of them investigating different tools to conduct LCA's because of a strong need to do it and the companies are investing more in sustainability. Because of this increased market interest it has been necessary for the users to do LCA's more quickly.

> P5 *P5: "we have a sustainability team, that can do quite comprehensive LCA's, but to do that for everyone who asks would be impossible, so I think this tool has been really valuable to provide sort of a very quick generic LCA analysis for many different prospects"*

Full LCA's are very complicated, mainly done for large projects and customers, which P2 and P5 have professional LCA colleagues doing. Even though the users value Envision because of it's quick and generic approach towards LCA's, it seems that professional LCA's are still necessary as P2 and P5 have LCA professional colleagues and both P3 who are the only LCA practitioners at their companies, mentions that in time, Envision might not be enough for them because questions from others gets more and more specific.

> P3 *"it's kind of preliminary work for further considerations (...) maybe start to use the professional version"*

> P4 *"I think it gets more and more specific (...) there are always more questions, so I think at some point the Envision version is not enough*

P3, 4 and 5 were responsible for finding and purchasing the right tool for their company. Their reasons for choosing Envision are based on limited time schedule, the level of accuracy compared to doing full LCA's and the fact that there was nothing similar to Envision in the market at the time.

> P3 *"I had a limited schedule (...) with Envision you got more support with the consultants, got further in the process more faster, that was a big advantage. Because there was no similar service sold in the market at that time."*

> P5 *"it's the right level of accuracy that we need for this, and I think it's the right level of accuracy for the majority of what people actually need to know in the market right now, everyone wants to know LCA"*

8.10 Values of Envision

One of the values of Envision lies in one of its core functionalities of doing scenario comparisons which also relates to the tool being *dynamic, fast, right level of accuracy, quick and generic* (key words mentioned by P4 and P5).

> P3 *"that's the main value, that's why we didn't choose to go with the professional, because you can play with the scenarios"*

> P5 *"it takes a lot of responsibility off of [the LCA expert] (...) to be able to do this type of analysis in addition to what we normally do with the full comprehensive, is good."*

Other key values of Envision mentioned are that it builds up the company's competitive values and the users feel they can be professional towards customers when they make recommendations, as they can base it on facts and concrete examples. Envision gives the users insight and transparency and help them build up knowledge and understanding of LCA.

P5 *"it builds up my competence in terms of LCA and without having to go and be educated about LCA, because obviously it's a very complicated thing (...) it gives me, and our sales team, the ability to really dig in and learn and see how different factors the life cycle of a product or a material."*

Key words mentioned by P3, P4 and P5 are:

P3 *"added value to the company", "valuable data", "insight", "credibility to claims"*

P4 *"competitive value", "good overview", "can be developed later", "base recommendations on facts", "be professional towards customers"*

P5 *"concrete information", "sort of simple to use", "don't have to be educated", "builds up internal understanding and competence", "gives confidence", "transparency" and "validity"*

8.11 Customizing

P3, 4 and 5 led the process of getting the tool.

P4 *"I think it took me 2 or 3 months in order to find out what we need and what is the best to use."*

P3 *"Thinkstep were marketing this bioplastic tool (...) they had some references (...) it was quite streamlined and easy to apply, so I was the one discussing with the sales representative and consultants (at Thinkstep) (...) and it was quite straightforward."*

They have all been through a trial session or preliminary sort of process to fit and customize the tool to their needs. For P3 it was a straightforward process. The model that P3 use might not have been through as much customization. For P4 and P5 it was a longer process. P4 says that it took 2-3 months to figure what tool to take and then also a fitting process afterwards.

P4 *"I said to my boss that I think that's the right thing to do (...) it took me 2 or 3 months in order to find out what we need and what is the best to use.", "we got the first delivery in July (...) the last delivery in December."*

P5 *P5: "it's a customized version, we worked for many months to get it built, I would say the report is the main part that's customized, but we have a specific dataset (...), and some special features"*

There are many different models being build. There are both desktop and cloud version. There are generic models such as packaging calculator and bioplastic tool, but they eventually also gets customized. The users sees it as a plus that they can develop the tool later and that they can fit it to their needs, but it also causes

errors. It seems there is a lot of unnecessary friction in this process. There are customization for organizing the reports and templates, customization for which parameters the users want to turn on, the database data, having different databases, fitting the database to the users company needs, and then also specific customization for the report. Even training sessions are not "standard", but asked for by the users, and Thinkstep provides them in the way that it fits the user.

Maybe they are too customized according to P5, who think the level of customization can be downside.

> P5 *"sometimes too much freedom is, results in chaos, and the level of freedom we need when it comes to organizing the reports (...) could be more restricted (...) in a more structured way. (...) it's one thing that I struggle with in terms of managing the content, and keeping it in sort of an orderly way, it's quite difficult at the moment."*

> P5 *"issue with the customization, (...) maybe it was the functionality, that was the price we paid for that, which is fine"*

There is a relation to UI/UX in this with "pay for functionality" meaning that you dont pay for good UX. There are also some of the same words here as in "values of Envision" The process of getting the tool can be long if you both need to consider which tool is the right one, and also need to customize and fit through a "trial and error" period.

8.12 Help & support

The users have LCA colleagues that helps them or they get help from Thinkstep. They have all been through some sort of introduction class to understand the tool, the results and the background. P2 had two introductions from a LCA pro colleague whom also built the model that is used. If help is needed P2 also turns to that colleague. P3, P4 and P5 get help and support from Thinkstep consultants, and P5 also answers or collects questions from the sales team using Envision. The ones that cant be answered are e-mailed to Thinkstep. Quite responsive team / good support: mentions P3, p4 and p5. P2 gets help from his colleague.

> P5 *"they are quite responsive and I feel comfortable reaching out if I need something."*

8.13 Learning to use Envision

I think a lot about learning to use Envision is about understanding the background. The users expresses that it can be used by many, but to really use it, at least these users still had to spend a lot of time to understand the background of the tool and why the results are what they are. This is also what seems have been the most of focus in the training sessions they had.

P4 *"I'm not a professional when it comes to LCA's, I mean I studied also with the focus of sustainability, but I never did LCA's my own (...) I needed to learn about, what is the background, so I read all the standards, and I read for every impact factor, I actually developed a knowledge base for myself in order to understand what is behind (...) I think it's when you are a non-professional, it's not hard to use Envision (...), but the background knowledge, yeah, it's hard to get it I think, or at least it's a lot of time to be used, when you are a non-professional."*

Users had trouble understanding: a lot, what data, where from, what does it mean (p3), general overview, whats in it, whats behind, the data sets and the impact factors, how to adjust numbers (p4),

P4 *"It was on the beginning the general overview, how to adjust the numbers and what the numbers mean and how to use it in the right way, I think it was a bit complicated in the beginning."*

Contradicting statements from P4 and P5 on learning envision:

P4: "I think it was a bit complicated in the beginning."
P5: "two months of, before I felt quite confident on a regular basis. I still make mistakes it's just that I'm better at catching them now. In the beginning there was many times where I would send something out to them and I would get feedback that I had missed something or labeled something wrong"
P5: "it was quite, it was quite fast to learn it, it was not super complicated I would say"

Also relates to p4 statement on how much time P4 used to understand the background and educating oneself - it is important, but it might not be transparent enough and too difficult to understand.

The trouble with Envision is that it can be used by non-professionals, but it can't be understood. And understanding it is an important part, to be able to communicate with others, because it is still new, but it is at the same time important that it is valid, you cant talk about it if you dont understand it.

Providing training sessions: P4 learned some cool new things in the training sessions and got "to review some of the reports and calculations I already did, just in order to see if we could use it in that way, or if we missed some things.", and also think that it should be provided to all new customers as parts of the package so that you dont have to ask for it.

P4 *"I know that there are some training sessions for the professional version, but they never offered training for Envision versions, so I just talked to [Thinkstep consultant] if we could do it, (...) I think it helped a lot, so it could probably be an advantage also to ask customers if they would like to do a training or something. I think that could be cool."*

P3 also appreciates having other features that she doesnt use, because it helps understand and learn the different processes. "data is valuable" Also P4 mentions real life comparisons could help understand, both for Envision user, but also for others when results are being communicated, and would ease the process of creating content for presenting and communicating results.

P4 *"real life comparisons, I think that would help a lot in the starting phase if you use it on your own, or if you are the user of it"*

8.14 *Main theme: Envision*

This theme has 12 sub-themes which are illustrated in the theme map in figure 8.3 where each sub-themes primary content is listed as well. Each sub-theme is described in the following sections starting from INTERNAL USE (the pink sub-theme in the right corner of the theme map figure 8.3) followed by BUILDING KNOWLEDGE going counter clock wise around the theme map until the last sub-theme USE SCENARIOS.

5 themes are presented in the main report as they are primary support for the main themes these are: DATA SOURCE, section 5.2, EXPORTING, section 5.3, COMMUNICATING RESULTS, section 5.3, DATA INPUT, section 5.4 and THE REPORT, section 5.4.

Each sub-theme is presented in the following structure:

- Headline
- Summary of what the theme is about
- Findings telling what problems and obstacles the users experience
- Data points with examples of statements supporting the sub-theme

[Krause, 2020]

Figure 8.3: Full theme map of the main theme Envision with its 12 sub-themes and their main content topics.

8.15 Internal use

Summary

This theme is about what the users need to use Envision for internally in their company. They need to make both calculations of existing products and materials to use as a library and documentation. They also need to make scenarios for new product designs and potential scenarios to aid decision making and steer their product assortment, and develop a more sustainable product portfolio in the company. In this process they also typically help their colleagues and get questions and tasks from them both about specific Carbon Footprint of specific products and materials, but also questions about understanding the numbers and need to be able to explain this to their colleagues.

Findings

There is a difference in the internal use between the users. P3 stands out in the way that they have exhausted the need for using Envision and have a falling frequency, using the tool once or twice a month and consider buying the professional version instead. P4 and P5 on the other hand seem to be expanding their needs and use of the tool to more and more focused on customers and sales. Both are looking into getting more data sets and want to expand the use of Envision to their sales department, where P5 is already doing it. P2's frequency of use seems more static and more dependent on the decisions of the GaBi pro user. P4, P5 and P2 uses the tool once or twice a week on average.

Data points

P3 *"There's a 50 percent chance of continuing because we already did all the calculations"*

P4 *"When I for example develop new products that we don't have, I use it in order to make, or at least support my decision, on which products to take in, we also use it in order to steer our product assortment in another way, for example which products to sort out"*

P5 *"we are very rapidly developing our product portfolio, (...) we haven't exhausted this in our development (...), so it will continue to be a key part for us"*

P5 *"my plan is that they (sales) should also be able to (...) sit with the customer and do the LCA together with them, I think, that is one of the benefits and it gives us a higher level of transparency and confidence (...) I don't think we are doing that, but ultimately that's where I would like to see, that we strive for as well. "*

8.16 Building knowledge

Summary

This sub-theme is about the users needing to educate themselves and others. Themselves in terms of being able to talk about it and confidently answer questions from others. They need to know about their products impacts on the environment and if they can be recommended. All users have created their own knowledge base or library where they fast can look up numbers they have already calculated. Also P4 and P5 creates content for their customers and sales to help them understand and to educate them.

Findings

For all users the need for Envision starts internally, all users are using the tool for internal decision making, learning and exploring, and then it is pointed outwards towards customers, mainly for P4 and P5, while for P3 as mentioned in the previous theme INTERNAL USE P3 feels that there is not much more to calculate. As mentioned in the data points below the same thing has happened for P4 as for P3, but P4 has a greater need to continue using the tool and developing in terms of getting the sales department to use it. This is maybe also what is happening for P5, but there is no concrete examples, and it seems more that the need of calculating is mutually divided between internal and external communications, while P3 and P4 have done enough internal calculations, which has resulted in P3 not needing the tool as much, and P4 expanding the need towards using the tool more in sales and customer relations.

Data points

P4 *"I actually developed a knowledge base for myself in order to understand what is behind"*

P4 *"First it was our internal questions in order to see what actually is better (...) now it changed more to customer questions, but also our sales department, (...) and we are in the development of having, that they (sales) can, even if they don't know a lot about the calculations behind, that they can have it on hand and use it also in their sales argumentation."*

P5 *"It's about building up a general knowledge ourselves and then also generating content, (...) that will educate the customers, so maybe we don't even have to make specific LCA's for them, because they will feel more knowledgeable themselves."*

8.17 Questions & Inquiries

SUMMARY
All users gets questions about LCA and sustainability from inside the organization. That is from colleagues in their team, sales, engineers, product development and for some users also other departments not necessarily linked with their own. This is partly they (P3, P4) are the only Envision users or primary users (P5). The questions and inquiries are mainly about carbon footprint and hot spots in the products life cycle. Likewise they also get questions from customers, and this is an increasing tendency, partly because their customers become aware that the company focus on sustainability and do calculations on this and partly because of the increased market interest.

FINDINGS
Other people mainly ask about the carbon footprint of products and different hot spots in the products life cycle e.g. end-of-life and transportation. Envision helps the users answer these questions with confidence and it helps them because they can use concrete numbers and support and document their claims with a 3. party software.

DATA POINTS

P2 *"interests also comes mostly from questions from others in the organization. People would like to know, what is the carbon footprint of the product, where are the different hot spots"*

P4 *"more and more sustainability questions pop up with our customers", "sales have questions on what is better, how can I explain it to the customers"*

P4 *"it comes from internal colleagues, it comes from sales, it comes from customers, why is it like it is, why is it not like that and yes. Or how much energy is used for that, or how much is here, yeah it, but that took also a while that these questions came"*

8.18 Impact categories

SUMMARY

The most recognized impact factor for all users is the Carbon Footprint [1]. Assessing other impacts of personal and customers interest and for P3 it is also a necessity to consider all impacts and express a general interest in understanding the whole context not only Carbon footprint. The users typically looks at carbon footprint for the different stages in the products life cycle and also compare carbon footprint for different materials seeking to find and recommend the best alternatives. P5 mentions sometimes looking at water consumption on customer requests. P2 mentions having all impacts available, but only looks at Carbon Footprint. For P3 some of the impacts are all irrelevant to what they are assessing. P4 mentions spreading through all impact categories time after time if product managers and category managers wants to understand more of the background.

[1] Carbon Footprint also referred to as CO_2 equivalent (eq.) and Global Warming Potential (GWP)

FINDINGS

It differs how carbon footprint is referred to. Carbon footprint is what is most understood in the market and what customers and colleagues typically ask for. There are many impact categories available and it seems that many of them are redundant. By presenting all impact for the user, it requires requires that the user knows about these impact factors and which actually are relevant for their case. This is maybe related to the theme about users spending a lot of time educating themselves, reading standards and attending training sessions to understand results.

DATA POINTS

P2 *"what is the carbon footprint of the product, where are the different hot spots. For example is it the aluminum that weighs the most in carbon footprint or is it a plastic component."*

P3 *"from the report generally we are interested in carbon footprint because it's the mostly recognized attribute, other (impacts) are according to interest or other related issues."*

P3 *"The comparisons that is expected from our customers are usually to the fossil based materials and then its sometimes a bit shady to compare something with land use issues. (...) I don't want to just present the numbers without doing a wider discuss related to the whole topic so if I just check the numbers without context then it's not so, I don't know, reasonable."*

P5 *"I would say 90 % of our projects and inquiries we are looking at the carbon footprint as a generic overall look, with the products that we work with I don't think there's huge differences in things like acidification and water consumption, at least in the primary concern (...) some of the really big companies ask for the full impact categories, but primarily we are looking at CO_2."*

8.19 Scenarios

Summary

Envision has a limited number of scenarios the user can compare, typically 2-4 scenarios. P2 mentions comparing 2 or 3 scenarios. P4 mentions comparing products with 6-7 different kinds of material, which means 6-7 scenarios, and mentions a customer project where they mapped out 9 different scenarios. P5 mentions doing several generic scenarios and doing large projects presenting a lot of different case studies.

Findings

The limited amount of scenarios that can be compared in Envision is one of the reasons the users need to export their data, as explained in the previous theme. But this does not necessarily mean that Envision should be able to compare more scenarios. Imagine a user comparing 9 different scenarios, with each 2 product parts, 3 stages in the life cycle (e.g. raw materials, transportation, and end-of-life) and assess all impact categories which P4 mentions is 16 in total, and at the same time sort through empty product parts that haven't been used. Currently Envision shows all numbers regardless of their relevance. For example P3 mentions that it is possible to combine 3 product parts in one product scenario, but actually only needs 2, and the third product part also shows in the results in the report. Further P2 also still exports data results, even though Envision meets P2's needs of comparing 2-3 scenarios at a time. There is a need to compare many more scenarios than available in the tool, and right now the users solves this by exporting their data where they can compare and map out everything.

Data points

> P4 *"we had a Danish company, and they wanted to have (product), so we had, I think it was around 9 different (products) that we get from different regions in the world made out of different materials, but for the same purpose and the same size and also the same thickness and everything, but with different materials and different regions in the world, and then I calculated the impact for a 1000 pieces"*

8.20 Calculation time

Summary

When the users calculate and recalculate their results, it takes quite some tome. All 4 users are aware of this and all 4 users complain complain about it in the interviews. In some cases the calculation time is also causing other problems than the user having to wait. Sometimes the users have to recalculate if they missed inputting some data, P5 experiences that when leaving and returning to the computer, Envision does not save automatically, and they have to recalculate Also the users are not able to sit with customers, even though both P4 and P5 strives for that, because of calculation time, which is why P3 typically calculate before customer meetings and maybe why P5 feel the need to educate customers more, so that they maybe can reduce the number of calculations.

Findings

Calculation time is a big problem which relates to the previous subtheme about data inputting and about having too many parameters available. Calculation time complicates this process even further. Envision demands quite a lot from the user on this point. First they need to realize they have missed something (no ques from the tool, hard to locate trough all the parameters), then they have to locate the mistake they have made (go through all lines), then change or input the correct numbers and then recalculate. A rather long process for a tool that is meant to make quick comparisons.

Data points

P3 *"you have a calculation, then you want to change something and you want to recalculate sometimes it's a bit slow, and if you're spending time with a customer sometimes it's not nice to have it working so slow, so that's why we usually have built reports beforehand."*

P2 *"it takes about 5 min, it is relatively long for a calculation, it should not be that complicated (...) you should not do it too many times"*

P5 *"The calculation time is already really short in comparison to others, but I think to reduce it even further would be valuable. (...) we often calculate the full report and don't need it"*

8.21 Use scenarios

Summary

This theme is concrete examples of how the users have used Envision and are directly from the interview question where the user is asked to tell about the last time they used the tool like a story. All 4 users have each their different use case. P2 had an internal project where Envision was used to assess Carbon footprint on different materials on a new product, which for P2 is also the most typical case: having a concrete task of comparing and replacing different materials. Besides this P2 has mentioned using Envision as a library to look up basic 1 kg materials. For P3 the most common way to use Envision is in the sales customers discussions on what is the additional value on the materials they provide. The last time P3 used Envision was for an EU project where calculations and LCA tools where discussed and compared. P4 typically use the tool to compare different materials, and the last time P4 use Envision was in a customer project where 9 different designs of a product were assessed in relation to CO2 and land use. For P5 it is also mainly about comparing different materials and blends, but also makes basic generic comparisons like P2 and P4 on kg to kg analysis only focusing on materials and CO2. P5 have also been part of a bigger project to investigate and compare the different ways raw materials, transportation and end-of-life effects Carbon footprint. P5 also mentions cases where only transportation is of interest.

Findings

They are many different purposes for using Envision both varying between the users and within users internal or external use, in which case there are also many purposes of using the tool. It is the impression that the users are aware of what they are doing and what they are interested in looking at, also because part of it comes directly from inquiries from customers.

Data points

P2 *"we have a new product (...) that will replace (product 1 and product 2). I got the bill of material for three different products, and then the various parameters are selected (...). Bill of material is inputted and that is calculated in relation to that ISO standard and, I only look at the carbon footprint, global warming potential according to the N-what is it-15808 I think and that was 2-3 weeks ago."*

P3 *"we have this EU project were there's a quite big consortium and they are also doing LCA for bioplastics in Europe and as we already have this tool, I built some scenarios according to what would be most likely to happen in the near future, (...) and I used that tool to make this report that it offers automatically, to share it with others who are discussing, considering and planning LCA. So, it was like researcher to another researcher. And also,*

their partners are considering what kind of LCA tools they should use, and they were comparing and doing this kind of discussion."

P4 *"we had a company and they wanted to have (a product), so we had, I think it was around 9 different (products) that we get from different regions in the world made out of different materials, but for the same purpose and the same size and also the same thickness and everything, but with different materials and different regions in the world, and then I calculated the impact for 1000 pieces, in order to compare for us which material is the most advantageous in regards to the environment in the terms of the focus of CO2 but also the land use, because it was also natural materials included, so we mapped that out with Envision and then we recommend the customer the best choice in the terms that they wanted to have, which was CO2 and land use."*

P5 *"we are creating downloadable content for our website, and it involves highlighting sort of the USP's of our focus applications that we are targeting with our material right now (...) so we are creating content specifically for those applications and then what we have done is highlight the relevant comparison materials. So, for example for cutlery it is mainly polystyrene that is used and then we sort of brake down the different arguments against using polystyrene and part of that of course is in LCA analysis. So for that I have made several scenarios in the Gabi software (Envision), very basic, kg to kg analysis with no transportation, so it's very generic, and then using the CO2 calculation, I put it into a separate graph, that's in the PP, but we also actually have the full reports that can be downloaded on the side as well, for those groups. So, I think having the report is a really good thing for us, it gives another level of, sort of transparency and confidence to the customer. People have questions 'how realistic is that', so I think that having this third party software generating this type of report is really valuable, and we want to showcase that as much as possible, so that was it, that website will be launched in the next week actually so I think that is the first time we actually have the reports available to download, and we will be able to see who downloads them as well, as a gated content site. "*

8.22 *Empathy maps*

In figure 8.4 is the first draft of the empathy maps which is only created for P2. It framed the categories and templates for the second draft made in adobe XD figure 8.5, and the rest of empathy maps followed this framework. In figures 8.5, 8.6, 8.7, and 8.5 are the full empathy maps that are used to support the finding of user needs. Afterwards they are compressed into the empathy maps included in the main content in chapter 6.1. In the empathy maps presented here the content that is included in the compressed version is represented with colored post its, while the content that is taken out of the compressed versions is grayed out.

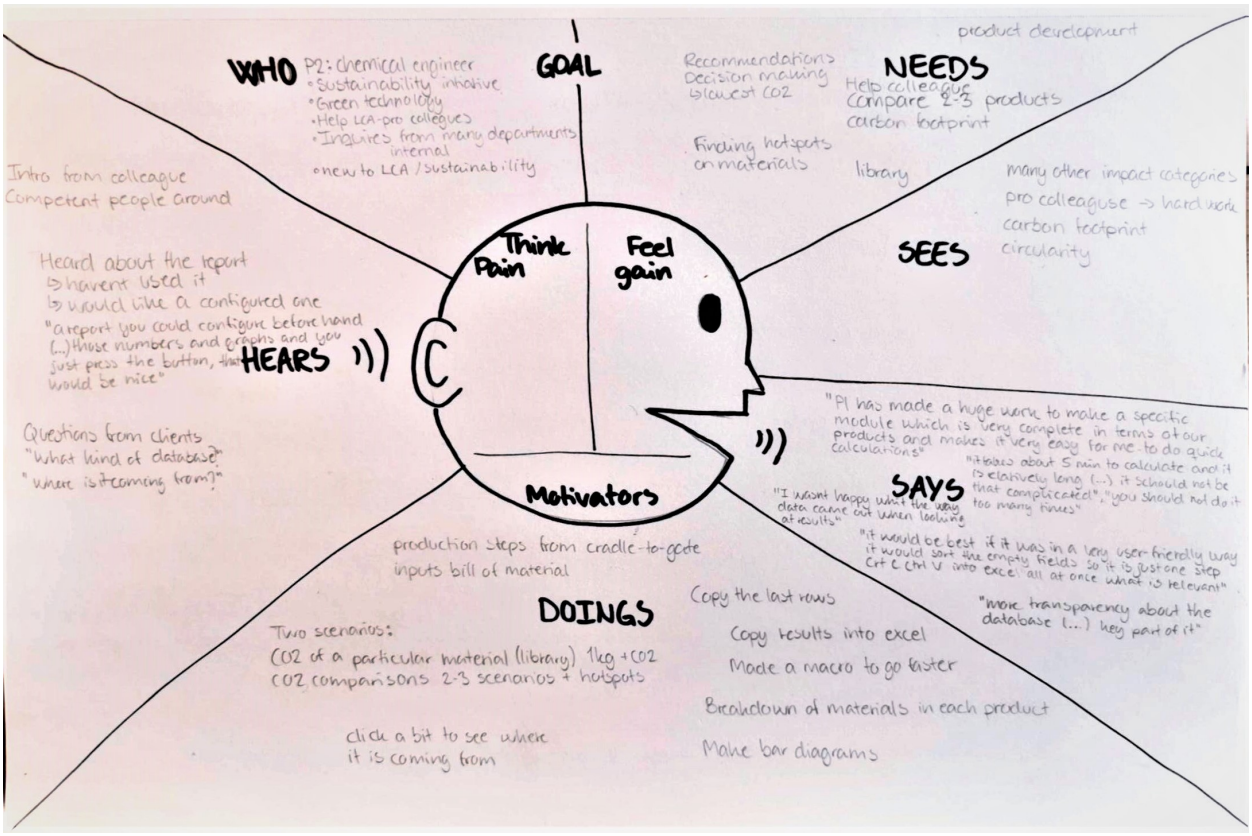

Figure 8.4: Paper draft of empathy map for P2

8.23 *Introduction to developer meeting*

Intro: *"Thank you for participating. I will shortly present the plan for this meeting. The time frame is 1 hour, which means I will be strict in keeping the schedule. The first part I will present 4 empathy maps of the users who participated in the study. This is a very important part for understanding who they are and understand what I present next, which is 3 different user needs causing trouble for these users. Please write down any questions you might have, there will be time for questions after each presentation. When this is done I have prepared a little workshop for you, where you will be presented for some design solution ideas for each of the 3 problems I presented for you. Together you will rank them on 3 different parameters. I will facilitate that, and explain along the way. In the end we have 5 min. for discussion and comments. Do you have any questions before I start?"*

Start: *"4 different user participated in this study, and it is important for me to tell you that they are from each their different company using each their different Envision model, which means it is completely new insights compared to what we know about the users from 1st iteration. I will start presenting the first participant."*

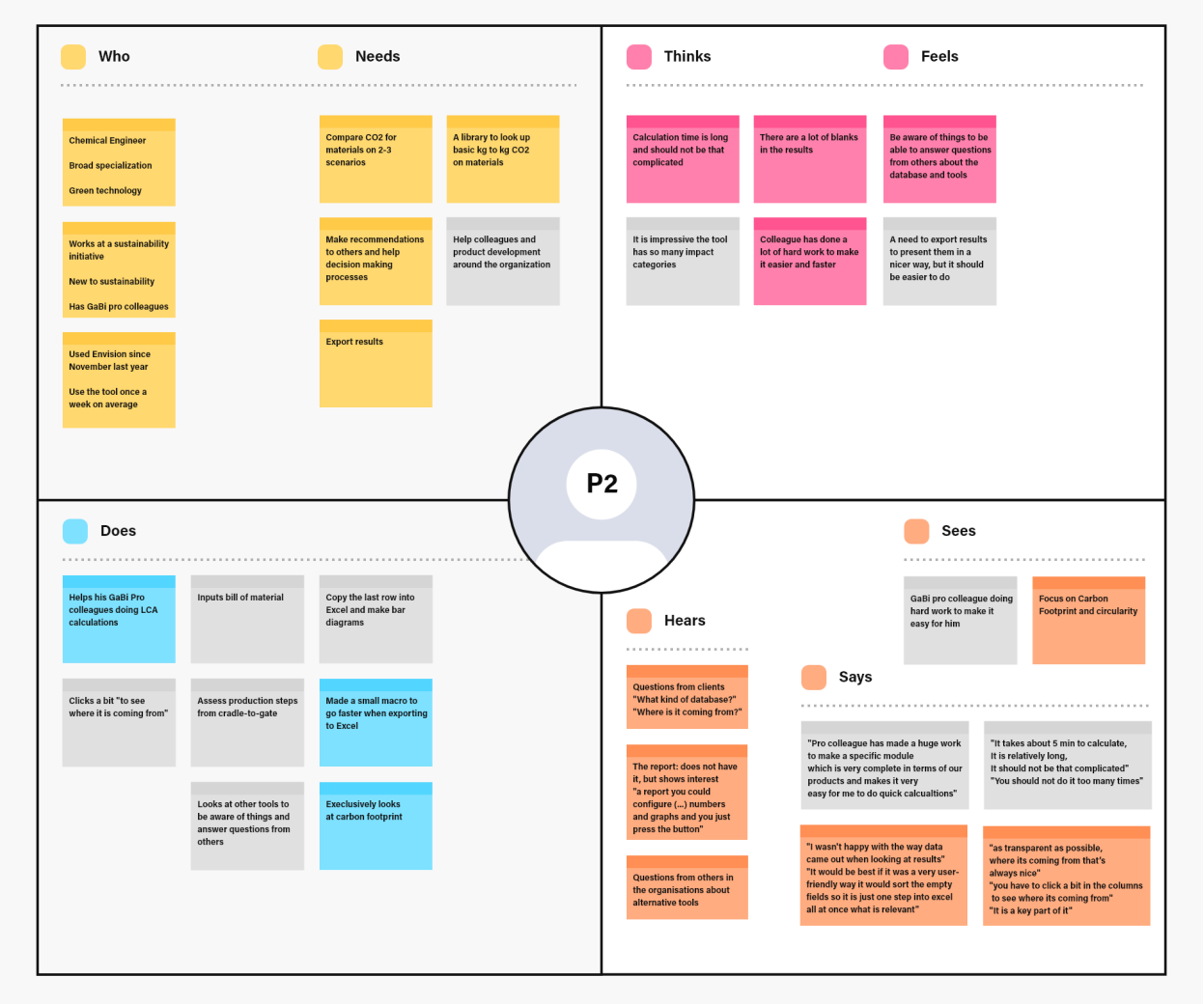

Figure 8.5: Full version of the empathy map for P2. The post its that are greyed out are the ones that are taken out of the compressed version.

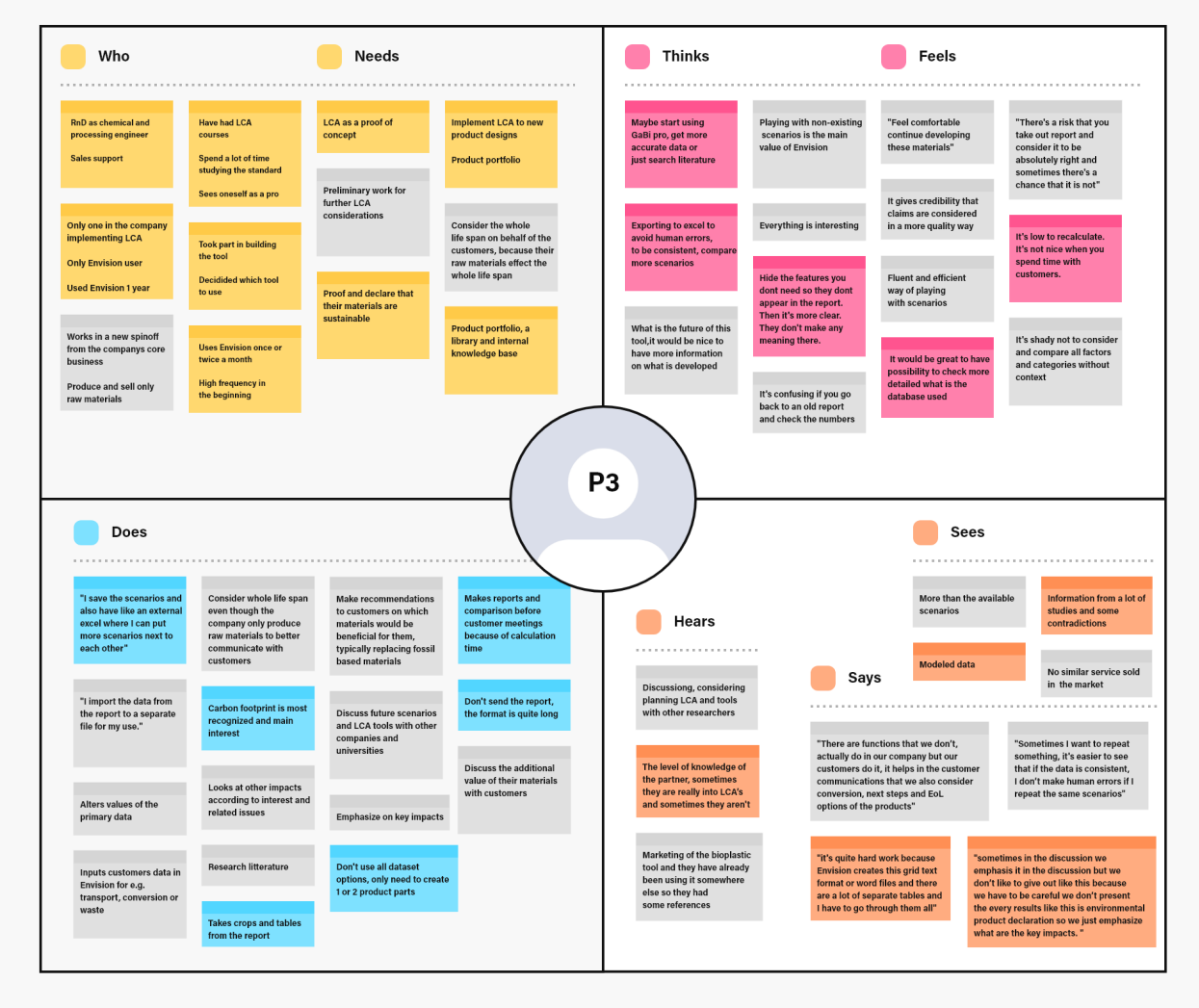

Figure 8.6: Full version of the empathy map for P2. The post its that are greyed out are the ones that are taken out of the compressed version.

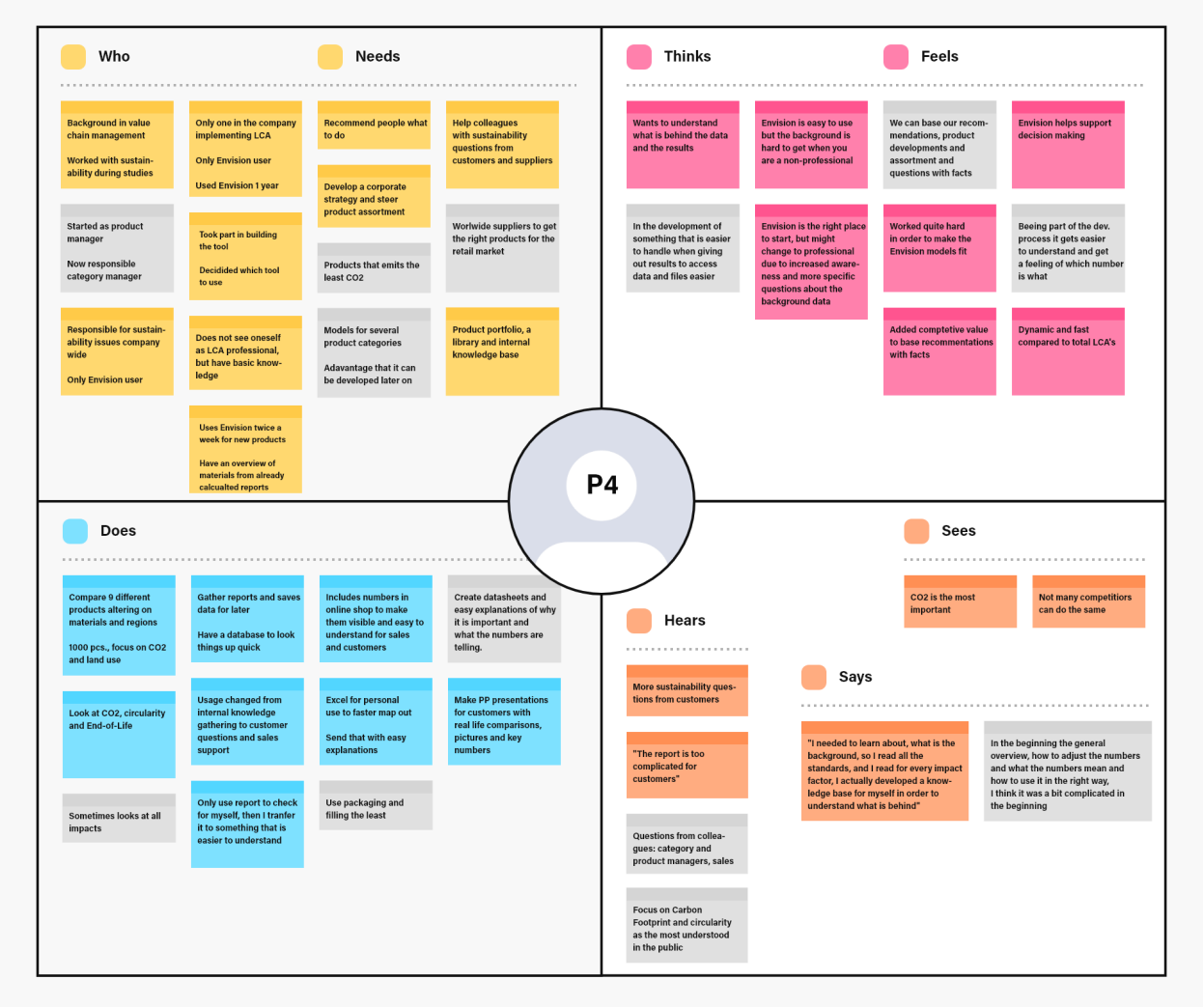

Figure 8.7: Full version of the empathy map for P2. The post its that are greyed out are the ones that are taken out of the compressed version.

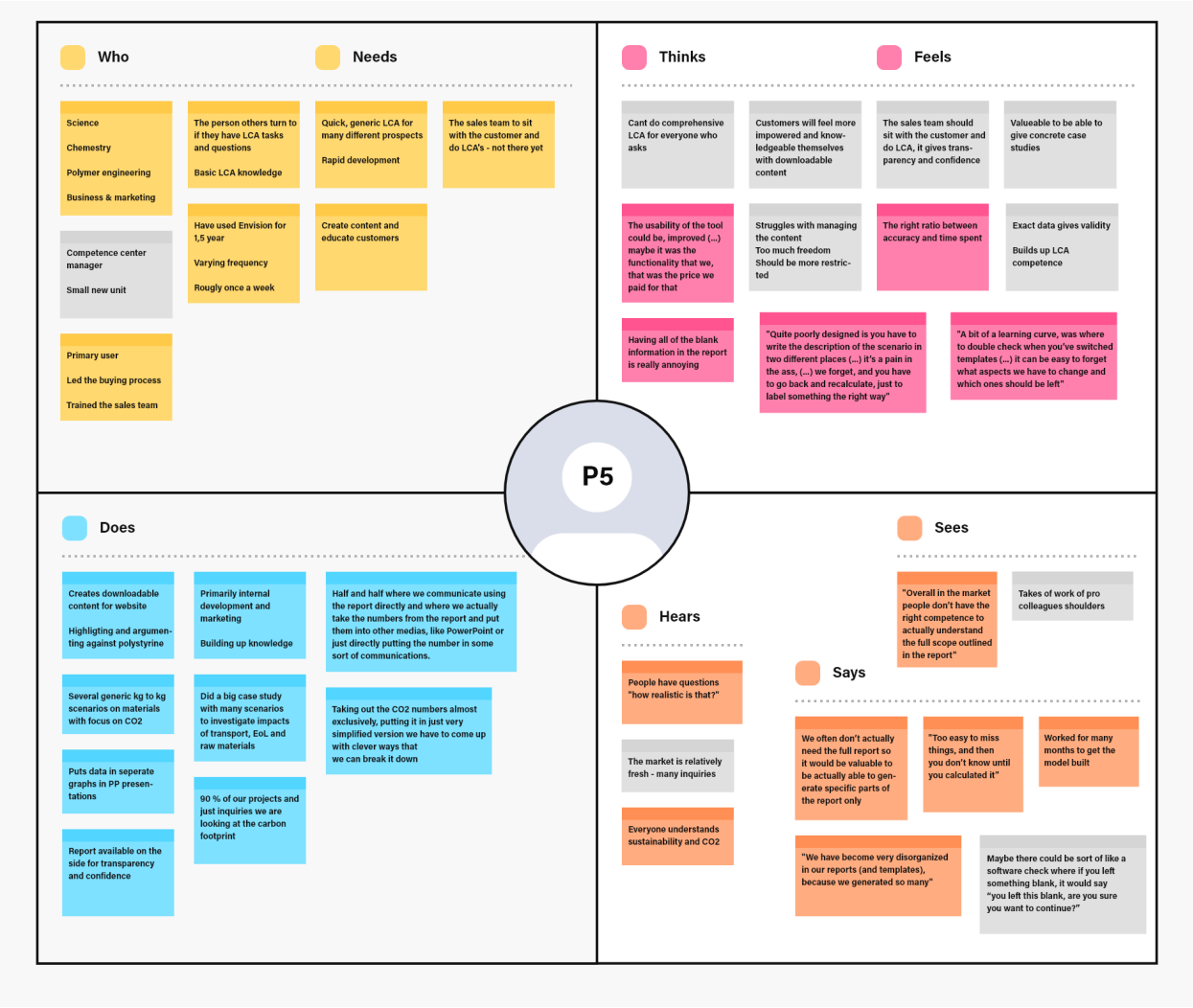

Figure 8.8: Full version of the empathy map for P2. The post its that are greyed out are the ones that are taken out of the compressed version.

Annex

8.24 *Annex\1stDesignIteration.pdf*

8.25 *Annex\StakeholderInterview*
8.26 *Annex\StakeholderInterview\FieldNotes*
8.27 *Annex\StakeholderInterview\InterviewGuide*

8.28 *Annex\UserInterviews*
8.29 *Annex\UserInterviews\Material*
8.30 *Annex\UserInterviews\Material\Consent_DA*
8.31 *Annex\UserInterviews\Material\Consent_ENG*
8.32 *Annex\UserInterviews\Material\InterviewGuide_DA*

8.33 *Annex\UserInterviews\P2*
8.34 *Annex\UserInterviews\P2\P2_Consent*
8.35 *Annex\UserInterviews\P2\P2_Transcription_DA*
8.36 *Annex\UserInterviews\P2\P2_Transcription_ENG_Translation*

8.37 *Annex\UserInterviews\P3*
8.38 *Annex\UserInterviews\P3\P3_Consent*
8.39 *Annex\UserInterviews\P3\P3_Transcription*

8.40 *Annex\UserInterviews\P4*
8.41 *Annex\UserInterviews\P4\P4_Consent*
8.42 *Annex\UserInterviews\P4\P4_Transcription*

8.43 *Annex\UserInterviews\P5*
8.44 *Annex\UserInterviews\P5\P5_Consent*
8.45 *Annex\UserInterviews\P5\P5_Transcription*

8.46 *Annex\ThematicAnalysis\NvivoFiles*
8.47 *Annex\ThematicAnalysis\Phase1Codes.xlsx*
8.48 *Annex\ThematicAnalysis\Phase3Themes.xlsx*
8.49 *Annex\ThematicAnalysis\MindmapsPhase4Level1*
8.50 *Annex\ThematicAnalysis\ThememapsPhase4Level2*