Integrating Contextmapping and Interaction Design: designing with and for small-scale urban farmers in Soweto.

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Plagiarism Declaration

I know the meaning of plagiarism and declare that all of the work in the document, save for that which is properly acknowledged, is my own.

Signed

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Abstract

This thesis describes and reflects on the effectiveness of integrating contextmapping as both a methodology and interaction design practice in order to co-design digital products with and for developing communities.

A Design as research methodology is applied in this study within the specific contexts of a co-design project involving small-scale urban farmers in Soweto. The final design outcomes of the project are the interaction design documents reflecting the design requirements of a mobile application as well as a low-level prototype demonstrating a number of the identified requirements contained in the documentation. The study assumes a human-centred design ethos that positions problems facing users as contextual, complex and indeterminate and requiring a degree of consideration and understanding by the designer before they can be resolved. The design process applied in this study therefore focused on gaining an understanding of the farmers' life experiences in order to design effective and empathetic technological solutions that will be meaningful and useful to the farmers.

For this purpose, contextmapping and interaction design theory, methods and tools were integrated. Examples of this integration include the application of Hassenzahl's *Three Level Hierarchy of Needs* model to guide the exploration of the farmers' experiences and contexts, the use of contextmapping*'s* Sensitization Phase and generative tools to generate user research data and lastly, contemporary interaction design tools such as problem-ecology maps, personas and user- journey diagrams to develop and communicate design concepts to the farmers.

The study concludes that this integration of contextmapping and interaction design is effective, in particular through its enablement of community participation in contributing meaningfully to the co-design process while further ensuring that contributions made by the participants are relevant and actionable to the interaction design.

Content

List of figures

Please note that the interaction design models and diagrams appear in a larger legible form in the Appendix Page

List of acronyms

AT	Activity theory
HCD	Human-centred Design
HCI	Human-computer Interaction
ICT	Information and Communication Technologies
IXD	Interaction Design
PD	User interface
UI	Participatory Design
UXD	User Experience Design
xD	Experience Design
ICT4D	Information and Communication Technologies for Development
ANT	Actor-Network Theory

Naming conventions of fields, methods and methodologies

As this dissertation contains a large number of design and research methods and methodologies in order to firstly identify them and to secondly avoid the confusion that can occur when left unidentified in a sentence (as many of them have a tendency to echo verbs or activities) the following conventions will be used:

1. When a field, method or methodology is referred to in text as a noun and in its full form it's font is dark blue**.** When used as a verb they are not. For example: 'co-design' is the field of practice while 'co-designing' is an activity.
2. When it is referred to as an acronym there is no colour change - 'IXD'.
3. Titles including models, books and aspects of the design are *italicised*.
4. Sections of the paper when referred to are capitalised- 'Literature Review'.
5. Phases of the primary methodologies used in this dissertation are also capitalised. For example, 'Analysis Phase'.

Chapter 1:

Introduction to the Study

The role of information and communication technologies (ICT) as an enabler of solutions that respond to the needs of developing communities has long been recognised [1, 2, 3]. ICT is however not value neutral and carries particular cultural and political assumptions [4]. These assumptions are often the result of ICT's focus on creating solutions for commercial clients and users in the developed world. Development communities tend to have different aspirations, needs and behaviours and thus require ICT products that are appropriate for their needs. A key aspect of creating 'appropriate' products and systems is the inclusion of stakeholders in the planning, implementation and evaluation of the design process, thus "*shaping the multiple ways in which ICT can support development*" [3 p.7].

In this regard, this study is concerned with co-designing meaningful and useful digital interactive products for and with developing communities. Interaction design (IXD) is interpreted here as *"a design approach focusing on situated interaction and meaning making"* as opposed to a more traditional human-computer interaction (HCI), positivist investigation focused on cognition [5 p.7].

1.1. Aims of the study

The specific aim of the study is to assess if theory, methods and tools of co-design and IXD integrated in a design intervention focused on the needs of a developing community could result in:

- A meaningful contribution by the participants to the design decision-making process.
- And that these contributions result in insights that are relevant and actionable within interaction design practice.

1.2. Scope of the study

The participants involved in the project were small-scale urban farmers[1] (farmers) working in Soweto, Johannesburg. The specific co-design methodology used in the study was contextmapping [6,7,8,9]. The problem that emerged during the co-design process, which the IXD provides a solution to, is the difficulty Soweto farmers have in accessing information relevant to their farming activities. The practical IXD outcome of this study are low fidelity prototypes for a mobile web application[2] called *Khula*[3] that was designed with the intention of facilitating the farmers' access to information.

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1 A 'small-scale farmer' is a farmer who farms to sell produce albeit on a very small scale. Small-scale urban farmers are more business focused than subsistence farming but not formal farm business owners.

2 Abbreviated to an 'app' or 'site' subsequently in this text

3 *Khula* is the Zulu word meaning 'grow' or 'growing'.

1.3 Outline of the study

As the emphasis of the study relates fundamentally to design, the Research through design methodology [5, 10] was selected to guide the research process. Selecting a Research through design methodology enables the study to contribute new knowledge to the fields of IXD and Human-computer Interaction (HCI) through a critical reflection of a practical, 'real world' design project.

While the co-design of the mobile application and its effectiveness in meeting the farmers' needs, as described in Chapter 4: Process, is an essential component of this study, the primary focus of this academic study is the effectiveness of the contextmapping design approach in the conceptualisation and design of an interactive product. This summative focus is described in Chapter 5: Discussion.

The research process focuses initially on establishing a concise theoretical description of co-design and IXD, outlining current viewpoints and possible approaches to the two fields as a unified design process. A range of these theoretical positions, most notably those of Marc Hassenzahl [11], Peter Wright and John McCarthy [5,12] are combined in a theoretical framework that is applied in the co-design of a digital mobile application for the Soweto farmers.

In correlation to the literature, the problems facing the farmers were recognised as contextual, complex and indeterminate. The initial phase of the design process therefore focused on obtaining a shared understanding of the farmers' experiences by applying aspects of the contextmapping methodology in workshops and exercises with community participants. The workshops and exercises resulted in a data set that was analysed and synthesised to extract insights reflecting the farmers' experiences and goals. These insights, which included the farmers' need to improve their knowledge of farming, to create sustainable businesses and to be valued within their community, were presented back to the farmers in various visual mappings to validate if the insights were an accurate interpretation of their reality and experiences.

Experience prototypes describing how the design solution could help resolve a number of the issues facing the farmers were also presented for discussion. Once agreement was reached regarding the validity and relevance of the mappings and experience prototypes, concepts embedded in these artefacts were used to define the interaction design of the mobile application. The concluding activity of the design process was the testing with the farmers of the design concepts using an array of low fidelity prototypes. At this stage it was evident that the use of contextmapping had resulted in a valid and effective approach to co-designing IXD products.

The study concludes by critically evaluating and discussing the Invention[4], Relevance and Extensibility of the situated project so as to determine the research contribution it offers to the fields of IXD, HCI and human-centred design (HCD).

1.4. Background to the design project

1.4.1. The design problem and aim

A robust and sustainable agricultural sector is important in ensuring food security and directly contributes to the elevation of many health, hunger and economical concerns. The *United Nations' 2001 Human Development Report* predicts that by 2025 the world's population will require a doubling of agricultural production [13]. Although the province of Gauteng has been identified as one of the world's leading hubs of technological innovation [14], there is a huge disparity in access to information across the various social and geographical groupings. Small- scale urban farmers in Gauteng contribute to the food security of the region, however, like many of their fellow farmers in the developing world they are often marginalised due to highly competitive commercial global farming practices and poor access to information and markets. Additionally, farmers in Soweto are faced with problems as diverse as a lack of training, inefficient municipal and government support, lack of willing labour, access to land, theft and social stigmatization [15].

In collaboration with the Izindaba-Zokudla [16] and the Soweto Region D Farmers Forum [17], the focus of this project is the interaction design of a mobile web application to improve the transfer of knowledge pertaining to permaculture[5] and the diversification of agricultural products to small-scale urban farmers in Soweto, in order to assist them in creating sustainable farming businesses.

1.4.2. Mobile phones as the selected delivery channel

Mobile learning or 'm-learning' is the term used to describe the use of mobile phones to deliver or enhance learning activities. M-learning is unique in its own way and offers flexible learning opportunities through a cellular network [18]. Numerous studies [2,19, 20] have focused on the value of mobile devices for learning. Traxler and Leach [20] describe m-learning as mobile training and or performance support that pursues activities that aim to "*improve the productivity and efficiency of mobile workers by delivering information and support just-in-time and in context for their immediate priorities*" [p. 99]. This description positions m-learning as a suitable approach for realising the broader goals of the proposed research project that is to support information needs of urban farmers.

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4 Invention, Relevance and Extensibility are specific evaluation criteria of the Research through design methodology

5 Permaculture is an approach to agriculture that prioritises natural and sustainable farming methods and products

1.4.3 Development contexts: a problematic concept

This study acknowledges that notions of 'development' can be contentious and that ICT is not value neutral but carries particular cultural and political assumptions [21].

In respect of these ethical considerations, this study applies a HCD philosophy to be as inclusive as possible. It considers development communities to be heterogeneous and have different needs and problems. In terms of language, the phrases 'development contexts', 'development communities' and 'development participants' are not used to imply any deficiency outside of access infrastructure, technology, information and capital.

1.5. Research questions.

The aim of this study is to ascertain the viability and value of integrating the contextmapping methodology in the co-design of meaningful and useful interactive products for and with farmers in Soweto.

The primary questions that collectively support this enquiry are:

1. By involving community participants within a contextmapping methodology, will they contribute meaningfully to design decision-making?
2. Can contextmapping generate insights that are relevant and actionable for interaction design purposes?

Question 2 can be further broken down into 4 questions. The first 3 of these questions relate to Marc Hassenzahl's *Three Level Hierarchy of Needs* [11], which in this dissertation is viewed as a model for understanding human activity, a central concern of IXD.

These questions are:

I. *What are the main aspirational needs that motivate Soweto farmers?*
II. *What are the information needs of Soweto farmers pertaining to permaculture and product diversification?*
III. *What are the behaviours and strategies currently practiced by Soweto farmers when acquiring information related to permaculture and product diversification?*
IV. *Can these insights be applied meaningfully and effectively in the interaction design of a digital product?*

While the Question I-III, explore the relevance of insights to IXD practice, Question IV examines how these insights can be applied in practice, and, as such, is the following:

1.6. Structure of the thesis

As this thesis follows a Research through design *(see Chapter 2, pg 8)* methodology the structure of the remaining chapters of this thesis are as follows:

- Chapter 2 reviews the research methodologies that will be applied.
- Chapter 3 contains a review of the literature that is used to define a framework for the practical design project.
- Chapter 4 describes the process aspect of the design project and as such describes both the contextmapping and IXD activities.
- Chapter 5 is the Discussion that is structured around the *Invention*, *Relevance* and *Extensibility* criterion for evaluation of the Research through design methodology.
- Chapter 6 concludes the study.

1.7. Ethics

An important focus of this study involves enquiry into the personal experience of others. Thus, the consideration of how to conduct the study in an ethical manner was prioritised. As the participants involved in this study were from 'vulnerable' communities, a particular decision was made to ensure that ethical clearance (with an ethics clearance number) was obtained officially through the University of Cape Town's ethics committee, as well as unofficially through the community channels in Soweto.

The unofficial clearance was obtained from the Soweto Farmers Forum during their May Monthly meeting, 2014, where the research project was presented to the forum members. Permission to do the study was granted by the forum and a contact person was made available. At this stage a call for participant volunteers was made to the members of the forum in attendance to take back to their fellow farmers. It is worth noting that the designer had been involved with the forum for at least a year prior to the presentation of the project.

At the beginning of the research study, the activities and aims of the study were explained in detail to the participants. Participants were informed of their right of consent, privacy and disclosure. Permission was asked to document the process and for the subsequent use of the documentation for research/academic processes.

The participants responded positively and the general consensus was that they felt happy to contribute towards something that would bring benefit to the broader farming community. All agreements were documented.

In my experience, one of the key misunderstanding that arise when doing design/technology related work in communities from development contexts is that participants expect a final product to be available to them at the conclusion of the project. In order to avoid this expectation a decision was made with Izindaba- Zokudla and the Farmers Forum to pay stipends to the participants in line with a day's worth of work on a farm.

The participants' expectations, as well as the need for honest and critical responses were discussed with the participants at the beginning of each session. Lastly due to the nature of the research engagement (the application of generative tools), bias from receiving payment was unlikely to affect the study.

Chapter 2:

Methodology

The methodologies used in this project include a review of the literature that focuses on IXD, contextmapping and Research through design [10].

Contextmapping is applied as the participatory methodology. As well as guiding the co-design process, contextmapping is used to apply theoretical framings identified in the Literature Review.

Research through design is a methodology that has a specific focus on integrating interaction design research within HCI [10]. In the Research through design method, designers produce original 'integrations' that engage with theoretical concerns in an attempt to "*make the right thing: a product that transforms the world from its current state to a preferred state*" [10 p.1].

Research through design is applied in this thesis to ensure that the (co-) interaction design project makes an explicit research contribution to the field.

2.1. Contextmapping

Contextmapping is a form of HCD [23], a design philosophy that focuses on the user and the context of use throughout the planning, design, implementation and reflections of a design solution

Contextmapping [1] was developed at the Department of Industrial Design at Delft University of Technology in the Netherlands, during the early 2000s. Contextmapping techniques have since been successfully applied across numerous domains to explore the "hidden world of user experiences" [6 p.5] in order to build a better understanding of experience.

While there are numerous design methodologies that broadly follow HCD principles (see Figure 2.1) contextmapping is a form of co-design. Co-design is a contemporary form of participatory design that focuses on creating new technologies or opportunities with everyday people, who are affected by a problem that technology or opportunities aim to resolve [23]. Community co-designers are seen as "*experts of their own experiences*" [6 p.5] and thus contribute to the research and design process in a more in-depth and collaborative way than in other modes of user research such as contextual inquiry that tend to treat the user as a subject to be studied [23]. Both participatory design and co-design has been applied to a number of ICT projects that focus on development issues [24,25, 26].

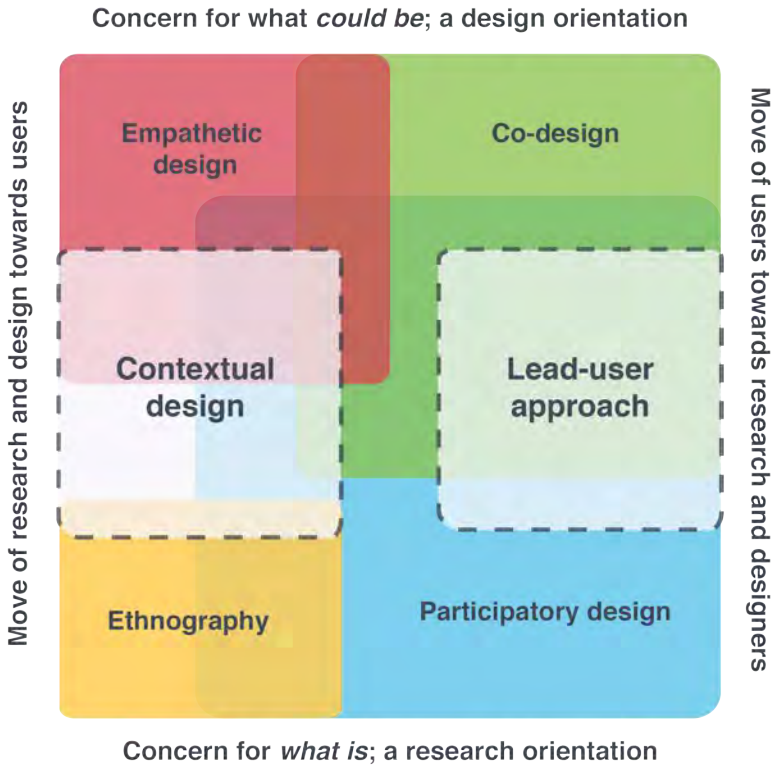

Figure 2.1: The different approaches to HCD (after Sanders, in [23])

The contextmapping methodology consists of six phases [6, 7, 8], *Preparation, Sensitization, Sessions, Analyses, Communication* and the *New Design Concepts.* These phases are discussed in detail in Chapter 4, Process. Briefly, they include:

- The Preparation Phase involving the formulation of research goals, preliminary mapping, selecting participants and choosing techniques.
- This Sensitization Phase which involves the preparing of participants for the co-design groups sessions.
- The Sessions Phase is the facilitation of co-design group workshops to learn about participants' potential future experiences.
- In the Analysis Phase, qualitative data collected during the workshop is analysed.
- The Communication Phase is when the designer presents an articulation of the users' experiences, resulting from the analysis, to the co-designers in both visual and narrative formats.
- In the New Design Concepts Phase the scope of practice returns to the 'standard' design practice, which in this project would be IXD.

Contextmapping can be considered a viable research methodology for the purpose of this study as it is specifically designed to help designers gain empathy with users, avoid fixation on pre-set

assumptions about the user or the product, and to create innovative concepts related to product experience [6].

The term 'context' is used to refer to all the factors both environmental and personal that "*influence the experience of a product use*" [6 p.3]. Contextmapping thus places a strong focus on the human contexts in which product use takes place (or will take place) while not overly fixating on existing products [6]. The use of 'mapping' in the name reflects the strong emphasis placed on visually displaying concepts in order to foster communication and express concepts.

Lastly, contextmapping is a *design* research method and as such it has been applied previously to interaction and industrial design work [8]. The design process of IXD (see Literature Review, pgs. 12- 13) can easily be contained within a contextmapping methodology, as depicted in Figure 2.2.

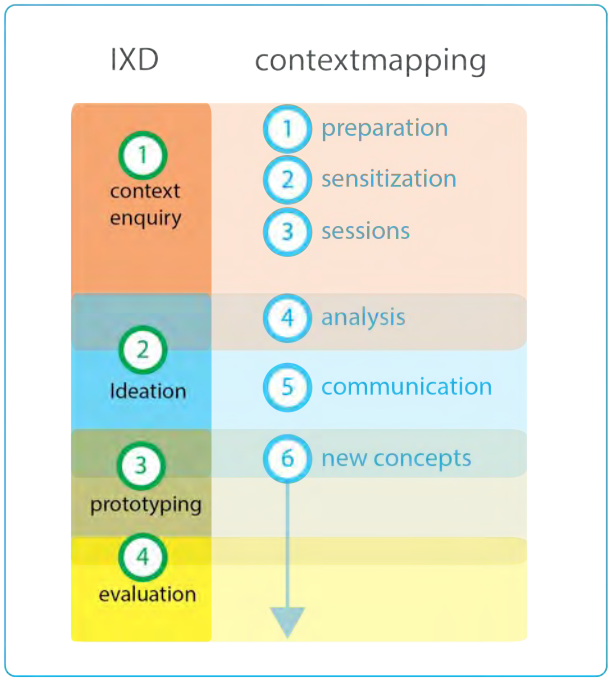

Figure 2.2: Relationship between the stages of IXD and those of contextmapping.

2.2. Research through design

Research through design is orientated around the creation and testing of prototypes [8] and other designed artefacts. According to Wright and McCarthy [5 p.92], Research through design similarly to action research involves the designer/ researcher as an agent in the situation taking some form of action to "*evaluate the action or throw light on how the situation is understood*". Often a Research through design approach is used to reflect on designers' actions and outcomes. Thus in this report, the Research through design methodology is used as a reflective summary evaluation of the co-design process. Zimmermann *et al* [10] present a set of criteria for the evaluation of a Research through design contribution, which are listed on the following page.

1. Process

This criterion requires that processes employed in the design be documented in sufficient detail so that they can be reproduced. The evaluation of the work is based on the rigor applied to the methods and the subsequent rationale for the selection of specific methods.

2. Invention

The research needs to demonstrate a novel integration of various subject matters to address a specific situation. This integration needs to be situated in reference to existing literature and detail what contribution the research makes.

3. Relevance

While scientific research requires validity, design problems are often unique to context and can be solved in many different ways. Thus, relevance of the project, for example why the transformed state made possible by the design is preferable to the existing one, is prioritised over scientific validity. This needs to be articulated and supported in the research.

4. Extensibility

The final criterion for judging successful design research is the ability to build on the resulting outcomes of the design research. This could be by describing how the process could be employed in a future design problem or considerations of the value and impact of what was learned in the creation of the design products.

Chapter 3:

Literature Review

The aim of the Literature Review is to provide an account of a range of the current theoretical and philosophical positions that inform the design thinking and implementation of the practical aspect of the research project. As such, the fundamental focus of the review is to explicate specific approaches for creating digital products that are relevant, usable and useful to developing communities.

This review is divided into two main sections namely the Theoretical Framework and Related works in ICT4D.

With respect to the focus of the review, the Theoretical Framework initially discusses the role of IXD in relation to both HCI and the broader field of HCD. The value of this discussion is centred on how IXD applies a particular 'designerly' way of resolving complex and often indeterminate societal problems whilst utilising the opportunities afforded by contemporary ICT.

The second sub-section of the Framework analyses how experience-*led* design addresses peoples' life experiences in order to shape, constrain and inspire interactive products. The discussion proceeds to review the philosophical underpinnings that inform Wright and McCarthy's dialogical [5] approach to participatory design, which positions understanding of users' life experiences, as essential to any design process.

The third sub-section introduces Hassenzahl's *Three-level Hierarchy of Needs model* [11] and argues for its validity in insuring that participatory engagement does result in actionable findings and outcomes that directly contribute to insuring the usefulness of the final digital product.

The Framework concludes by critiquing both participatory and activity theory approaches to IXD and suggests how they can be integrated into a framework for practice.

The Related works in ICT4D section briefly reviews a range of key text and theoretical positions that inform ICT4D, the field that this study relates strongly to and identifies with. This account takes on a particular South African account of the field.

The Literature Review concludes by presenting an outline of key insights, which will be applied to and critiqued by the design practice.

3.1. Theoretical Framework

3.1.1 Interaction Design, Human-computer Interaction and Design

As noted by Zimmerman et al [10] much of the terminology used within the HCI and design communities is understood or applied in an inconsistent manner. Thus to clarify meaning, it is worth defining how the terms IXD, HCI and design are applied in this research project.

IXD is commonly used as an umbrella term to describe a range of disciplines and practices concerned with the design of digital products[6] that facilitate the communication and interactions of people in their everyday life [27]. These disciplines include experience design as well as user-interface design, software design, user-centred design, product design, web design, and interactive system design.

HCI is understood as the design, evaluation and implementation of interactive computer systems for human use and the related study of the phenomena surrounding these systems [27]. IXD is closely related to HCI [27, 5, 10, 12, 28] as both fields are fundamentally concerned with the design of digital software, products and systems[7] from the perspective of how humans interact with digital technologies.

Many authors do not distinguish between the two fields viewing IXD as a latter day version [34], extension of, or offshoot from HCI. For example, Wright and McCarthy [12 p.3] refer to HCI with a focus on "relationships between people and interactive technologies" with an onus on "peoples lived experience" rather then functionality as IXD. Rogers, Sharp and Preece [27] describe IXD as similar to HCI but with a broader application concerned with the theory, research, and practice of designing user experience for all manners of technologies, systems and products.

Other authors contend that HCI and IXD are related but distinctly different. Zimmerman et al [10] describe HCI as having a strong focus on technology engineering and behavioural science while interaction design is described as a complimentary knowledge form that applies HCI research *"in an attempt to make the right thing: a product that transfers the world from its current to preferred state"* [10p.1]. Cooper [29] and Lowgren [30] extends this definition to conclude that although IXD has been highly influenced by HCD, IXD has been equally influenced by design fields such as communication design, industrial design and architecture and that in its is orientation towards exploring the possibilities of what might be, interaction design is an inherently design discipline. This thesis applies this interpretation of HCI and IXD in which IXD is a design discipline that applies and contributes to HCI knowledge.

The term design as used in this review refers specifically to the practices, theories and methods involved in the creative and innovative resolution of problems affecting people and society. This

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6 While generally used to in relation to the design of digital products IXD is not restricted to just digital products. Industrial designers could for example apply IXD in the design of a new vacuum cleaner.

7 Referred to collectively as 'digital products' in the remainder of the paper

definition is different to the common use of 'design' in HCI that refers to the engineering of software systems [10]. Additionally, this view of design can also be contrasted with a stereotype of design as focused on surface structure and visual aesthetics [10]. Design as an act of societal inquiry and positive, transformative action through the conceiving of the possibilities of the artificial is commonly referred to as 'design thinking' [31, 32] and it is this definition of design that will be applied in this review.

Essential to understanding design thinking is the contemplation of, and approaches to resolving 'wicked problems'. The term wicked problem was first coined by civil engineers, Hans Rittel and Mervin Webber, in 1973. In *Dilemmas in a General Theory of Planning* [32], Rittel and Webber describe the need to resolve civic problems through a better understanding of how the problem impacts and relates to the needs and aspirations of the surrounding society. While Rittel and Webber describe the requirements of understanding a problem as necessary in order to solve the problem, they also warn that understanding societal problems is itself an arduous process as the problems themselves can be ill-defined and elusive, hidden in the complexity of social reality and offering no clear direction for resolution. The complexity of the Soweto farmers' problem as described in section *1.5.1.The design problem and aim* (pg 3), is a classic example of a wicked problem. The complexity introduced in attempting to clarify wicked problems is amplified as wicked problems seldom present obvious or determinate solutions [30, 32].

Design theorists such as Richard Buchanan [30], Nigel Cross [33] and Keinonen [22] and Johann van der Merwe [34] describe design as a discipline-neutral groundless field of practice that constantly sources knowledge, skills, practices and contexts from other fields of knowledge as dictated by the location of the specific design problem.

This conception of design as complex and indeterminate favours a HCD[8] approach allowing problems and their reciprocal design solutions to emerge from the contextual placement of the design intervention [30, 32] through communication and collaboration with the user and stakeholders. This view recognises design as a subjective act of meaning-making informed by the designer's "*informed and specific interpretation*" [22 p.18].

Therefore while design problems (and by default IXD problems) are not always wicked, and IXD is not always digital, and not all HCI can be applied in practice, this review positions interaction design as the application of HCI theory and technology, in combination with design theory and methods, for the resolution of wicked problems[9].

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[8] While Keinon [22] makes the distinction between User Centered Design and Human Centered Design, he acknowledges that these terms are often used synonymously. I use HCD in this review.

[9] Zimmerman et al [10] describe IXD as such.

3.1.2. Interaction Design

As stated earlier, IXD is a multi-disciplinary field and as such has a wide variety of methods and practices. At a general level IXD consists of a number of phases that are described below:

- **Establishing contextual requirements** [27, 28].

  Requirements include identifying the end-users that would use the product, how they would use the product, where they would use the product and lastly what kind of activities and goals the products will facilitate for the users [27].

- **Ideation**.
  Ideation is the design of alternatives [28, 29]. Alternatives in this sense can be understood as 'alternative' to what exists currently (or alternative to nothing).
- **Prototyping**
  Prototyping [27, 35] is the concrete representation of a design concept. Prototypes can exist at a very low level of fidelity or at a high level fidelity where the prototype is very close to the final product. In IXD the prototype is constructed in order for the designer to understand problems and opportunities through the process of making and/or in order to test the validity of the solution with a test group of end-users.
- **The Evaluation Phase**
  The evaluation phase of IXD is concerned with ensuring that the design is appropriate [27] to the people it was designed for. Evaluation can be formative occurring at stages during the design process or summative at the end of a particular stage such as high fidelity user testing. The point of evaluation is to routinely test that the design hypothesis embedded in the prototypes and product reflects the needs, aspirations and abilities of the designated user group.

While working within the general framework of IXD, a focus of this project is to design products that correlate with the users' current life-experiences (so that the products are needed and can be used) in order to enhance and transform future experience (so that things can be better). Therefore, while applying other practices of IXD in the practical project as described in Chapter 4, the remainder of the review focuses on experience design.

3.1.3. Experience Design

Experience design (xD) is a discipline of design that seeks to design solutions that reflect people's current life experiences and/or curate people's experiences through design solutions. In IXD the design of the users experience[10] normally refers to the design of how products work and behave

[10] Any discussion concerning experience design needs to acknowledge the relationship between experience design and user- experience design (UXD or UX). In this review UXD is understood as a broader discipline [36] that encompasses "*the practices of information architecture, interaction design,*

and the subsequent 'experiences' people derive when using them [37, 27, 5] and as such can be considered under two main areas of practice namely, usability and experience design [27].

3.1.3.1. Usability Design.

The goal of usability design is to ensure that interactive products are designed to be easy to learn and effective to use [27]. The practice of usability design involves '*optimizing the interactions people have with interactive products*' [27 p.19] to enable them to carry out the activities offered by the product [27]. The key goals of usability design are efficiency, effectiveness, safety, utility, learnability and memorability [27]. Often these goals are used to assess how an interactive product improves or does not improve users' performance [27].

Hassenzahl contends [11] that while the usability and utility aspects of interactive products are important, in themselves, they contain no meaning. The usability focus is primarily on enabling the experience rather then creating the experience. However, without a considered design of usability an interactive product even with a well thought out experience strategy, will likely result in a negative and frustrating experience for the user.

3.1.3.2. Experience Design

Experience can be described as a continuous commentary of 'self talk' that reflects the stream of feelings and thoughts that people have while conscious and which is distinctly different from 'having an experience' [11]. Experience is considered an emergent quality, which is both subjective and situational [12]. Thus experience arises from diverse aspects, many of which are beyond the auspices of the designer to control [11].

xD is often considered from the perspective of how designed artefacts emotionally engage the user. These experiences include emotional response values such as satisfaction, enjoyment, engagement, pleasure, excitement, fun, helpfulness, boredom, frustration, irritation, and patronisation, amongst others [27]. A review of current practitioner orientated literature [27, 37, 38, 39] supports this view of experience as an emergent reaction obtained through interaction with a product and is thus primarily shaped by visual and form-based design [12].

However authors such as Hassenzahl, Wright and McCarthy argue that xD should be primarily concerned with how life experiences shape, constrain and inspire interactive products. Hassenzahl, describes this approach to designing interactive products as starting from "*the assumption that if we want to design for experience, we have to put them first, that is, before the products*" [11 p.2-3]. He describes interactive products in this experience-*led* approach as important only as far as how they mediate and shape experience.

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information design, interface design – and other related practices, applied user-centred research and iterative design methods collectively employed for the design of digital experiences and products" [35 p.37].

The remainder of this literature review will discuss two approaches to engaging with experience-*led* design. The first of which is Wright and McCarthy [5 p.4, 12] framing of experience design as capable of addressing *"people's desires, values and feelings*" in a realisation of a "*humanist vision*" for interaction design through participatory design processes, while the second approach is Hassenzahl's *Three Level Hierarchy of Needs*.

3.1.3.3. The argument for participatory design

In *Technology as Experience*, 2004, Wright and McCarthy [12] highlight the value of the user's imagination in assessing experiences of technology. They use the terms 'felt' or 'feltness' to describe the emotional and sensual quality of experience to emphasise a "*personal and particular character of experience with technology*" [p.13]. While *Technology as Experience*, is primarily concerned with how user's experience technology, it provides a useful description of the role of the users' aesthetic relation with technology centered around "*engagement, situated creativity and sense making*" [IIX]. This consideration of an 'experience aesthetic' as a background from which new experiences emerge, and are regulated by, is critical for understanding the role of experience-led design in IXD practice.

Wright and McCarthy acknowledge that experience as a concept is difficult to define because for humans, experience is a natural, constant state that is hard if not impossible to consciously detach from, in order to reflect upon [12]. While Wright and McCarthy cite examples of other characteristics of experience such as 'engagement' and 'absorption' it is their account of the pragmatist philosophy of experience that adds most to an understanding of experience as emergent.

Pragmatism is fundamentally concerned with practice and its consequences [12]. Pragmatism employs *Revisionary Theory,* which does not seek to establish truth but rather seeks to promote thinking through understanding relationships such as those between people, technology, and design. For pragmatists, theorising is a practical, consequential activity geared toward change, not representation [12]. Revisionary theory unlike traditional scientific modes of enquiry that seek to understand 'what is' [40], is ideally suited to explorations that understand the world as in flux and thus focus understanding on what 'can be' [12]. Therefore, pragmatism and design share very similar approaches to engaging with the world [30] as both discourses address the potential of the future.

Towards the purpose of designing interactive products that are empathetic with users' experiential backgrounds, Wright and McCarthy refer to John Dewey and Mikhail Bakhtin's descriptions of the process of 'creative understanding' in the relationship between designer, technology, and user [12].

Wright and McCarthy [12 p.17] describe Dewey's interpretation of experience as *"constituted by the relationship between self and object, where the self is always already engaged and comes to*

every situation with personal interests and ideologies".

Dewey views human action as situated and creative in the sense *"that people create goals and the means to achieve those goals in the midst of their engagement with the world*" [12 p.18]. For Dewey action is similar to children's role-play games in which, as the imagined story gains more detail, more options for the players emerge, to imagine more 'story'. In many ways Dewey's description of experience as situated evokes other descriptions of meaning and practice such as Bourdieu's theory of *Habitus* [41] and Searle's theory of the *Background of Social Reality* [42]. Bourdieu and Searle's descriptions place the 'actor', their actions, and subsequent meanings within a social reality that while allowing for a sense of individual spontaneity to occur, orientates the spontaneity within a tacit system of meaning that is regulated by tastes, dispositions, abilities, practices and understandings [41]. Dewey's evolving child's game is consistent with Searle and Bourdieu, 'social reality' that guides action. While Bourdieu and Searle position the 'act of sense making' as a formation of relational knowledge orientated by teleological goals and constrained by a cultural rationalism, Dewey positions experience as the act of sense making, as actions are emotional, volitional and imaginative [5]. Russel [in 11] similarly views emotional experience as emerging from many different elements and sub-processes that can be either subjective or cultural. Russel describes experience as arising "fully-fledged as a narrative" but "heavily coloured" by societal knowledge.

3.1.3.4. Dialogism

According to Wright and McCarthy [5], Bakhtin argues that the contexts of experience and subsequent meaning made of it can only be understood dialogically. A dialogical approach to communication focuses on the relationships between the people involved rather than on individual intentions [5]. All participants involved in the act of communication are seen in dialogism as "*mutual, present, and responsive to each other*" [5 p.51]. The act of understanding in a dialogical approach is centred on creating a new shared meaning between those involved in the dialogue rather then a transfer of understanding from 'speaker' to 'listener'. Thus, new meanings and shared understanding emerge through engagement with others, in alternative iterations of talking and listening [5]. Dialogism is in essence a process of 'mutual learning' made possible by the "*acknowledgement of the other as a different centre of value*", it involves " *a commitment to empathically understanding the other in terms the context from which they speak and act*" and is never final, only approximate and provisional [5 p.56]. Bakhtin refers to dialogical communication as 'creative understanding'. Wright and McCarthy [12 p.18] concisely summarise a dialogical perspective of sense making as "*a process of bringing together different perspectives and, in this creative bringing together, forging understanding*."

Wright and Mcarthy position storytelling and narrative as valuable approaches to dialogical understanding in design as the act of stroytelling does not only involve the teller's account but also their consideration for the listener's point of view. In addition, the listener also brings their own

point of view, life-experiences and interpretations to the storytelling experience [5]. Understanding in storytelling is thus always co-created.

In design and specifically IXD, the use of stories is common; examples include ethnographies often written in narrative form, diaries, focus groups, drama, role-play games and scenario design [5]. Other design research methods such as cultural probes, directed storytelling, and diary studies [43] are often used early in the design process to elicit stories and thus facilitate 'creative understanding' between designers and communities' users. However, it is within participatory design (PD) that Wright and McCarthy envision a dialogical approach to experience design to occur as, they believe, PD seeks to directly engage with the user not just in order to understand contexts of use but also to include and empower the user as an active agent of change [5].

Wright and McCarthy do caution that participatory design does have its own set of problems not least the emotional and political issues that emerge within any social activity [5]. In addition, they warn that integrating users so intensely in the design process can curtail the creativity, innovations and ideals of the designers. To this purpose they offer fictional inquiry as a response to this problem. Fictional Inquiry [5], design fiction [44] and fictional space [45] are design methodologies that all employ a fictional design engagement that provokes user imagination in interesting ways.

In *Experience-Centered Design* [5], Wright and McCarthy present a range of interactive design products developed through a dialogical participatory process. These products include Jane Wallace's digital jewellery project *Blossom* [p.42] and Interaction Research Studio's *The Prayer Companion* [p.44]. Wallace after conversing and holding workshops with participants, designs a piece of jewellery that uses sensor technology to react to stimuli from the natural world in a manner meaningful to the owner. *The Prayer Companion* is a digital presentation that displays headline text from Internet news feeds. The digital display is placed in convent and acts as a sight of reflection and connection to the outside world for the nuns.

While arguabl, each of these products provides a meaningful experience to its user, they do seem to offer outside the experience, of the experience itself, any useful purpose. Marsden [46] describes the need of ICTs that seek to support resource restricted communities to be not only usable but useful as well. Therefore, while experience for the sake of experience may be acceptable for first world users, people with more fundamental needs and limited resources need digital products that "*significantly improve their livelihoods*" [p.452].

3.1.3.5. Hassenzahl's Three Level Hierarchy of Needs

In this respect Hassenzahl's [11] *Three Level Hierarchy of Needs* and Top Ten psychological *needs* framework are presented as tools for the identification and contemplation of emergent user-goals and related experience needs in a more focused and explicit manner than Wright and McCarthy's dialogical approach.

According to Hassenzahl [11 p.51-52] *"products can be more or less experiential depending on how clearly they communicate a relationship to needs through their attributes*" because, he continues, "*emotion is closely related to action and motivation*" [11 p.3]. In IXD the concept of fulfilling users' needs is often referred to as goal-orientated design [29]. A user-goal is an expectation of an end-condition that is personal to the user [29]. From a design perspective, the interactive product or system needs to facilitate the accomplishment, by the user, of their intended goal.

Hassenzahl's *Hierarchy of Goals* model (**Figure 3.1)** informed by activity theory[11] depicts the categorisation of users' goals into three levels, which he terms *Why-be goals (be goals)*, *What-do goals (do-goals)* and *How-motor goals* (*operations)* [7].

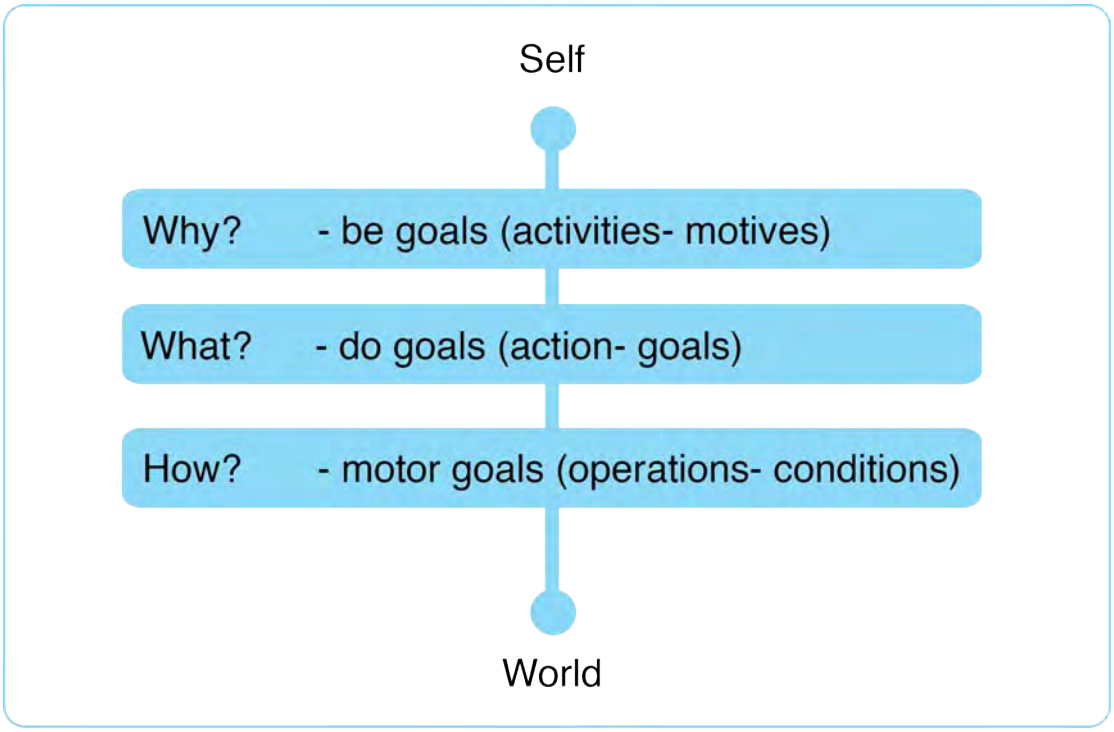

Figure 3.1: Hassenzahl's *Three Level Hierarchy of Needs* [11]

The *Hierarchy of Needs* models how the individual relates to the world through action [11]. A *do goal,* which sits at the middle level of the hierarchy, is a concrete outcome the person performing the action wants to achieve. For example, a *do goal* would be 'to ride to the shops'. *Do goals* generally do not change much over time but are often linked to technology though not necessarily one form of technology [5]. For example, while we may ride in a motorcar or a bus or a motorcycle to the shops, a hundred years ago we may have used a horse or a wagon.

Operations in Hassenzahl's hierarchy are the smallest sub-units of actions that collectively define how a *do goal* is achieved. *Operations* can be understood as the behaviours and actions employed to achieve the *do goal*. While *do goals* are consistent, *operations* tend to be contextual, describing

[11] Activity Theory provides a framework that focuses analysis around the concept of an activity and helps to identify tension between the various elements of a system [27, 47, 48]

how particular *do goals* are achieved under specific conditions orientated by a higher level *do goal* [11]. Therefore, the operational actions involved in riding a bicycle are different to riding a bus even though they both fulfil the same *do goals*. Interaction design has traditionally through usability design focused on the design of *operations* in order to fulfil *do goals*. A hierarchical task-model [11] and task-flow diagrams [38, 49] would be examples of applying *operations* in interaction design, while user journeys (see section 4.5.6) would be examples of *do goals*.

At the top of the hierarchy are *be goals*. According to Hassenzahl [11] *be goals* are the user-goals that motivate action and provide meaning to the action. He continues to describe *be goals* as 'self-referential' focusing on the life-needs of users rather then on technological needs such as those described by *operations* and *do goals*. So for example, while *operational* goals would define how a user would navigate through the individual processes involved in the *do goal* of selecting a specific recipe from a recipe-book app, the *be goal* would focus on the 'why' of the meal to be cooked.

These motivations could be as diverse as providing healthy food for children, cooking a romantic dinner for a partner or even just the enjoyment of gastronomic experimentation.

Hassenzahl identifies human feelings as the drivers of behaviour at the *be goal* level. He exemplifies this point by describing a scenario of using a mobile phone to make a telephone call. The telephone call in the *operational* and *do goal* sense has little meaning, in itself. However, the act of connecting with a wife or husband while on a long distance trip due to loneliness, or frustration or excitement does have meaning. The *Hierarchy of Goals Model* provides a holistic account of experience design that includes perception, action, motivation, and cognition [11]. These conditions occur when *do goals* are orientated by motivational and life- centred *be goals*, whilst made actionable through the contextual application of *operations*. Without well considered *operations* and *do goals* an interactive system could possibly provide poor service. Likewise, *operations* and *do goals* without the teleological aspects of *be goals* could provide poor user-experience and subsequent uptake.

While experiences may occur in any multitude of variations, Hassenzahl argues that they do share a common core. Hassenzahl maintains that approaching xD from the perspective of needs allows for experiences to be identified and considered in a structured manner as categories of experience relate directly to categories of needs [11].

Hassenzahl provides a framework (Figure 3.2) for recognising needs most important for satisfying events based on Sheldon *et al's Top Ten Psychological Needs* [11]. The purpose of the *Top Ten Psychological Needs* framework is not to be definitive in terms of identifying individually occurring needs but rather provides a model that describes the different classes of occurring needs [11]. To this purpose the *Psychological Needs* framework is helpful guiding inquiry related to understanding associated feelings, typical behaviours, conditions, rules, and problems [11] of users' current lived experiences.

Autonomy/ Independence	Feeling like you are the cause of your own actions rather than feeling that external forces or pressure are the cause of your action
Competence/ Effectance[12]	Feeling that you are very capable and effective in your actions rather than feeling incompetent or ineffective
Relatedness/ Belongingness	Feeling that you have regular intimate contact with people who care about you rather than feeling lonely and uncared for
Self-actualizing/ Meaning	Feeling that you are developing your best potentials and making life meaningful rather than feeling stagnant and that life does not have much meaning
Security/ Control	Feeling safe and in control of your life rather than feeling uncertain and threatened by your circumstances
Money/ Luxury	Feeling that you have plenty of money to buy most of what you want rather than feeling like a poor person who has no nice possessions
Influence/ popularity	Feeling that you are liked, respected, and have influence over others rather than feeling like a person whose advice or opinion nobody is interested in
Physical thriving/ Bodily Health	Feeling that your body is healthy and well-taken care of rather than feeling out of shape and unhealthy
Self-esteem/ Self-respect	Feeling that you are a worthy person who is as good as anyone else rather than feeling like a "loser"
Pleasure/ Stimulation	Feeling that you get plenty of enjoyment and pleasure rather than feeling bored and under stimulated by life

Figure 3.2: Hazenzahl's Top ten Psychological Needs [11]

3.4. A framework for practice

Wright and McCarthy [5] view Hassenzahl's attempt to classify experiences as problamatic as it potentially runs the risk of reducing people to objects of research rather then as participants of in design. However, Hassenzahl's application of activity theory presents a more practical direction for ensuring that the core attributes required to understand users motivations and approaches to fulfilling those motivations become the focus of any user study. Wright and McCarthy's argue for a more qualitative and interpretive position. It is in respect to these two positions, each with their own unique value, that I propose to unify the two viewpoints into one framework in which the dialogical modes of enquiry applied in a participatory design methodology are orientated around the *Three Level Hierarchy of Needs* model.

[12] Effectance is a psychological term that describes the influence an individual may have on their environment [50].

3.2. Related work

The primary aim of this study is to ascertain if theory, methods and tools of contextmapping and IXD when integrated can facilitate meaningful and actionable decision-making between designers and community participants in an ICT project. The encompassing methodology used in this study is that of Research through design**,** which applies a pragmatic approach to knowledge generation. In the scope of this study, the co-design of a mobile application with farmers from Soweto is used to extend the theoretical framework presented in the prior section of the Literature Review. Lastly, the placement of this study within a development context, the selection of co-design as the research method and the utilisation of Research through design as an encompassing descriptive/reflective methodology relates this study to the broad field of ITC4D (ICT for development). In order to support this claim, this section will with a particularly South African focus, briefly, introduce ICT4D and discuss key contemporary concerns of the field.

The historical precedents of ICT4D is described in literature including [51, 52, 53, 54]. The traditional focus of ICT4D is the value that the application of ICTs can bring to development contexts [55, 56]. 'Application' in this sense refers to the improved access for developing communities to technology so as to bridge the digital gap [55]. While this approach has value, this study corresponds rather with an alternative view of ICT4D, which Heeks [56 p.13] refers to as 'Para-poor innovation' or 'ICT4D2.0'. ICT4D in this framing is viewed as an 'inherently multi-disciplinary' [57, 58] practice, foregrounded in design [57], in which ICT practitioners work with development community members as co-designers to collectively identify and resolve problems [57, 53]. As will be discussed in following sections, this involves for the ICT researcher/designer both a pragmatic stance that integrates practice with theory [57, 53] as well as need for critical reflection [53, 59, 51] on relationships, practice and intervention.

While the pragmatic and abductive value of design has long been recognised in ICT research [53], Blake *et al.* draw attention to design as a practice that seeks to considers the experience of people and their contextual relationship to technology in "situated social and cultural environments" [57 p.16] in order to respond in a malleable, creative and innovative manner [57]. This consideration of experience as situated in the prior, lived experiences of people relates strongly to Hassenzahl, Wright and McCarthy framing of experience (see section 3.3.2).

While the value of participatory collaboration in design has been described in detail in the theoretical framework it is worth noting that it is not a novel concern in ICT4D. Participatory practices have been noted in numerous international accounts of practice [5,10,12, 60] as well as many local or African ICT4D interventions [24, 46, 59, 53, 61]. Perhaps most notable is the special edition of the *South African Computer Journal*, October, 2014 [51] that focuses on ICT4D in Southern Africa. Of the four articles selected for publication, the three articles [59, 62, 63] that reflected on the creative acts of ICT4D all advocated a participatory, design approach.

Blake *et al*. [57] describe the co-design of interactive mobile prototypes that supports Deaf people with their communication and information needs particularly in the context of consulting with doctors and pharmacists. The participants in the co-design activities were deaf people from the Western Cape. The study employed a broadly action research methodology termed community-based co-design. The 'community-based' aspect of the name refers to the aim of including the wider Deaf community in the participatory process. In the texts, the authors explicitly describe co-design as a holistic application of action research in the design setting [57]. Co-design, they argue, utilises participation in order to not only elicit user-needs but also throughout the design, development and evaluation process. Co-design can be understood here as a philosophical stance as well as a design methodology which, when applied seeks as its primary aim to bring benefit to participating communities. This consideration of 'co-design' can be juxtaposed with alternative descriptions of 'co-design', such as in [62], that apply the term to refer to generative research methods (normally workshops) that involve community participants. Contextmapping should be understood as belonging to the former consideration of co-design as it seeks to include participation throughout the design phases and not only during the design conceptualisation phase[13].

The philosophical categorisation of co-design draws on the heritage of action research as a reflective engagement with action that does not separate the intervention from the research learning [57]. The 'reflective' engagement can be considered to draw on critical theory, which seeks to in addition to exploring community participants' subjective views in order to pursue emancipatory goals, also promote reflexive accounts of phenomena and practice from both the researcher and research participants. The framing of the study as human-centred (see section 3.1) and the use of the Research through design methodology with its close associations to action research [53] ensures that the study prioritises the resolution of the problem through communication and collaboration within a rigorous reflective framework.

Gelderblom in [63] critiques the lack of involvement of end-user in ICT for education design projects. She advocates the use of participatory design for projects particularly those focused on children and development contexts. In the text, Gelderblom advises that due to unique power relationships that can occur in development contexts that the application of traditional co-design methods are not always effective in development contexts. Gelderblom suggest applying Irani *et al*. frameworks for participatory design engagement, which consists of three steps: Engagement, Articulation and Translation.

Engagement relates to a deep immersion into the life-world of users to "*gain real understanding of their context and behavior*" [63 p.39]. Articulation involves the interpretation of the understandings

[13] It is worth noting that generative tools, the primary method of the contextmapping methodology are examples of co-design in the later interpretation.

gained in the Engagement step, so they can be formulated as requirements. In the Translation step the requirements are 'solutioned'- types of technologies or the technologies themselves that meet the requirements are selected. Gelderblom suggests that through the application of these steps that "*relevant issues of power, politics and history are acknowledged in design*" [63 p.39]. While this claim is somewhat under supported in the text, what is important in this framework, if again perhaps not recognised by the author, is the designer's explicit framing of their understanding of the participants' life-world in the Articulation section. By articulating their understanding, designers create a means to communicate their 'story of understanding' back to the participants and by doing this stimulate 'creative understanding' before focusing on problem resolution.

De la Harpe in [62] describes the participatory design with a community in the Western Cape of a mobile application for home-based healthcare. In this project design science research is used as the primary method of eliciting insights from the users that informed the subsequent digital product. Design science research is a research method widely applied in computing during which knowledge is generated through the application of design processes [53] and subsequent descriptive theorising [62]. In the participatory project described by De le Harpe, the design methods included an ethnography study, design probes, observations, interviews and a co-design workshops. A low-fidelity prototype was used to communicate and discuss design concepts. Actor-network theory (ANT) was used to better understand the involvement of the participants in the various design processes. De la Harpe's application of ANT demonstrates the reflective theorising of practice required to ensure the rigor of the design science research method. While design science research is well regarded in information studies [62], this study is located in IXD and HCD. Thus, it is inherently a design project and therefore methodologies originating in the design thinking and IXD fields have been selected for use. While this distinction may appear to be arbitrary, it can be argued that the 'design' methodologies see the 'understand', 'ideate' and 'evaluate' phases of co-design as an integrated as per Blake *et al.* while design science research appears to separate 'understand' from the remainder of the design continuum.

De la Harpe's recognition of the need for critical reflection in the support of theory formation sits at the heart of contemporary ICT4D. As an academic field ICT4D research has been scrutinised for a lack of depth [61, 53] due to firstly, studies that tend to veer towards describing interventions rather than the critically reflecting on knowledge that is scalable and extendible and secondly a tendency to favour empirical research over pragmatic research. To further illustrate this point the editorial [61] that precedes these papers [57, 62, 63] states:

> "The aim of this special issue is therefore to explore topics that would enable a more profound understanding of and directions for extending research into the use of ICTs in support of economic and social development in Southern Africa, with an explicit aim of also contributing to the methodological and theoretical discourses amongst researchers in this area". [51 p.v]

The needs identified in this short statement are significantly similar in intention to those of this study.

4.7 Conclusions of the Literature Review

Thus, and to conclude this Literature Review, the following framework for steering the practical aspect of the study emerged from the literature:

- In order to meaningfully collaborate with developing communities' ICT practice should be constituted as fundamentally 'designedly' in nature in order to creatively and abductively negotiate the complexity of societal problems.
- That design is in nature a form of pragmatic research, capable of generating new knowledge through action.
- That a viable theoretical lens for approaching the design of digital products is through experience- led design. And central to an experience- led approach is the recognition that new experience emerges from prior experiences and there is thus a need to be empathetic of current and prior lived-experience.
- Co-design is a viable approach to gaining this empathetic understanding particularly if the participant community differs from that of the designer. Which is most often the case when designing in development contexts.
- That co-design is not just a series of research methods but rather a philosophical stance to design that encourages collaborating with participants throughout the design process.
- That co-design methods cannot be uncritically applied to local contexts but should be critically assessed before implementation
- ICT4D research should have an explicit aim of also contributing to the methodological and theoretical discourses of the field.

Chapter 4:

Process

The Process section of the dissertation describes and reflects on the activities and methodologies involved in the co-design practice that culminated in a digital prototype of a web-based mobile application site called *Khula*. In terms of structural organisation individual sections of the Process follow the phases of the contextmapping methodology as depicted in Figure 2.2.

The focus of the Process is on how the co-design informs the interaction design practice. Of particular interest is the level of meaningful contribution made by the farmers in defining the direction of the final product. 'Meaningful contribution' is understood here in two distinct but interrelated ways. The first of which relates to the degree that farmers could access and engage with the design process. The second interpretation is concerned with whether the contribution made by the farmers, directly or indirectly, is of value to an interaction design approach to problem resolution. Ensuring that both of these interpretations are fulfilled supports the interaction design of digital technologies that, in combination with farmers' current practices and existing support networks, can contribute to the improved accessibility to farming information by Soweto farmers.

Any single design project includes a vast range of activities and considerations. For the sake of brevity, the narrative scope of this discussion will be limited to the co-design and IXD aspects of the design. Furthermore, the detailed IXD of the product in the New Design Concepts section is exemplified more than reflected upon, and is discussed only in as much detail as to provide continuity between concepts agreed upon in the co-design workshops and the interactive deliverables and prototypes. This relates back to the focus of the research, which is concerned with the application of the various design methodologies to support meaningful participatory design. The details of the designed prototype are only important insofar as to establish that the transfer of meaning from the participants to the designer and back to the participants through their use of the digital product has taken place.

While the major methodologies that inform the research project are described in the Methodology section of this paper, contemporary UXD/IXD practices include many variations of design and research methods. This project includes a range of these applied methodologies. They will be introduced and explained as they arise.

4.1. Contextmapping: Preparation Phase

The Preparation Phase of contextmapping involves the formulation of research goals, preliminary mapping[14], selecting participants and choosing techniques [6].

4.1.1. Setting research goals

The research goals of the contextmapping exploration are informed by the *be goals*, *do goals* and *operations* of the *Three Level Hierarchy of Needs* which are defined here as to better understand the farmers' life-motivations, information needs and their current approaches to finding farming related information.

The decision to focus on the broad *do goal* of 'accessing information' was a result of preliminary discussions on the needs of the Soweto farmers with stakeholders involved in farming in Soweto[15]. The original concept of creating a mobile information depository was presented at the Soweto Farmers Forum monthly meeting in May 2014, where it was warmly received and has been subsequently well supported.

The techniques that were used to solicit an understanding of the relevant hierarchy goals were organised in the following manner. Firstly, the Sensitization Phase was designed to identify and extract the *do goals.* The Session Phase was designed to explore the *do goals* and *operations.* The Analysis Phase was planned for the assessing, organising and synthesis of the tacit contributions made by the farmers to the design strategy. In the Communication Phase, these findings were mapped and presented visually to the farmers, so that they could make an explicit contribution to the design direction. Agreed upon design-decisions were then expected to be applied in the New Design Concepts section, which would culminate with low-fidelity prototype testing where, once more, participants could make explicit recommendations.

For the planning of the Analysis Phase, the primary tools for analysis was the affinity diagram method [43] as it allowed for both an emergent bottom-up approach to categorisation as well as a top-down approach that could be structured around the hierarchy of the *Three Level Hierarchy of Need*.

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14 While I did undertake a preliminary mapping, I did not feel reporting on it would add to the discussion, however, is included in the appendix

15 Particularly, Dr N Malan, from the Department of Development Studies at the University of Johannesburg who coordinates the Izindaba-Zokudla outreach programme and has worked extensively with the Region D Farmers Forum and the City of Johannesburg on the organisation and training of small-scale farmers in Soweto.

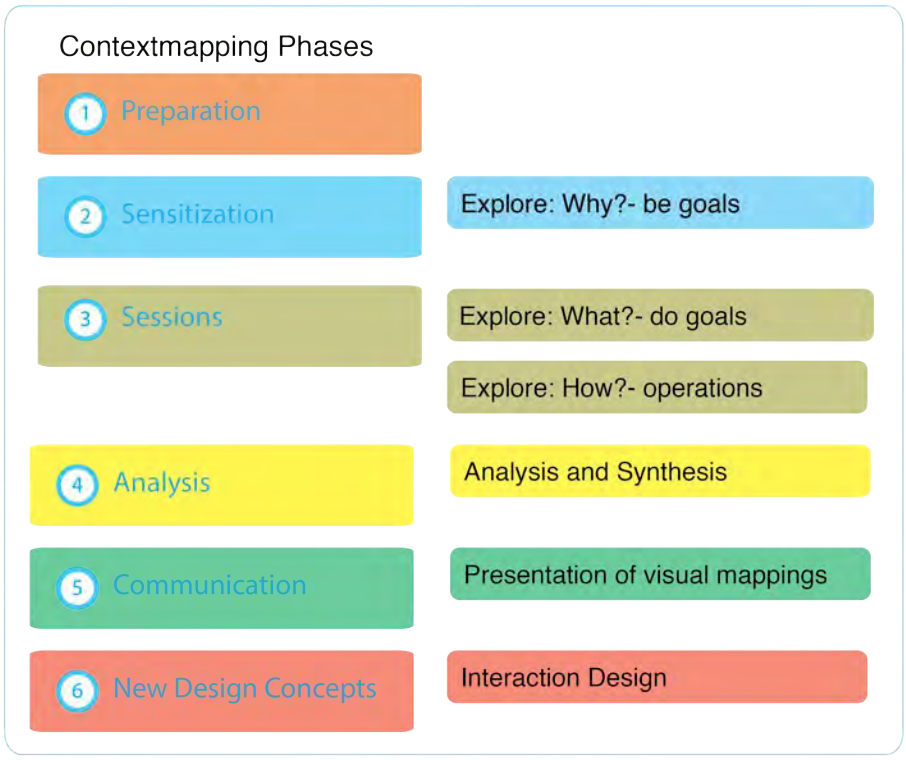


Figure 4.1.1: Describes a brief outline of how the research activities map to the contextmapping phases.

4.1.2. Participant selection

In line with numbers suggested by the literature [6], five participants were selected for the co-design workshops. The Region D Farmers Forum undertook the recruitment of the participants in line with the inclusion criteria described in the second last paragraph of this section.

The Farmers Forum is an organisation constituted and run by farmers in Soweto. It has affinities with other formal entities such as, governmental agencies, non-governmental organisations and university research initiatives, but is primarily concerned with self-organising the local farming community. Activities of the Farmers Forum include monthly meetings, building local capacity, facilitating skills transfer workshops and voicing farmers' concern. Monthly meetings attendance averages 30 participants while workshops can attract over 100 farmers. Workshops and meetings are undertaken in English due to the varied languages spoken by the farmers. Working with the Farmers Forum allowed for the research to be situated in an existing network of farmers. However, it is worth stressing that this network is that of small-scale farmers in Soweto. These farmers are in essence professional farmers as they earn or supplement their income from their farming activities. Small-scale farmers in Soweto are clearly distinguishable from subsistence farmers and from large-scale professional farmers. Small-scale farmers, as described later in the design research process, were in most cases previously part of the formal economy- educated and focused on expanding their farming concerns.

The political role of the Farmers Forum in the Soweto farming community and on the research project needs to be acknowledged. All participants selected were active members of the forum. Two of the participants were in leadership roles while the other three were normal members. However, as the Forum is a grass roots organisation constituted by the farms themselves, it was viewed as a legitimate representative of the farmers in Soweto.

The inclusion criterion for participation was that the candidates were active small-scale farmers, or engaged in small-scale farming activities in Soweto. The final group of famers who became the co-design group included two full-time farmers and three part-time farmers who were also involved in farming training initiatives. The participant's ages ranged between 30-50- all of whom had been farming for at least five years. The gender breakdown was one woman and four men.

The selected participants were broadly reflective of small-scale farmers in Soweto. While the inclusion of two full-time trainers might appear to bias the study towards existing power structures within the farming network, it is worth noting that for both the trainers, the role was transitional rather than permanent. Both farmers who identified as trainers still had their own farming concerns. The gender breakdown of 20% underrepresented female farmers[16], but as the study was qualitative in nature with results generated through interpretation rather than statistics, this issue was acknowledged but not regarded as highly problematic.

4.2. Contextmapping: Sensitization Phase

The Sensitization Phase involves the preparing of participants for the co-design groups sessions. 'Sensitizing' is a process where participants are encouraged and motivated to think, reflect and explore aspects of their own personal context independently of the group [6]. The Sensitization process in contextmapping often takes the form of a sensitization pack consisting of exercises given to participants prior to the group workshop sessions. The purpose of the sensitization packs are to focus and help form, the participants' reflections of their own experiences, in preparation for the co-design workshop.

The sensitization packs designed for the farmers included a 10-page double-sided A5 worksheets and a 3-day diary. Rather than using the sensitization pack to only focus the participants on the forthcoming workshop, the worksheets were conceived as a data-gathering tool consisting of a range of questions that probed the experiences of the farmers.

The questions on the worksheet were based on Hassenzahl's *Top Ten Psychological Needs*. Figure 4.21 shows how the worksheet questions were indexed to the *Psychological Needs* and Figure 4.2.2 provides an example of two of the worksheets.

[16] There are no formal statistics indicating the gender breakdown of Farmers in Soweto. Derived from observations and direct feedback from the farmers, the number of female farmers would be closer to 40%

The decision to utilise the *Psychological Needs* in the sensitisation of the users was based on a number of reasons:

Firstly, Sensitization activities are meant to encourage participants to think about the contexts and meanings of their actions. The *Psychological Needs* questions provide a framework in order to encourage this type of reflection from the participants.

Secondly, as discussed in the Literature Review, an activity theory based approach such as the *Three Level Hierarchy of Needs* is a valid approach for determining user-goals in IXD. The *Top Ten Psychological Needs,* which correspond to the *Hierarchy of Needs* model, can help categorising users' '*be'* or motivational goals. Applying the *Needs* model in order to generate data, relating to the farmers' experiences, in relation to the *Psychological Needs* categories, extends the *Hierarchy of Needs Model*'s application from a purely analytical tool to one that can focus research. Thus defining the *be goals* i.e. why and how farmers attribute value to the act and 'being' of farming would orientate *what* farmers need to learn and *how* they can potentially learn.

Psychological Need	**Worksheet question**
Autonomy/ Independence	1. Do you feel you are independent? *Write down some of the things that help a farmer to be independent.* 2. Are you an independent farmer? *Write down some of the things that stop you from being independent?*
Competence/ Effectance	1. As a farmer what are you good at and enjoy doing? 2. What do you find difficult or do not enjoy doing?
Relatedness/ Belongingness	1. Write down the names of people or organisations that help or support you? 2. Do you feel there is somebody that should be helping you more? 3. Who do you help, and how do you help? 4. Do you feel you could help others more, if yes how?
Self-actualizing/ Meaning	1. Do you think farming is a good career? 2. Why did you become a farmer? 3. Why are farmers important in South Africa?
Security/ Control	1. What are the things you can control in terms of your farming? *2.* What are the things you cannot control? *Describe how these things make you feel.*
Money/ Luxury	1. How do you spend your income from farming?
Influence/ Popularity	1. Do you feel that other farmers respect you
Physical thriving/ Bodily health	1. Does your work make you feel healthy
Self-esteem/ Self-respect	1. Are farmers respected in the community?
Pleasure/ Stimulation	1. What do you enjoy most about farming? 2. What do you enjoy doing when you are not farming?

Figure 4.2.1: Shows how the worksheet questions were indexed to Hassenzahl's Top Ten Psychological needs (see Figure 3.2)

The initial visual design of the worksheets were tested firstly, with a co-worker with an equivalent English[17] literacy level to the farmers, secondly, with a colleague with expertise in information design and lastly in a pilot test with one of the farmers. The sensitization packs were given to the farmers five days before the workshops. All the cards were filled in and while the range of details varied across the participants and questions, rich answers was presented collectively for all areas.

In the feedback session, which formed the icebreaker to the co-design workshops, the value of doing the worksheets was raised. The farmers responded favourably with most of the farmers stating that (outside of the projects intentions) that they felt that reflecting on issues raised through filling in the cards was a worthwhile activity. Comments such as 'we do this everyday, but we don't really think about it all the time' were offered as positive commentary on the subject. The group of farmers felt 'respected' that the study placed a value on their activities. One participant went as far as asking the group of farmers she worked with to reflect on the questions.

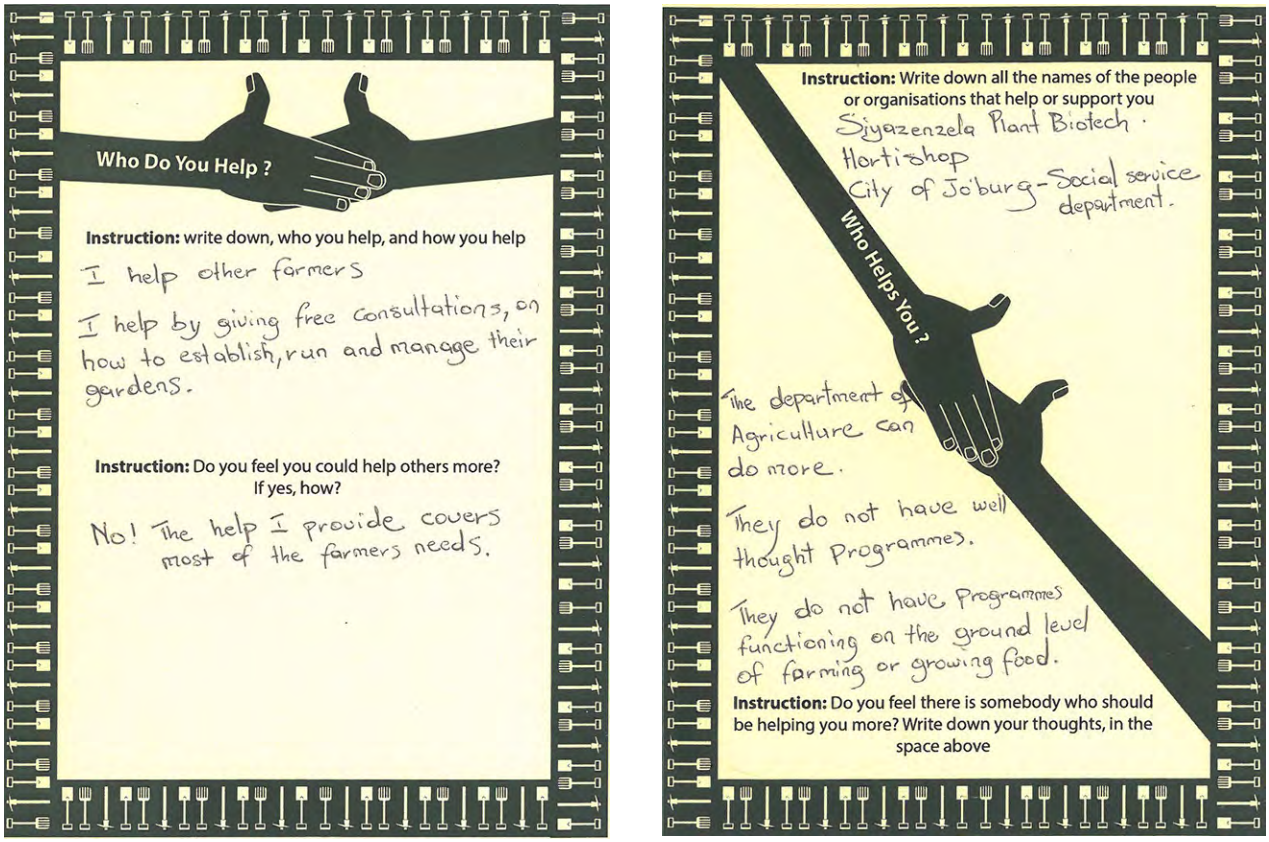


Figure 4.2.2: Shows two of the sensitization worksheet questions completed by a participant. Examples of all the worksheets are available in the appendix.

[17] English was chosen for the survey questions on the basis that it is the language most commonly spoken during the Farmers Forum meetings and agricultural workshops. While it was anticipated that language may be a barrier to communication and alternatives were offered, in affect as discussed later, English did not present any problems and options to use local languages were never taken up.

4.3. Contextmapping: Sessions Phase

The Sessions Phase of a contextmapping methodology involves the facilitation of co-design workshops in order to explore participants' potential future experiences. The workshops for this project took place over two three-hour sessions. The workshop included the five selected farmers, a research assistant whose primary duties were to video, audio record and photograph proceedings, and lastly, myself as the workshop facilitator.

The workshop began with an introduction to the purpose of the workshop. Key issues discussed included a brief outline of responsibilities, the value that the participation of the farmers would bring to the design project, the need for openness and candidness in the discussion, and to what extent and for what purposes information arising from the workshop would be used. The participants were informed that the project was design orientated, but the expected technological outcome was not discussed. This was done to avoid influencing the farmers' thinking and thus bias the possibilities of what might emerge naturally from the process.

In contextmapping workshops participants assume the role of experiential experts and are provided with creative materials to enable them to "*play an active role in requirements setting, idea generation, and even concept development*" [64 p.1]. These creative materials are known as generative tools [6, 7] and include techniques such as collage, sketching and modelling that are normally used by professional designers to ideate.

When applied as generative tools, these techniques are used by the community participants to 'design' artefacts that reflect the participants' ideas for solving an often fictional problem. The creative activities are conceived to encourage imaginative, 'what if' thinking rather than responding to the constraints of 'what is' rationally possible. The purpose of the fictional project is not premised on the creation of professional design concepts but rather to help the researcher elicit insights related to the participant's motivations, experiences and needs.

While these insights can be derived from the made artefacts, they are gained predominantly from the dialogue between the facilitator and participants during and after the design activity. The rationale behind generative tools is that users' experiences are often determined by latent needs or tacit knowledge, which is often difficult to express verbally [6].

In the Soweto farmer's workshop, two different generative tools activities took place. The first activity involved the creation of a collage poster and the second activity involved clay modelling.

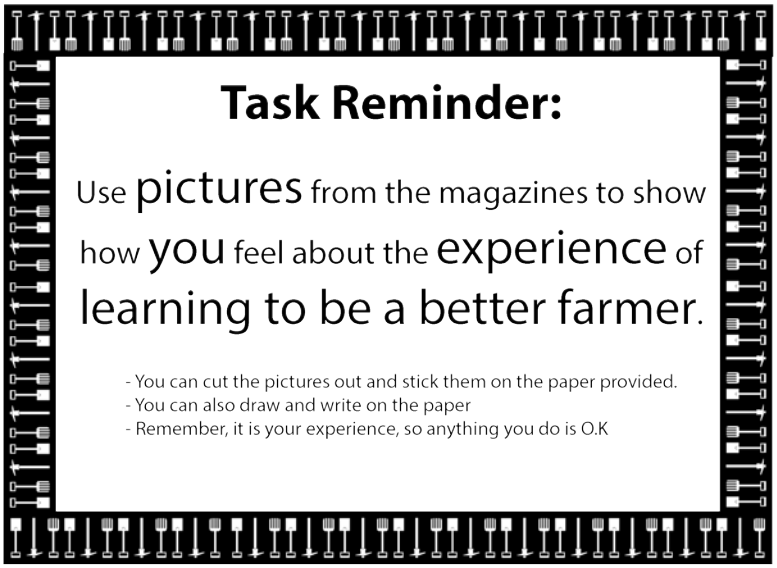


Figure 4.3.1: Task reminder for the first *generative tools* activity

In the first activity, the farmers were asked to cut out images and text from magazines in order to compile an illustrative account of their experience of learning to become farmers, and how they continue to learn to be better farmers. Figure 4.3.1 shows the task-reminder that was given to the participants to help focus their activities. Figures 4.3.2- 4 are the collages that the participants constructed.

Figure 4.3.2: Example of a participant's experience collage.

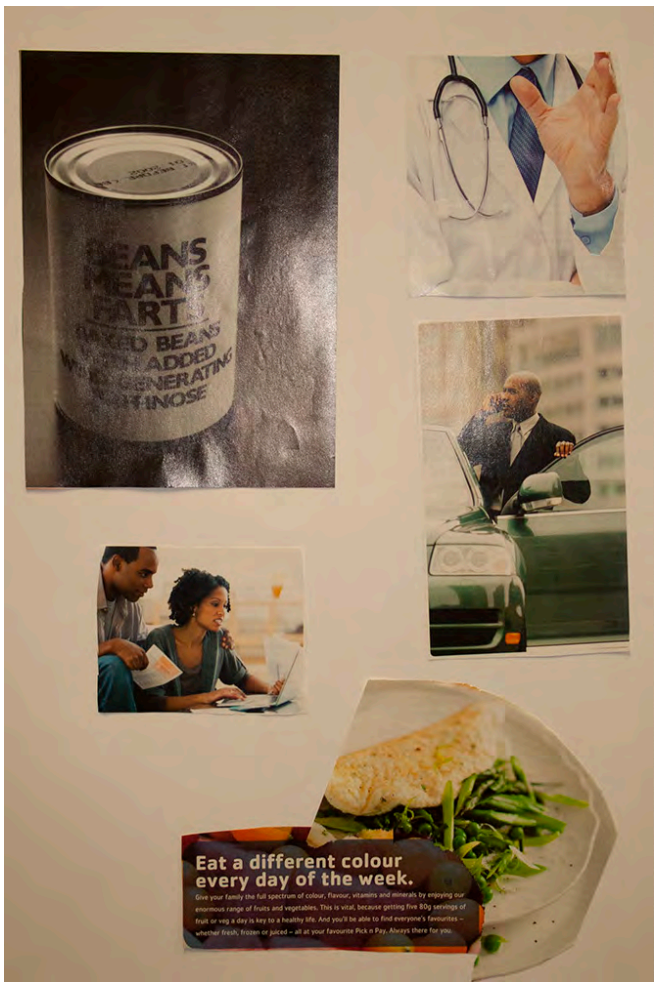


Figure 4.3.3: Example of a participant's experience collage.

Figure 4.3.4: Example of a participant's experience collage.

Once the participants had completed their collages, they were tasked with verbally explaining their compositions. The discussions were on average 15-minutes long and involved questions and open conversation around specific points. In general, the farmers' explanations provided a great deal of relevant, qualitative information pertaining to their experiences.

An example of the value of the oral discussion is shown in the conversation related to Figure 4.3.2. The participant who constructed the collage began by outlining a 'grand narrative' of the value of small-scale urban farming (most likely due to her participation in previous farming workshops) rather then reflecting on her personal experience of learning to be a farmer. However, the open dialogue format that accompanied the discussion allowed for the conversation to be refocused back to the prescribed task.

In the second generative tools activity, the participants were given clay and ceramic modelling tools and asked to create a fictional tool for farming, as detailed in Figure 4.3.5.

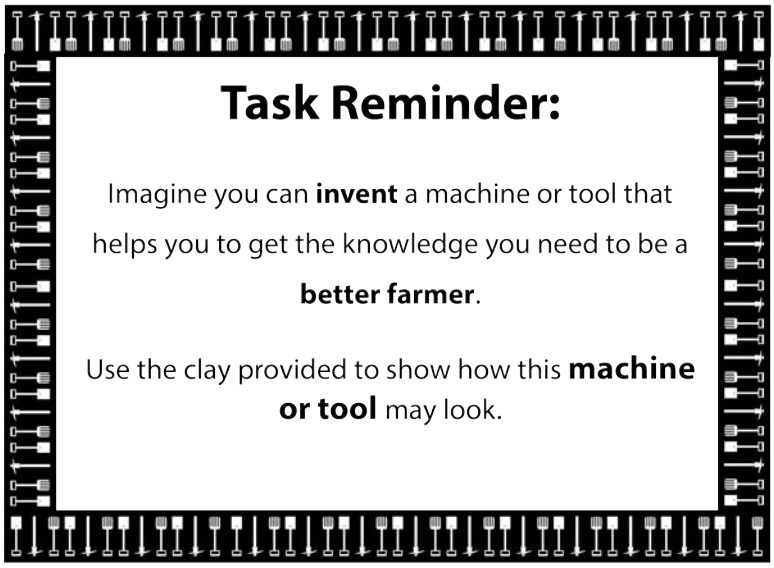
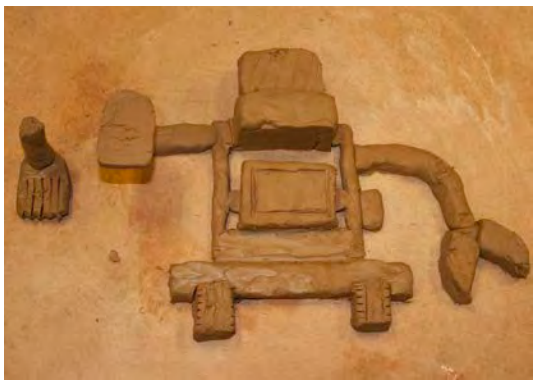


Figure 4.3.5: Task reminder for the first Generative tools activity.

Similar to the first activity, participants were then tasked with explaining what they had created and why they felt their creation would be useful to them in their farming activities. Figure 4.3.6 shows a range of the clay artefacts. Perhaps most interesting is an example (top-left) of a 'robot helper' that contains a networked computer as well as changeable robotic arms to assist in physically difficult work.



Robot helper

Mini truck

Farming plough

Mechanical mulcher

Figure 4.3.6: Examples of a selection of the clay models.

Participants responded well to the exercises although many at first considered the task to be 'for children'. Once the discussions of artefacts begun the participants become very engaged and often facilitation was required only to redirect or end the conversation. Having the designed artefacts as the focal points of the conversations allowed for additional follow-up questions to be asked in response to the artefacts. For example, in the second exercise many of the farmers modelled farm equipment such as 'mulchers'[18], tractors, water purification systems, robotic arms etc. At first these items seemed to offer very little relation to possible interaction design solutions however, it soon became apparent through discourse that what was represented in the clay models was the farmers' desire to expand production utilising semi- industrial methods and smarter business practices. This became a highly informative insight that orientated aspects of the design strategy.

Once the contextmapping activities had been completed a final set of research activities were undertaken with a particular focus on the farmers' relationship to digital technology. The aim of

[18] Mulch is small shavings of organic material spread over soil to increase water retention. A 'mulcher' is a machine that shaves the material.

these research activities was not meant to be comprehensive, but rather to ensure that basic assumptions of the farmers' engagement with mobile technology were accurate.

The first activity was a short survey of what types of phones farmers used. As depicted in Figure 4.3.7, the five farmers produced eight phones. The majority of the farmers owned a smart phone and an additional basic phone for use while working on the land. Only one farmer had just a basic phone.

Figure 4.3.7: Participant's mobile phones.

The second activity was a short set of questions related directly to farmers' use and emotional engagement with their phones.

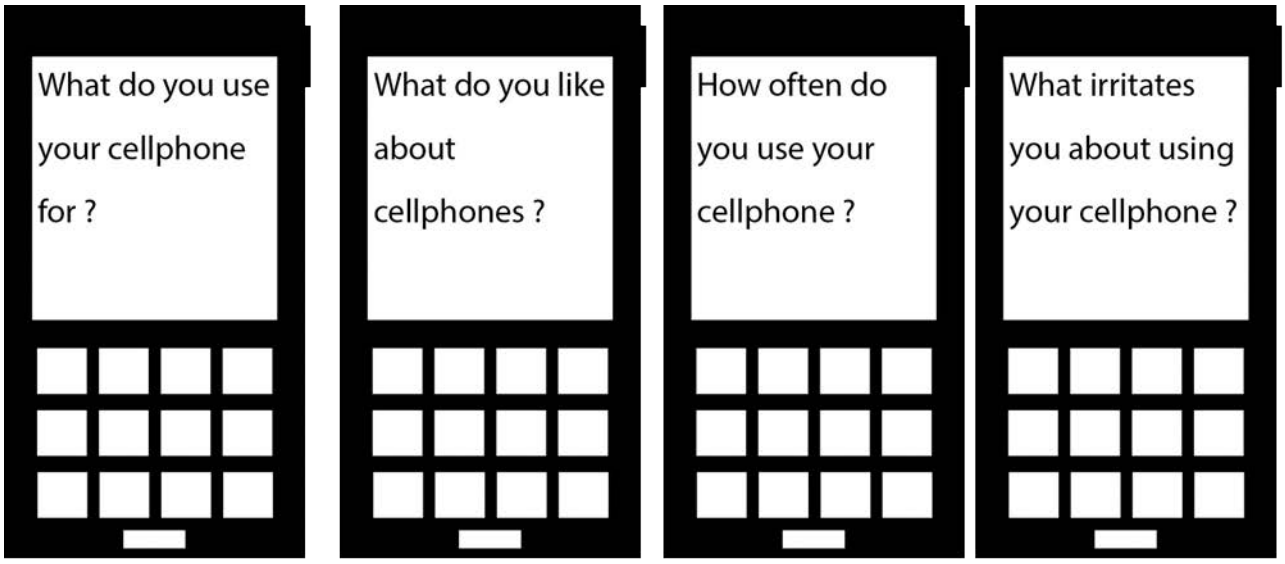


Figure 4.3.8: Questions relating to the farmers' engagement with mobile phones

General insights gained from these questions implied that many farmers in Soweto have crossed the digital divide. All the farmers interviewed used the Internet, and often used their phones for this purpose at least once a day. A range of activities and services in which the farmers used their phones included *Google, Facebook, Olyx, WhatsApp, News24,* voice communication, texting and

Skype. The negative experiences reported by the farmers included data and voice costs, complex functionality and receiving 'please call me' messages. These insights implied that the Soweto farmers' understanding of digital technology was more sophisticated than many other participants from more rural areas of South Africa involved in ICT4D participatory design projects[19].

Lastly, the farmers were asked if there was any functionality that they would like to see added to their phone. Interestingly, despite the opportunity to be as imaginative as possible, this line of direct questioning did not generative many 'feature' insights that stretched beyond the capabilities of current top-end smart phones. Of value was the participants' expression of a need for farming information and the form they felt the information should take. In essence, they described a categorisation system that would be centrally organised around crop types rather then farming methods or processes. They also expressed a general need for information to be converged in one site to avoid wasting data through unnecessary browsing.

4.4. Contextmapping: Analysis Phase.

In the Analysis Phase of contextmapping, the qualitative data collected during the co-design workshops was analysed. Most of the data was generated through the farmers' written and oral descriptions of their experience. The data like most other Contextmapping projects was rich, fragmented and multi-layered [6].

In the literature describing Contextmapping, it is acknowledged that methodological approaches to data analysis are not well developed [6] and therefore there is no prescribed or preferred method. The closest the literature comes to describing a particular method for analysis is Visser *et al's* description of an "*approach that is largely in line with Grounded Theory*" [6 p.14]. As there was no clearly defined method it was decided to use affinity diagrams [43] as the primary method for analysing the data in this project.

Affinity diagrams are commonly applied in design practice for the interpretation, organisation and synthesis of qualitative data. Similar to grounded theory and content analysis [43] in the affinity diagrams method, the raw data is coded into 'chunks' of information. In affinity diagrams the data chunks are most often transcribed onto small sticky pieces of paper[20], which can be pasted on to a surface and physically rearranged into categories or relational affinities.

In order to create the affinity diagrams for this project the following steps took place. Firstly, the digital video or audio recordings from the workshop were reviewed. Information fragments, either keywords or whole sentences, relevant to the farmers' experiences were then captured as data chunks in a number of spreadsheet. This process was then repeated using the written information captured in the Sensitization worksheets.

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19 See [24], which describes a range of these difficulties.

20 Commonly known by their product names: 'Post-its' or 'Sticky-notes'.

The data chunks were initially organised in respect to the research exercises. The data chunks were then transcribed on to over 200 individual sticky-notes.

Activity Sensitization packs	
Question	**Data**
What are the things you can control?	
	Maintenance, making compost
	Seed propagation
What are the things you can't control?	
	Potato ducks, insects
Do you feel you are an independent farmer?	
	Yes- grow own food
	Yes- sell food to the community
Barriers to be an independent farmer?	
	Lack of resources
What do you enjoy doing when you are not farming	
	Site visits to other farmers to see work progression
What do you enjoy most about farming?	
	Learning new things (knowledge)
Do you feel that other farmers respect you?	
	Yes-shared goals, mission
Are farmers respected in the community?	
	No: C-opinion: think we don't know what we are doing
	No: opinion: don't respect our efforts

Figure 4.4.1: Section of a spreadsheet showing data captured from the Sensitizatio*n* worksheets.

explantion	agriculure at school	origin
of	wanted to be a nurse	origin
how	courses in marketing	origin
she learned	school governingbody chairman	origin
the value	maintaing school property-	value
of farming	agriculture seen as poor persons job	info need
	permaculture course	learning behaviour
	hard work	
	compost	info need
	pesticides	info need
	work with people to gain experience	learning behaviour
	cellphones	learning behaviour
	google	learning behaviour
	don't understand google explanation	learning behaviour
	familiar with peoples eating habits	learning behaviour
	look in shops	learning behaviour
	ask other food sellers	learning behaviour
	tv programs	learning behaviour
	climate/weather	info need
	government support	info need
insects	pests	info need
fence	security	info need
	reaching custumers	info need
pretty girl	healthy food	value
sick man	avoid illness	value
Ship	be your own boss	aspiration
	make money	value

Figure 4.4.2: Section of a spreadsheet showing data captured from a participant's description of her journey to be a farmer and relates to the collage shown in Figure 4.3.2.

In reference to Hassenzahl's *Three Level Hierarchy of Needs* model, the data chunks went through three rounds of categorisations. The first affinity categorisation was the *do goals* of the model, which was determined as the 'things' farmers needed or wanted to know. The second topic was the *operations*, which was determined as the current behaviours or practices that farmers undertook when trying to find out information pertaining to farming and associated activities. Within these two themes a bottom-up categorisation system was applied which allowed for categories to emerge through prevalence in the data.

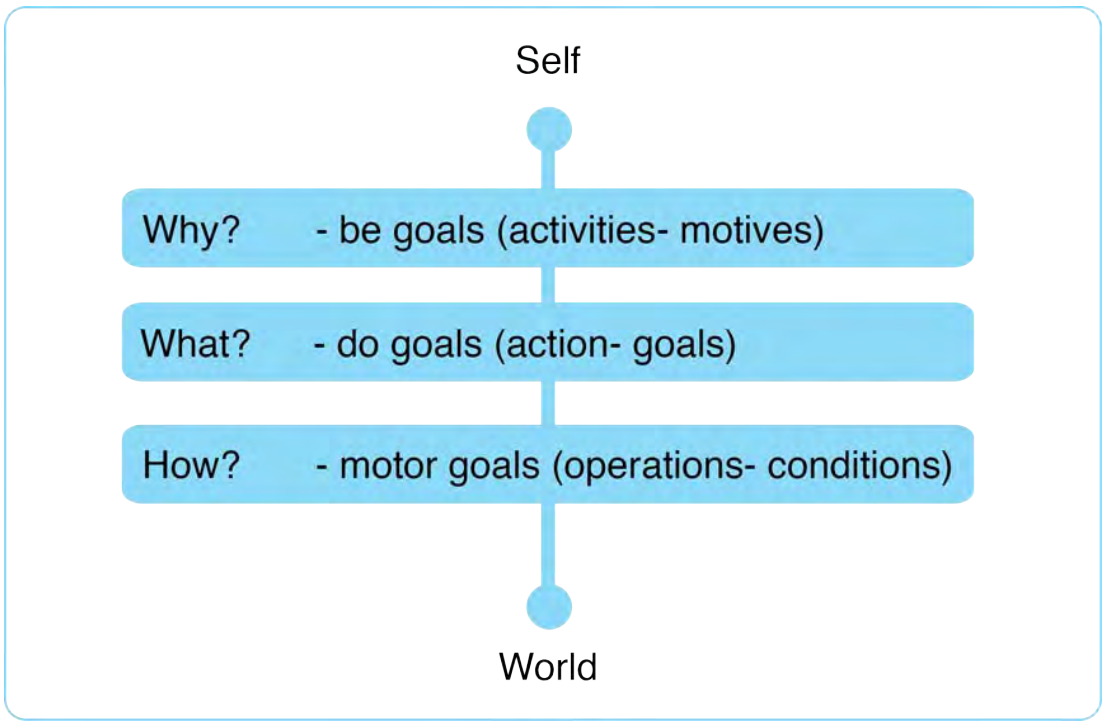


Figure 4.4.3: Hassenzahl's *Three Level Hierarchy of Needs* model.

Figure 4.4.4: An **affinity diagram** in progress. The sticky-notes shown are in the early stages of the organisation and patterning process of affinity diagramming. In **Figures 4.4.5- 4.4.17** the affinity categories that emerged are shown as schematic diagrams.

The third affinity diagrams categorisation was a tighter top-down arrangement in which all the chunks were arranged into categories indexed to Hassenzahl's *Top Ten Psychological Needs*. This categorisation related to the *be goals* of the Hierarchy of Needs model. Each affinity categorisation was done separately as often data chunks could be interpreted under different levels of the needs hierarchy. For example, a data chunk describing a need to be better at handling conflict could be interpreted as either 'management skills' and thus sitting at a *do goal* level, or as an aspect of the '*Competence/ Effectance'* psychological need and thus sitting at higher *be goal* level.

4.4.1. The What?- do goals

The *do goals,* as indicated in **Figure 4.4.5**, illustrate the seven categorical variations that amend the broader *do goal* of 'what information do farmers in Soweto want to acquire?'. The information needs were categorised into ten sub-sections, which can be described as follows:

1. Information related to the value of farming.

This information relates to how farming can benefit the broader society, the individual farmer and the environment. The articulation of the value of farming is immensely important as many of the farmers reported feeling demoralised as farming was often related to been unemployed or poor by the community. Providing information to the farmers that negated these types of perceptions emerged as an important psychological benefit.

2. Farming Networks

This area described the need for information pertaining to the local organisation of farmers in Soweto. Similar to the previous point, this category describes information such as NGO's who focus on agriculture, and upcoming workshops. Describing a broader community and support network could serve to negate the individual farmer's sense of isolation.

3. External Needs

External information needs were those that did not directly relate to agricultural production but were valuable in the creation of sustainable farming business.

4. Information related to the macro-farming environment

The information in this category relates to the construction, preparation and protection of agricultural sites. In the first sub-category, information relates to using naturally occurring and ecologically sound materials. The second sub-category contains technical information relating to construction practices such as building walls and fences. The last sub-category

orders information relevant to securing an agricultural site and can be understood in reference to the high-crime rate in Soweto

5. Knowledge of plants

The information requirements of this category are divided into three sub-categories. The first category relates to the planting of crops in reference to location and season. The second is meta-data information on the plants themselves. This is useful as any one type of plant may be referred to by a number of different names. While local names are obviously useful in workshops etc., the farmers reported that knowing the scientific or 'English' name was essential for any Internet search. The last sub-section relates to the viability of the planting a particular crop.

Figure 4.4.5: Model of the farmers' information needs

6. Preparation of Plant Beds

The information in this section is concerned with the planning, building and maintenance of plant beds.

7. Crops

This information need is concerned with knowledge related to the life cycles of particular crops that the farmers can grow.

8. Adding Value

The need identified in the *Adding Value* pertains to information that would increase the financial return of produce. Content would relate to information primarily on secondary products made from the crops.

9. Marketing

The two sub-sections which comprise the *Marketing* section relate to the need of farmers to ensure that they are selling the produce at a realistic and competitive price and secondly, information related to dealing with customers and orders.

10. Future Thinking.

The need addressed in the *Future Thinking* category is specifically relevant to farmers who are looking at increasing their income by expanding their farms. Much of the discussion that generated the data that informs this area was concerned with the introduction of semi-industrial farming equipment. Farmers felt hand-held tools would always limit the profit ceiling of farming. They felt that there tended to be a focus (by government and NGO's) on very small farming operation or the very large mechanised farms but not much in between.

4.4.2. The How?- operational goals.

Figure 4.4.6 below describes the behaviours and strategies currently practiced by Soweto farmers to increase their farming knowledge. As such **Figure 4.4.6** and the subsequent explanation reflects Hassenzahl's *operations* category.

The top-right hand corner data relates to how participants came to be farmers. The majority of farmers worked previously in careers different to farming. While the choice of farming was either out of desperation or coincidence, the participants once involved in farming became deeply passionate about farming and view knowledge acquisition as a powerful tool for improving their capabilities.

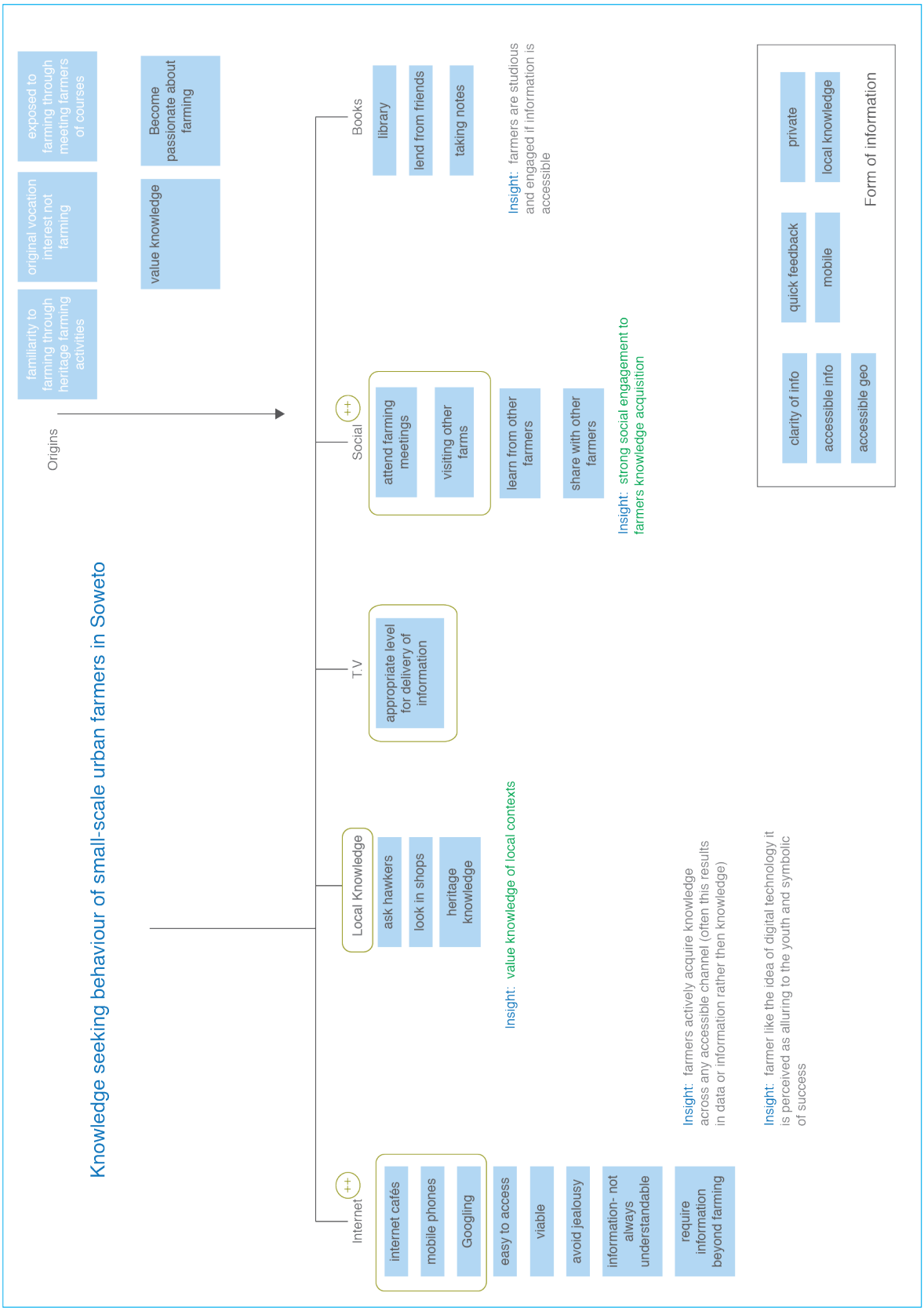


Figure 4.4.6: Model of the farmers' knowledge seeking behaviours

The five most prominent techniques for acquiring knowledge, ordered from lowest to highest in terms of farmers' preference, are as follows:

1. Local knowledge

Types of behaviours in this category include asking or observing local sales people in order to determine market requirements and prices. A second approach is reflecting on heritage or cultural knowledge in order to decide what to grow.

2. TV

Participants' identified television as a primary source of entertainment. They reported that they enjoyed watching programmes about farming, however, they felt the programme content was often to general and shallow.

3. Books

The format and level of information in books was identified as the best medium for learning. However, accessing books was seen as problematic as local libraries generally did have books on farming. Libraries were not particularly local and often entailed a trip to the Johannesburg Library in the inner city to get adequate books. Books were often acquired in an erratic manner, lent from friends or NGOs. Owned books often contained outdate information.

4. Social Learning

Learning through social-based activity was highly regarded. This type of learning was both formal in terms of workshops and meetings and informal such as learning from co-workers and friends. Social activities such as church groups and school societies were identified as an important aspect of Soweto life. However, the farmers preferred community activities that included other farmers. Subsequently, activities such as farmers' forums, workshops and visiting other farms were well regarded as sites of knowledge acquisition. Farmers felt happy to share their knowledge and learn from other farmers, however, they distrusted discussing farming matters with the broader community.

5. The Internet

The Internet (predominantly *Google*) was overwhelming identified as the best source of obtaining information. Farmers accessed the Internet on their own mobile phones or at Internet cafes. They felt the information was 'easy to access' and 'viable'. They enjoyed the fact that their activities were private and thus 'avoided (community) jealousy'. The Internet, in their view, surpassed books as information was more diverse, current and specialised. Additionally, information related to knowledge outside of the traditional farming sphere such as business and marketing was also available. Negative issues related to the Internet included; the amount of time and data wasted on browsing for the right content,

the complexity of returned information that could often be too advanced for the farmers to comprehend, as well as obtaining information that was written for foreign climates and is unsuitable for Gauteng.

Uniformly, the farmers described the type of content they sought to acquire as locally relevant and accessible in reference to pitch and retrieval.

4.4.3. The Why? –be goals.

The *Psychological Needs* categories, Figures 4.4.7- 16, provide a framing of the lived experiences of the farmers.

Autonomy/ Independence

In reference to *Autonomy/ Independence*, the participants tended to see farming as an enabler of independence as it gave them a greater sense of control over their own destiny compared to when they were unemployed. In order to be more independent in the financial sense, farmers aspire to expand production and hire labour. This was a major barrier as often the ability to expand production related to capital and land tenure, two aspects that farmers felt that they could not control. Labour was an issue as many people refused to work on the promise of payment delayed until after the harvest. Other barriers included that farming is essentially hard, physical work that often requires good people and management skills

Figure 4.4.7: Representation of Autonomy/ Independence affinity category

Competence/ Effectance

Farmers indicated that they felt that they were knowledgeable and able in respect to farming activities. They believed that they had obtained good skills through various training workshops and felt that their skills would be valuable to others. They felt that nature in the form of insects, disease, weather and fire was the greatest threat to their effectiveness. Additionally, they felt managerial, business and learning better farming methods were aspects that they could improve on.

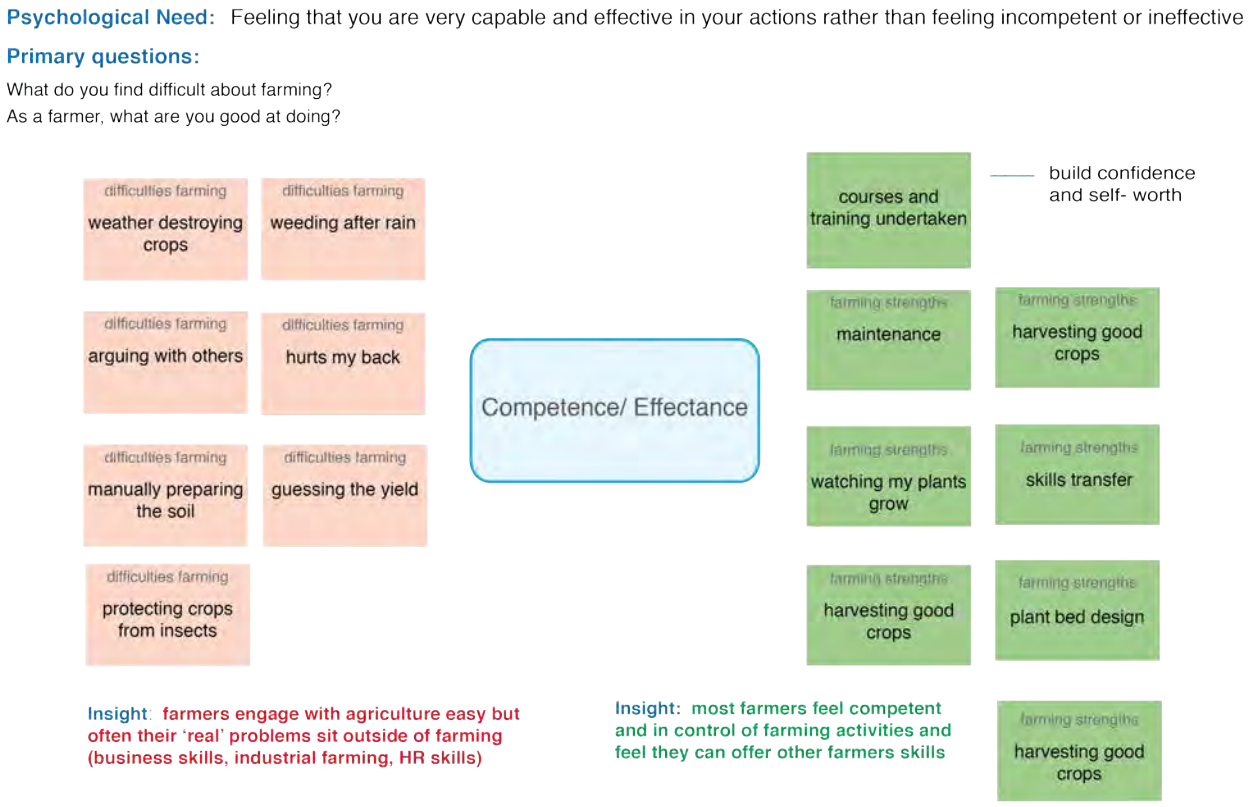


Figure 4.4.8: Representation of Competence/ Effectance affinity category

Relatedness/ Belongingness

Farmers placed a strong emphasis on community. What was highly insightful was the degree to which farmers saw themselves as having a strong sense of agency within their community. Many instances of farmers supporting local schools, orphanages and old-age homes were reported. Farmers also identified as belonging to a wider community of farmers. This community included commercial and large-scale farmers. They viewed their contribution to the local and national economy and food security as important. The other aspect of *Relatedness/ Belonging* was the relationship of the farmers with NGO's, tertiary institutes, municipal and national governments. This was a double-edged sword as while farmers benefit from these organisations, expectations of entitlement and indications of unsustainable relationships did present in the data[21].

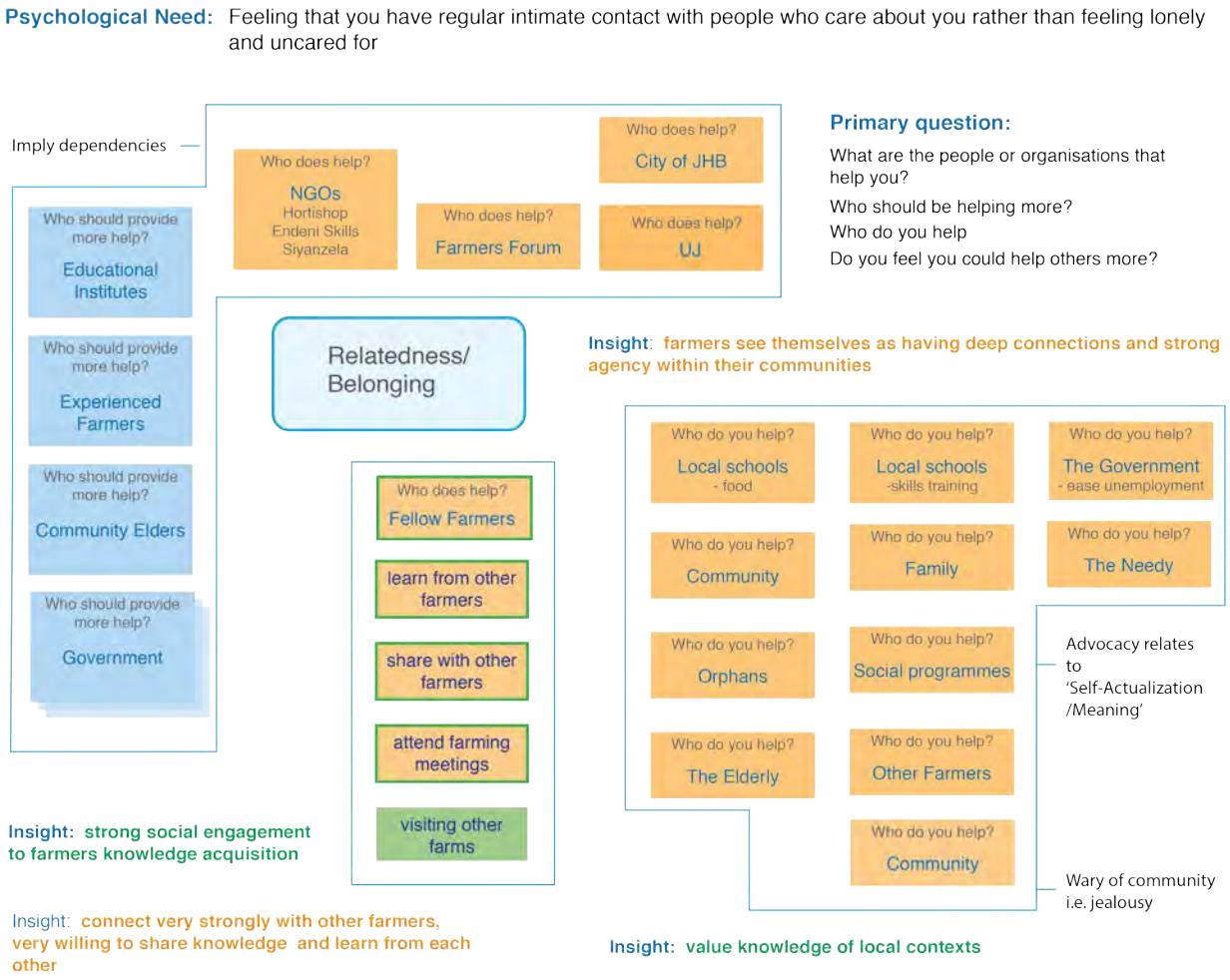


Figure 4.4.9: Representation of Relatedness/ Belongingness affinity category.

21 It is worth noting that this feedback was often in the form of critical reflections, by the farmers, on the provided services rather than a 'lack of delivery' gripe.

Self-actualizing/ Meaning

Relative to Self-actualization/Meaning, the data described that farmers felt fulfilment within three areas related to providing good health, improving their economic status and learning and sharing knowledge. The health aspects of farming extended beyond nutritional value and included positive mental health and the improvement of the surrounding environments. Economic value was seen as related to the farmers' own personal financial security and also in terms of community job creation.

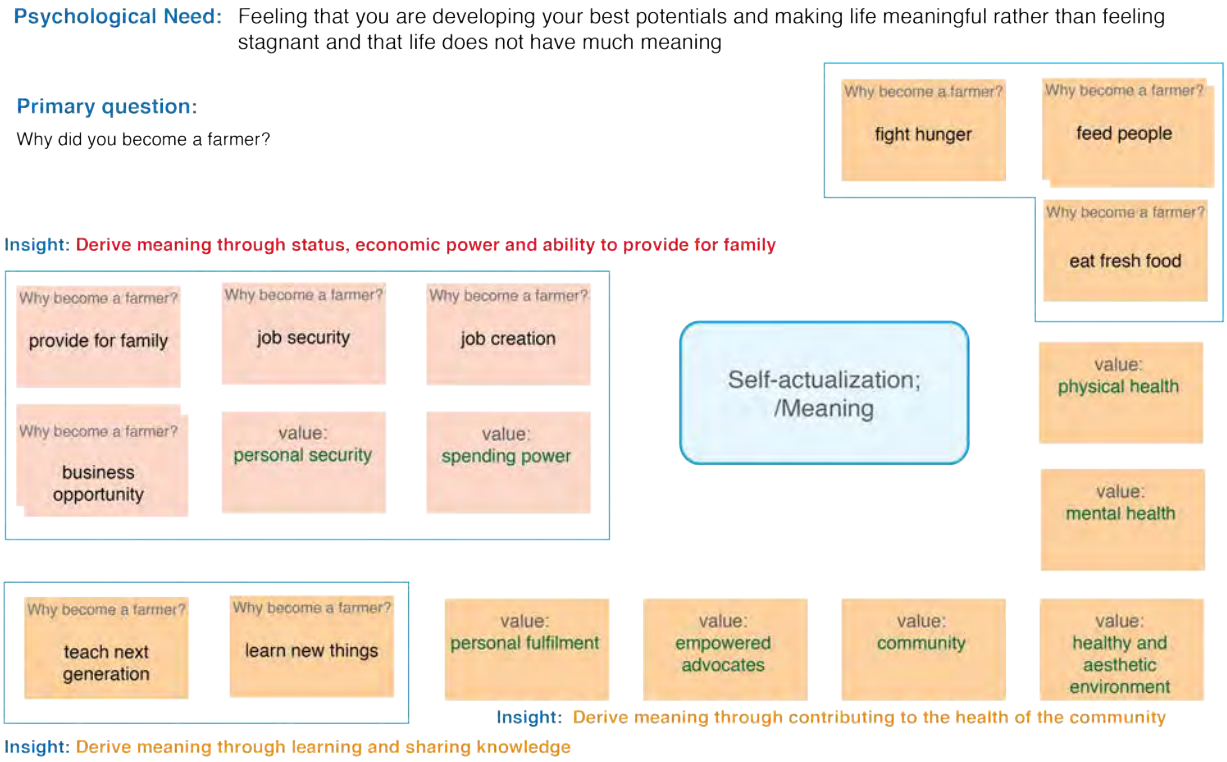


Figure 4.4.10: Representation of Self-actualizing/ Meaning affinity category

Security/ Control

In reference to what the farmers felt they could control, issues related to farming expertise dominated. However, threats that they felt they had little control over include theft, vandalism, and an unsecured future due to natural threats and their inability to own the land on which they work.

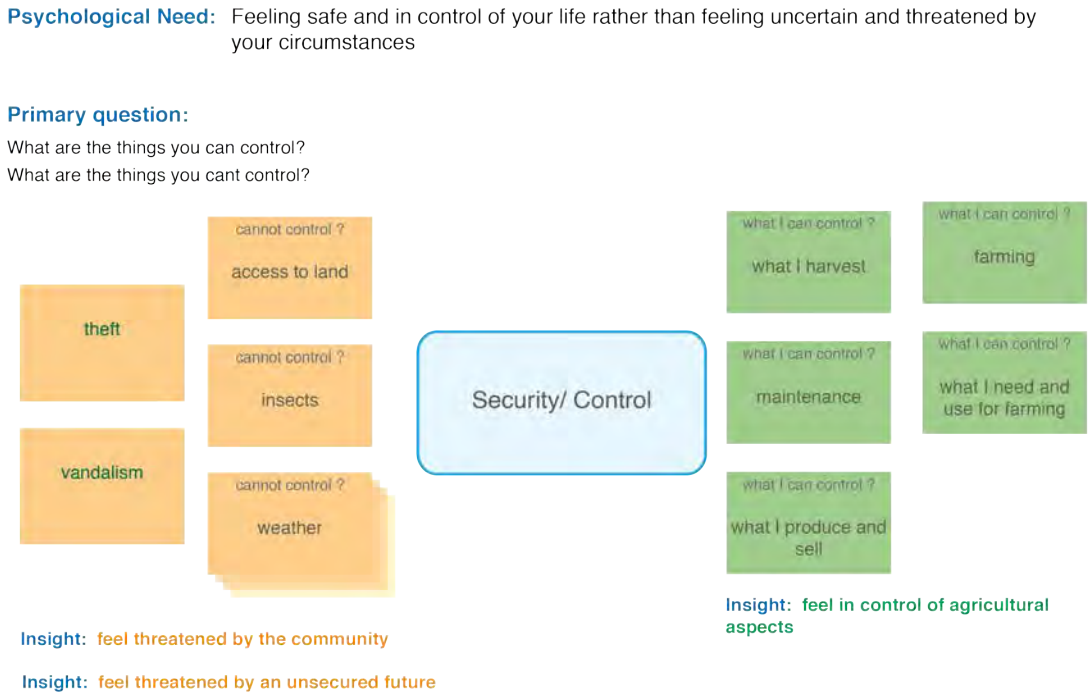


Figure 4.4.11: Representation of Security/ Control affinity category.

Money/ Luxury

Farmers responded that in relation to meeting their primary needs such as feeding families or paying school fees, farming had made a valuable contribution to their financial security. A major aspiration of the farmers was to own successful farming businesses that extended beyond self-sufficiency.

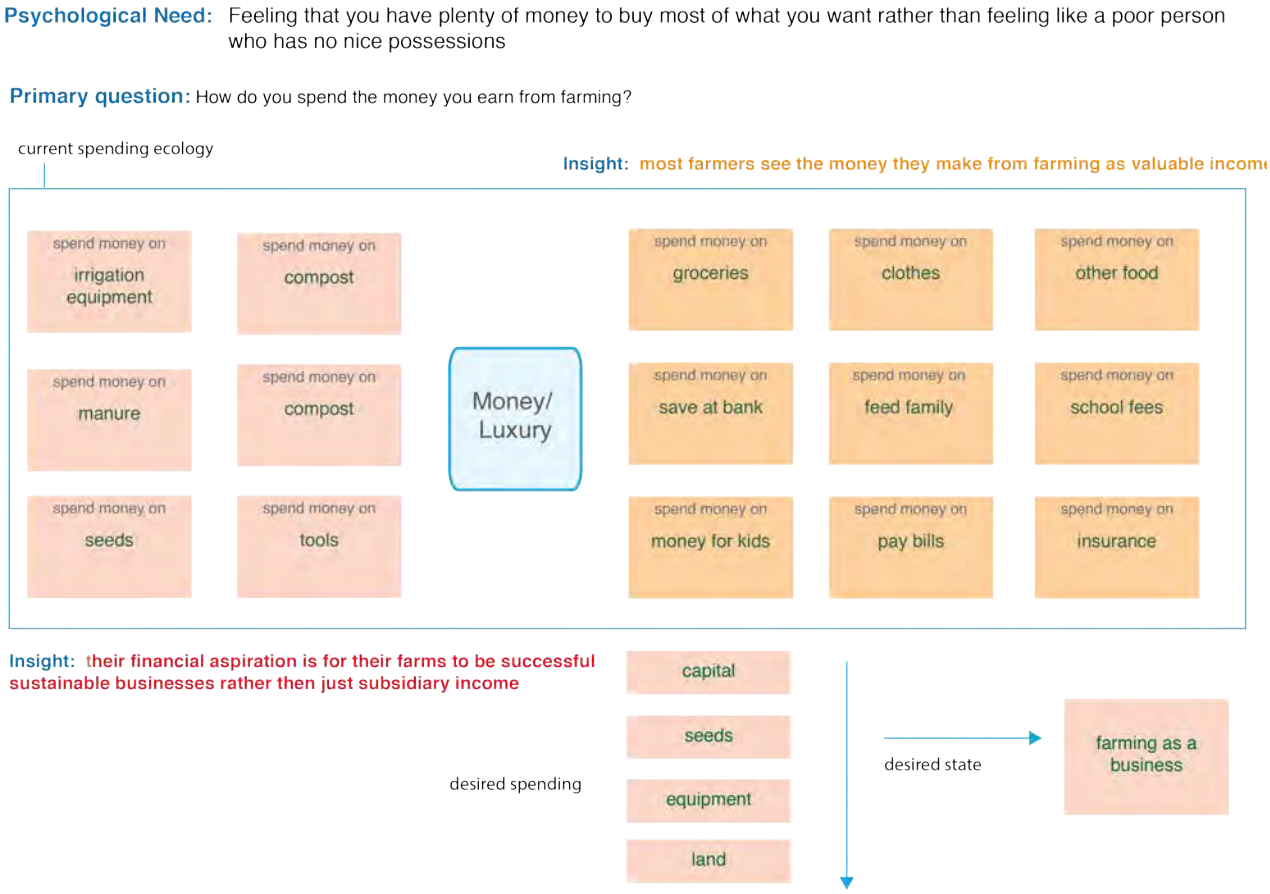


Figure 4.4.12: Representation of Money/ Luxury affinity category.

Influence/ Popularity

Farmers felt well respected within the farming community. Although often praised in the community for their well-priced and healthy food, farmers aspire for more respect in the broader community. Farmers believe that they are perceived by the community as dirty and poor. Often their efforts are viewed as a waste of time. One farmer reported that farmers were seen by the community as 'less than unemployed people', as the unemployed had 'the good sense not to waste their energy and time labouring in the dirt'. These perceptions of farming by the community are disheartening to the farmers and clashes with their own self-identity of been ambitious and having strong social agency.

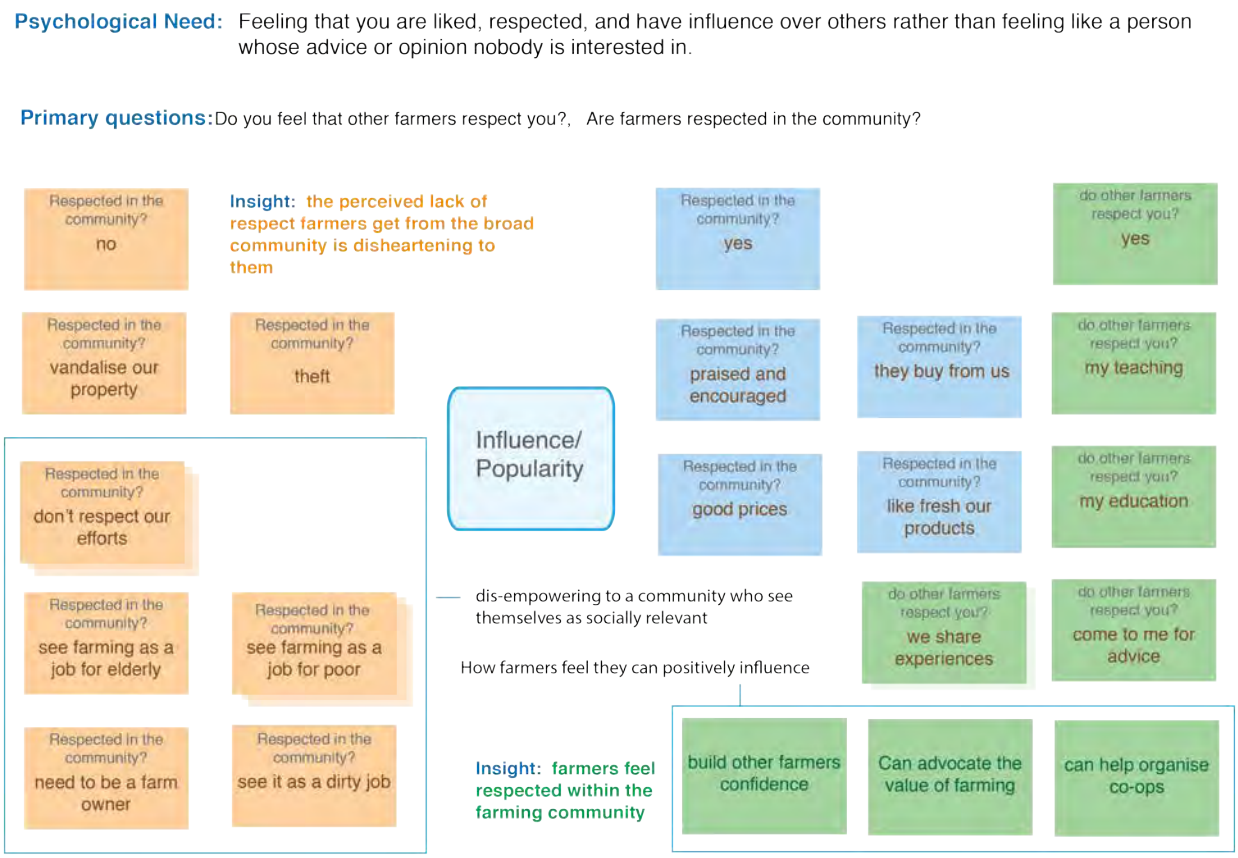


Figure 4.4.13: Representation of Influence/ Popularity affinity category.

Physical thriving/ Bodily

The farmers' perception farming as a healthy activity was prevalent in the data. Farming was frequently reported as having positive mental value as opposed to 'staying at home and doing nothing'.

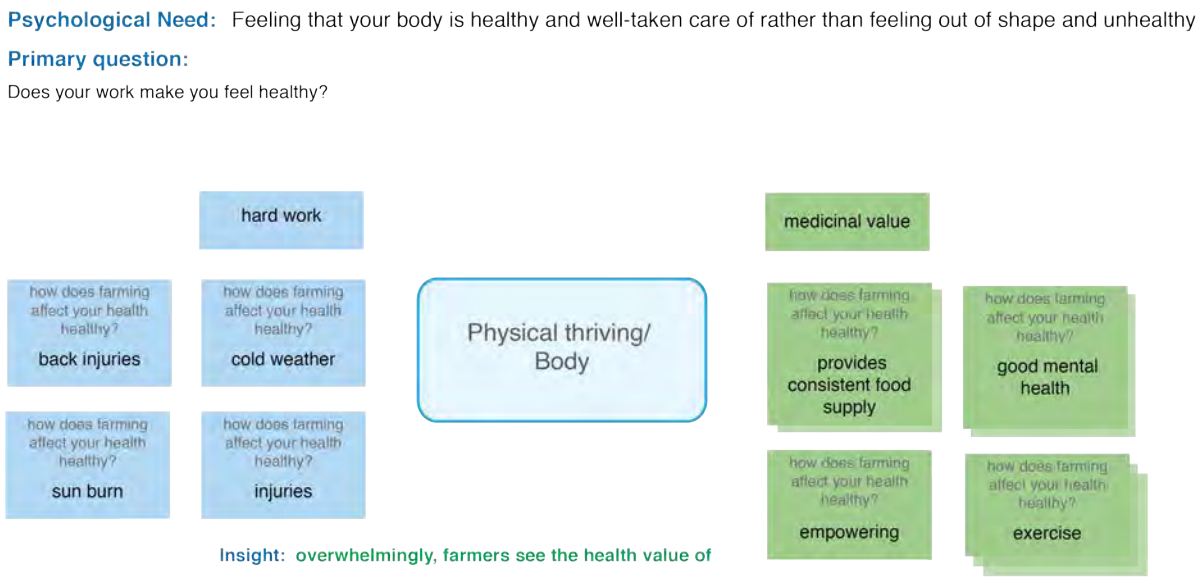


Figure 4.4.14: Representation of Physical thriving/ Bodily affinity category

Self-esteem/ Self-respect

Similar to points raised in *Relatedness/ Belongingness,* the farmers in Soweto strongly identify with the vocation of farming. They draw an immense sense of pride in the contribution farming makes to the economy and food security. They see themselves as people who are useful and needed and who have made an effort to improve their lives

Figure 4.4.15: Representation of Self-esteem/ Self-respect affinity category

Pleasure/ Stimulation

Farmers find pleasure in three distinct areas. The first of which is involvement in the community. Activities here range across work groups, charity work, church groups, spending time with their families and involvement with community initiatives. The second area is concerned with learning new things. Activities here include watching T.V, reading and browsing the Internet. The last area is the pleasure gained from working with plants and the enjoyment of watching plants grow and eating healthy food.

Figure 4.4.16: Representation of Pleasure/ Stimulation affinity category.

4.4.5. Developing the design strategy

Once the affinity diagrams related to the motivational goals had been completed, the *Psychological Needs* categories were further analysed to extract insights that synthesised key issues evident in the data. These insights were then further categorised into a final affinity relationship as shown in Figures 4.4.17- 18[22].

22 The data in all the images was colour coded retrospectively to explicitly illustrate how the synthesis emerged from the data.

1. Feeling that you have regular intimate contact with people who care about you rather than feeling lonely and uncared for.

- Strong social engagement to farmers' knowledge acquisition
- Value knowledge of local contexts
- Farmers see themselves as having deep connections and strong agency within their communities
- Connect very strongly with other farmers, very willing to share knowledge and learn from each other

2. Feeling that you are very capable and effective in your actions rather than feeling incompetent or ineffective.

- Farmers engage with agriculture easy but often their 'real' problems sit outside of farming (business skills, industrial farming, HR skills)
- Farmers feel competent and in control of farming activities and feel they can offer other farmers skills to learn

3. Feeling that you have plenty of money to buy most of what you want rather than feeling like a poor person

- Farmers see the money they make from farming as valuable income.
- Their financial aspiration is for their farms to be successful sustainable businesses rather then just subsidiary income.

4. Feeling that you are liked, respected, and have influence over others rather than feeling like a person whose advice or opinion nobody is interested in.

- The perceived lack of respect farmers get from the broader community is disheartening to them.
- Farmers feel respected within the farming community

5.Feeling safe and in control of your life rather than feeling uncertain and threatened by your circumstances.

- Feel threatened by the community
- Feel threatened by an unsecured future
- Feel in control of agricultural aspects

6.Feeling that you are developing your best potentials and making life meaningful rather than feeling stagnant and that life does not have much meaning.

- Derive meaning through learning and sharing knowledge
- Derive meaning through status, economic power and ability to provide for family
- Derive meaning through contributing to the health of the community

7. Feeling that you are a worthy person who is as good as anyone else rather than feeling like a 'loser'.

- Farmers see themselves as belonging to the vocation of farming (just as much as a commercial farmer)
- Farmers see themselves as useful and needed in the community and with in the broader South African community as well

8. Feeling like you are the cause of your own actions rather than feeling that external forces are the cause of your action.

- Farmers feel that they have power over their futures (compared to when they were not farmers)
- Expansion of farms relies on better external systems
- Independence would be greater if they could expand farming production

9. Feeling that your body is healthy and well-taken care of rather than feeling out of shape and unhealthy.

- Overwhelmingly, farmers see the health value of farming

10. Feeling that you get plenty of enjoyment and pleasure rather than feeling bored and under stimulated by life.

- Farmers are studious and engaged if information is accessible
- Value community activities
- Find farming a fulfilling activity in its own right
- Farmers actively acquire knowledge across any accessible channel

Figure 4.4.17: Key Insights extracted from the psychological needs affinity diagram.

Key Insights

- Strong social engagement to farmers' knowledge acquisition
- Value knowledge of local contexts
- Farmers feel competent and in control of farming activities and feel they can offer other farmers skills to learn
- Farmers feel respected within the farming community
- Feel in control of agricultural aspects
- Farmers feel that they have power over their futures (compared to when they were not farmers)
- Overwhelmingly, farmers see the health value of farming
- Find farming a fulfilling activity in its own right

Key Insights

- Farmers engage with agriculture easy but often their 'real' problems sit outside of farming (business skills, industrial farming, HR skills)
- Their financial aspiration is for their farms to be successful sustainable businesses rather then just subsidiary income.
- Derive meaning through status, economic power and ability to provide for family
- Expansion of farms relies on better external systems
- Feel threatened by an unsecure future
- Independence would be greater if they could expand farming production

Key Insights

- Farmers see themselves as having deep connections and strong agency within their communities
- Connect very strongly with other farmers, very willing to share knowledge and learn from each other
- Farmers see the money they make from farming as valuable income.
- The perceived lack of respect farmers get from the broader community is disheartening to them.
- Feel threatened by the community
- Feel threatened by an unsecured future
- Derive meaning through learning and sharing knowledge
- Derive meaning through contributing to the health of the community

Figure 4.4.18: Final categorisation of the farmers' psychological needs

The final act of synthesis in the Analysis Phase was the development of a service solution model which described at an abstract level how the envisioned design product would integrate with the context of the farmers needs and their existing social practices.

The design strategy, as represented in Figure 4.4.19, was reflected in three lifecycle stages that described the broad motivational goals the final product would facilitate achieving. These stages were:

- Improving Farming Abilities
- Increasing Effectiveness
- Co-create Value

The relevant content that would support these lifecycle stages are reflected through the colour coding applied in the model of the farmer's information needs as shown in Figure 4.4.5. For example, all the green information categories relate to *Improving Farming Abilities.*

The strategy focuses on supporting these broad goals by utilising the farmers' main modes of accessing information namely through the Internet and social interactions. The primary channel for accessing the Internet that was selected was mobile as this was the channel most commonly used by farmers for accessing the World Wide Web. Additionally, mobile content can easily be viewed in Internet cafés on personal computers, if required.

Supporting these behaviours and goals by complimenting current farming practices rather than altering or replacing them was considered an essential strategic intention so as to ensure the design intervention would fit as naturally as possible with the farmers' current experiences.

The mobile application would therefore seek to support these intentions as one channel within a broader solution system that included the farmers, farmers' associations, NGO's, outreach projects and government.

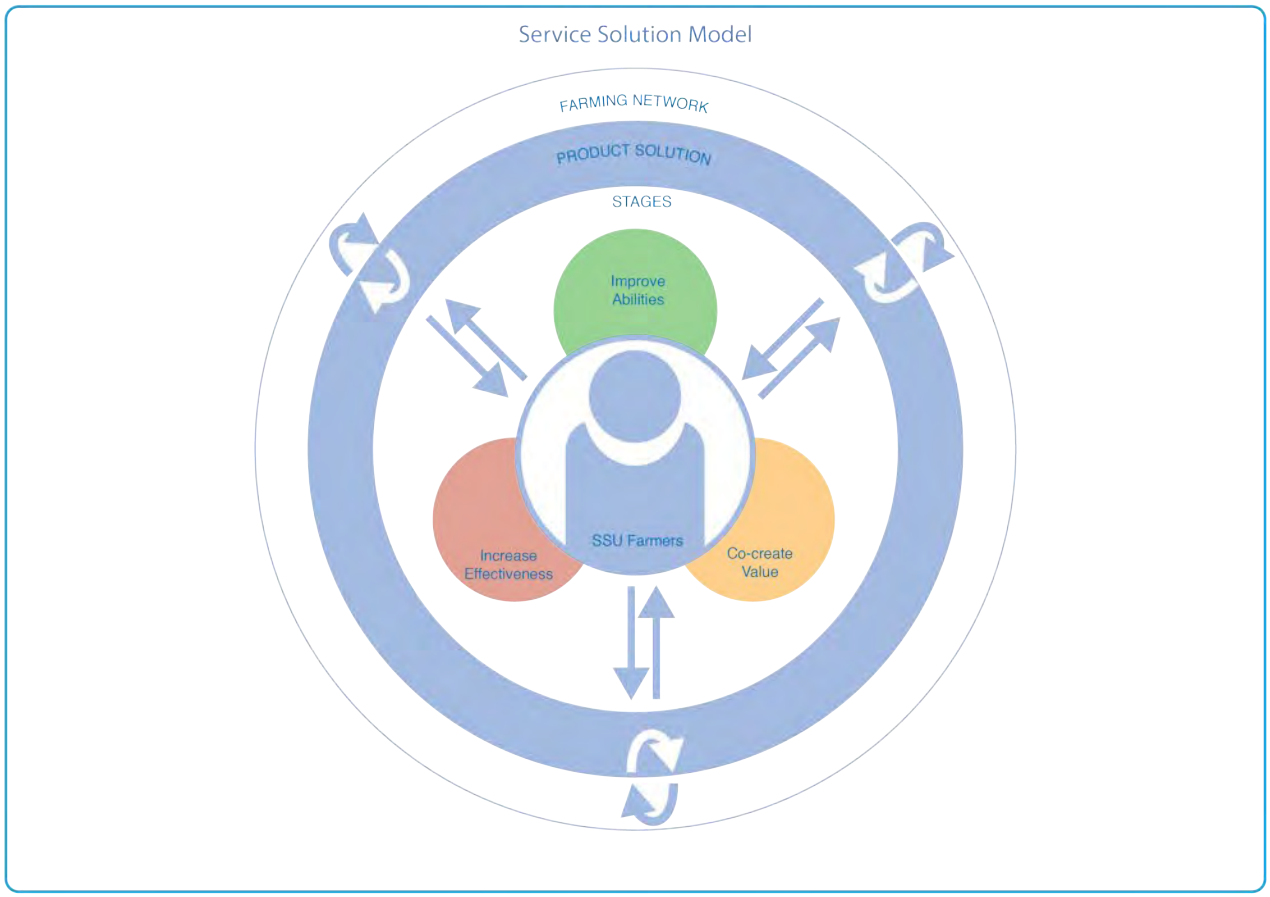


Figure 4.4.19: The *Service Solution Model* represents the conceptualisation of the design solution

4.5. Contextmapping: Communication Phase.

The purpose of the Communication Phase in contextmapping is to bring the results of the research process back to the design team [6] in order to inspire design ideation. In a traditional contextmapping process the design team is a group of designers and/or area specialists. In this project, the farmers were considered as the 'design team'.

The Communication Phase was constructed as a workshop session that sought to achieve two outcomes. The first outcome was to present my framing of the farmers' contexts and experiences back to the farmers for feedback. The second outcome was to obtain consensus on the design strategy and the proposed design solution. The fulfilment of this outcome was informed by Wright and McCarthy's dialogical approach to creating shared understanding [5, 12]. I opted to use visual tools such as personae and user-journeys that emphasised storytelling. Other visual tools such as ecology maps and the solution lifecycle mappings were incorporated into the larger narrative of the research process. This section 4.5: Communication Phase, describes the various visual tools that were used to communicate the farmers' experiences, the design strategy and the solution. The flow of this section is orientated around the description of the visual tools that were used to communicate concepts and the corresponding discussion with the farmers. A range of these tools such as the twelve affinity diagrams and the *Service Solution Model* were the result of the process of the analysis and have already been introduced in 4.4 Contextmaping: Analysis Phase**.** The new visual tools introduced in this section include:

- Problem ecology mappings
- Lifecycle stage mappings
- Persona models
- Information-needs models
- User-journey designs (swim lanes)

In reference to Molapo and Marsden's [24] identification of the problematic nature of using abstract diagrammatic prototypes when communicating understanding with 'development' participants, I used the visual tools as a form of 'experience' prototyping[23]. Experience prototypes as implemented in this study reverse the typical application of prototypes. Typically, prototypes are 'concrete' articulations of a designer's concept for solving a problem, applied in user-testing to evaluate the appropriateness of a design. A range of the type of criteria that can be tested include ergonomic, cognitive, cultural and functional suitability. Experience prototypes differ as they aim

[23] See Chris Down's description of experience prototypes [in 65]. Downs applies the term 'experience prototypes' in a similar vein to how the term is used in this thesis, however, Down's experience prototype focuses on how the user experiences the solution where it is used here to test a shared understanding of experience.

instead to capture an articulation of the users' experiences that the design can then be tested against.

Therefore, when I presented and contextualised the visual models mapping the farmers' experiences, I asked for critique and discussion around how the information presented in the models could be amended in order to be a more accurate. This approach was adopted to bridge the conceptual gap between understanding users' experiences and creating an interactive product that was empathetic to these experiences. My intention was to facilitate a strong shared understanding of the intention and contexts of use of the final mobile app in order to avoid concept testing until such a time that the interactive product was sufficiently developed as not to appear overly abstract to the farmers.

4.5.1. The communication narrative

The communication session happened two months after the last workshop. The narrative began with a review of the workshop session activities. This reminder was followed by a description of how the data was analysed and how insights were generated. Each of the twelve affinity diagrams were discussed in turn and amendments were noted.

The most substantial changes made concerned the model of the farmers' knowledge seeking behaviours (see Figures 4.4.6 & 4.5.1). Specifically, additional information related to the farmers' use of the Internet and their problems accessing appropriate information were added. Contrary to my expectation that the final product would need to be multilingual, the farmers strongly argued to prioritise an English version with quality information[24]. The reason for this was that they felt that farmers that owned and used mobile phones would more than likely be proficient in English. Consensus was reached that the function of the app was to deliver good content to the more technologically adept members of the farming community, who could then disperse the information through the existing social practices. They felt a focus on general information in many languages was not as useful as good content. Additionally, the non-training farmers agreed that it was easier to find someone who could translate complex English than it was to find quality information.

[24] The intention would be in due course to create multiple language versions.

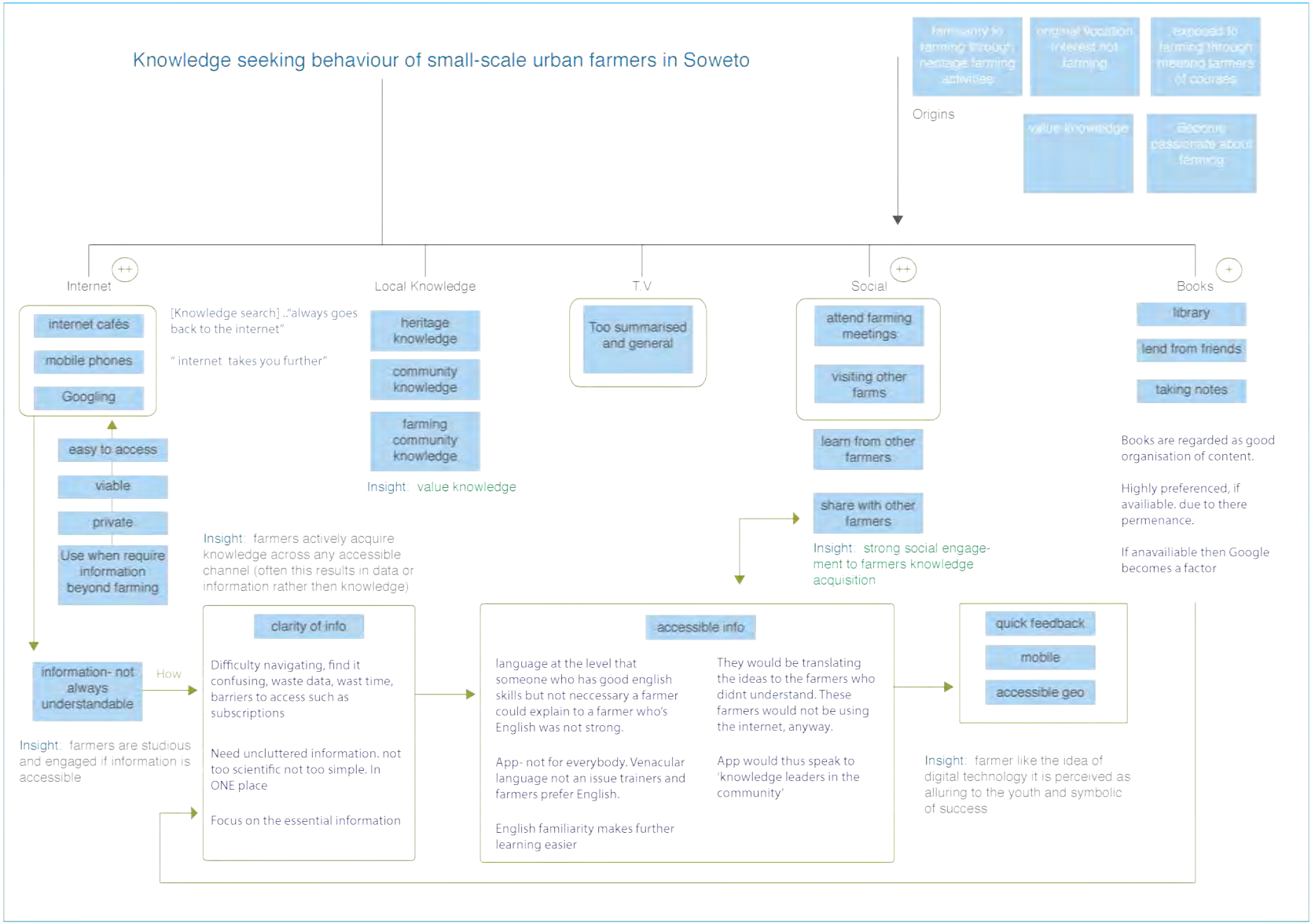


Figure 4.5.1: Revised behaviour model.

4.5.2. The Problem Ecology of Small-scale Urban Farmers

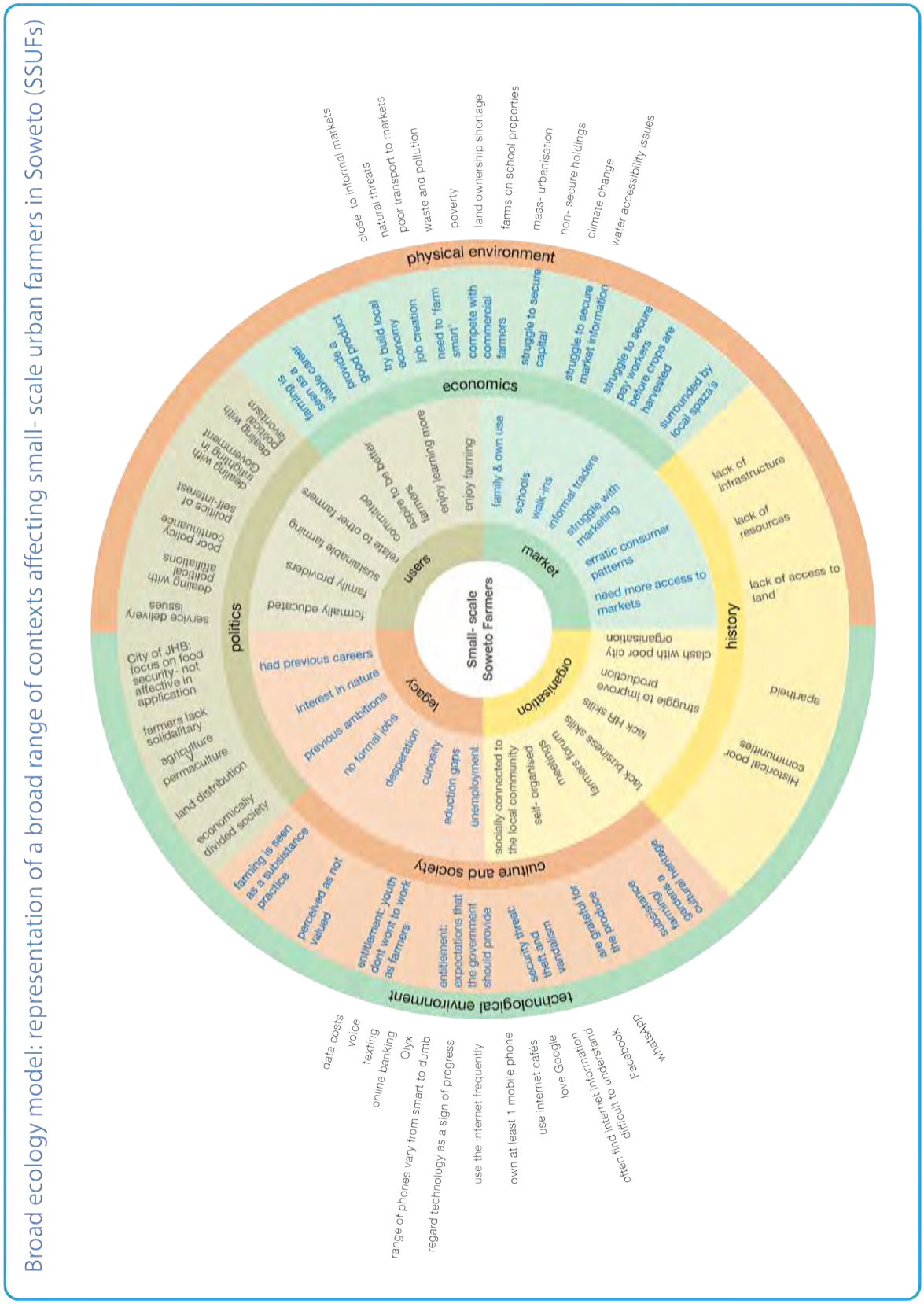


Figure 4.5.2: The problem ecology map describing the contexts of farming in Soweto

The problem ecology map describing the contexts of farming in Soweto, Figure 4.5.2, represents the contextual landscape within which, farming in Soweto takes place and seeks to provide a visual overview of the farming experience. Each of the 10 categories was discussed with the farmers in turn and either confirmed or edited. The value of the mapping was to return the data, which had in the Analyses Phase tended towards abstraction, back to the everyday reality of the farmers.

The discussion of the analysis concluded with the explanation of the three solution lifecycle stages presented in the *Service Solution Model* (Figure 4.4.19). The *Service Solution Model* was explained in detail by breaking each focus area into its own service model[25] (Figure 4.5.3-5) that converged the research insights, aspects of the data and the broader farm network.

4.5.3. Lifecycle stage mappings

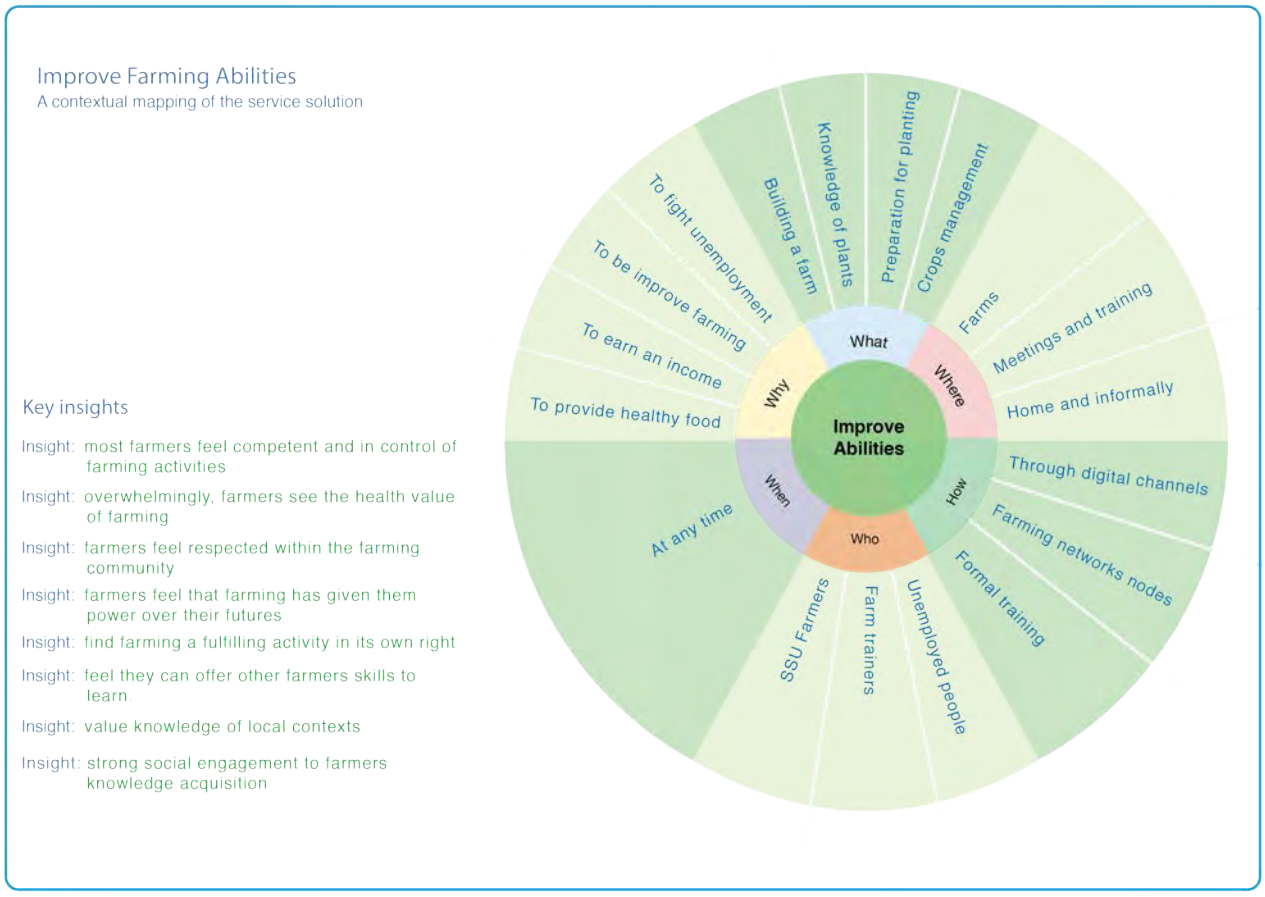


Figure 4.5.3: Mapping of the *improving Farming abilities* lifecycle.

25 The Lifecycle stage mappings follow the LIVE|WORK problem ecology mapping model, see [65, 66]

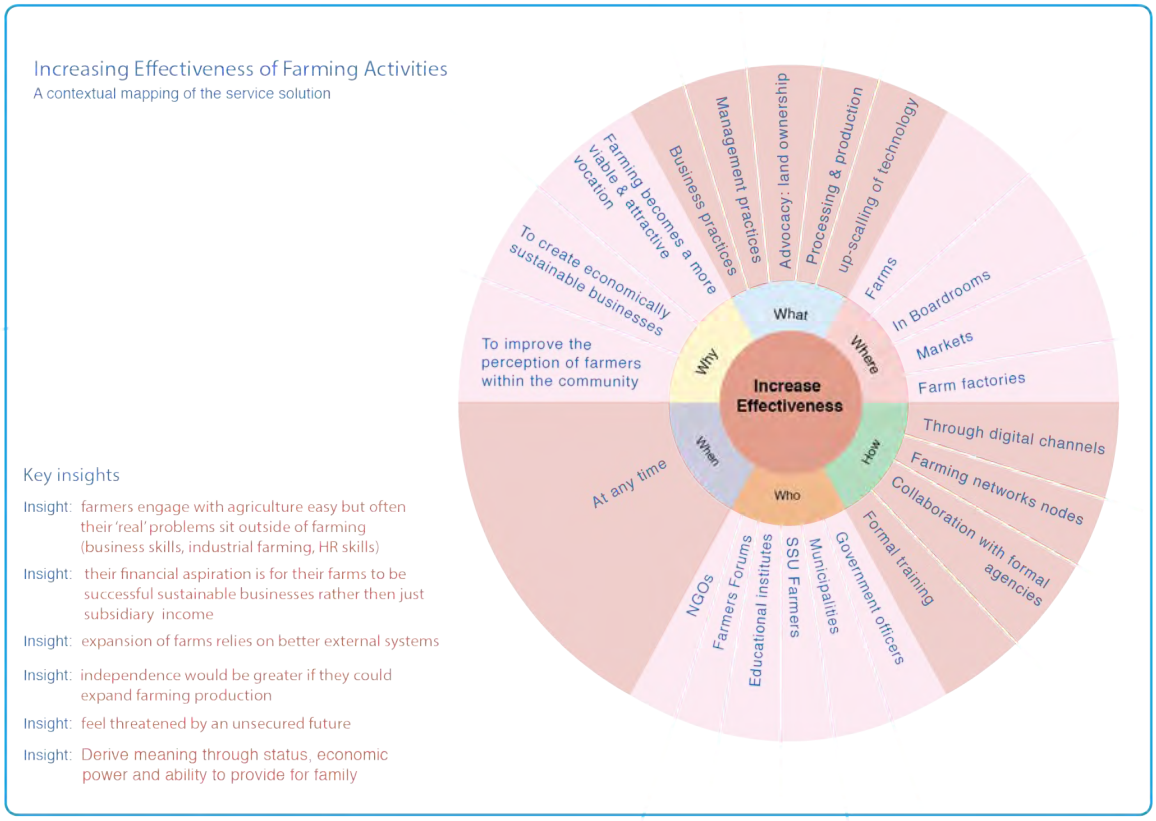


Figure 4.5.4: Mapping of the *improving Farming abilities* lifecycle. Below, **Figure 4.5.5:** Mapping of the *improving Farming abilities* lifecycle.

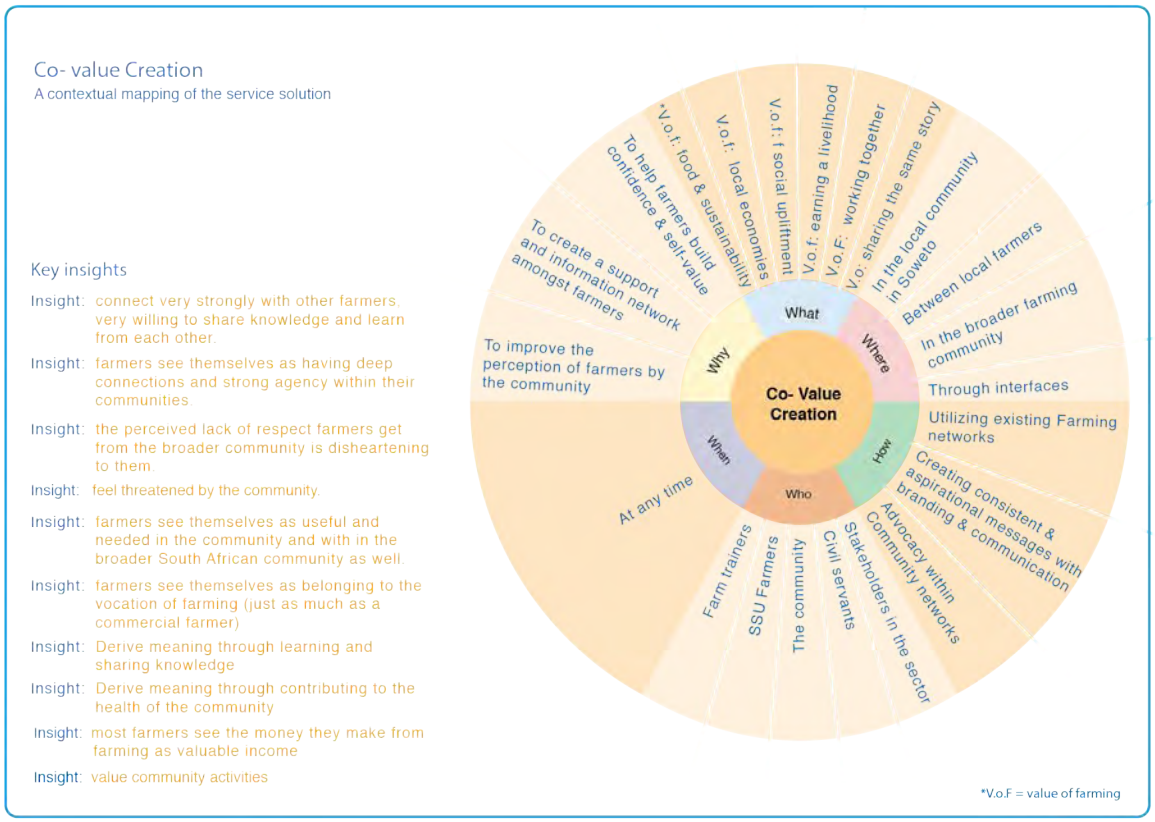


Figure 4.5.5: Mapping of the *improving Farming abilities* lifecycle.

During the feedback session the farmers indicated that they felt the focus areas were appropriate and indicative of their needs. They also felt the analytical and synthetic processes that led to the selecting the focus areas were understandable and rational.

4.5.4. Persona models

The next stage of the communication narrative involved the presentation and discussion of three personae [27, 29]. The personae framed the experience of the farmers from the viewpoint of fictitious characters that represented and told the story of the different types of farmer who would potentially use the app. Although highly narrative in terms of the written and photographic content, the personae were constructed to reflect the research data. Each persona was modelled to represent different levels of farming experience, perception of community relevance, knowledge acquisition abilities and community engagement. The three personae, as shown in Figures 4.5.6-8, represent Nomsa, who wants to learn to farm, Sithole, an experienced if somewhat disheartened farmer, and Morena an experienced farmer who is now working as a trainer of other farmers.

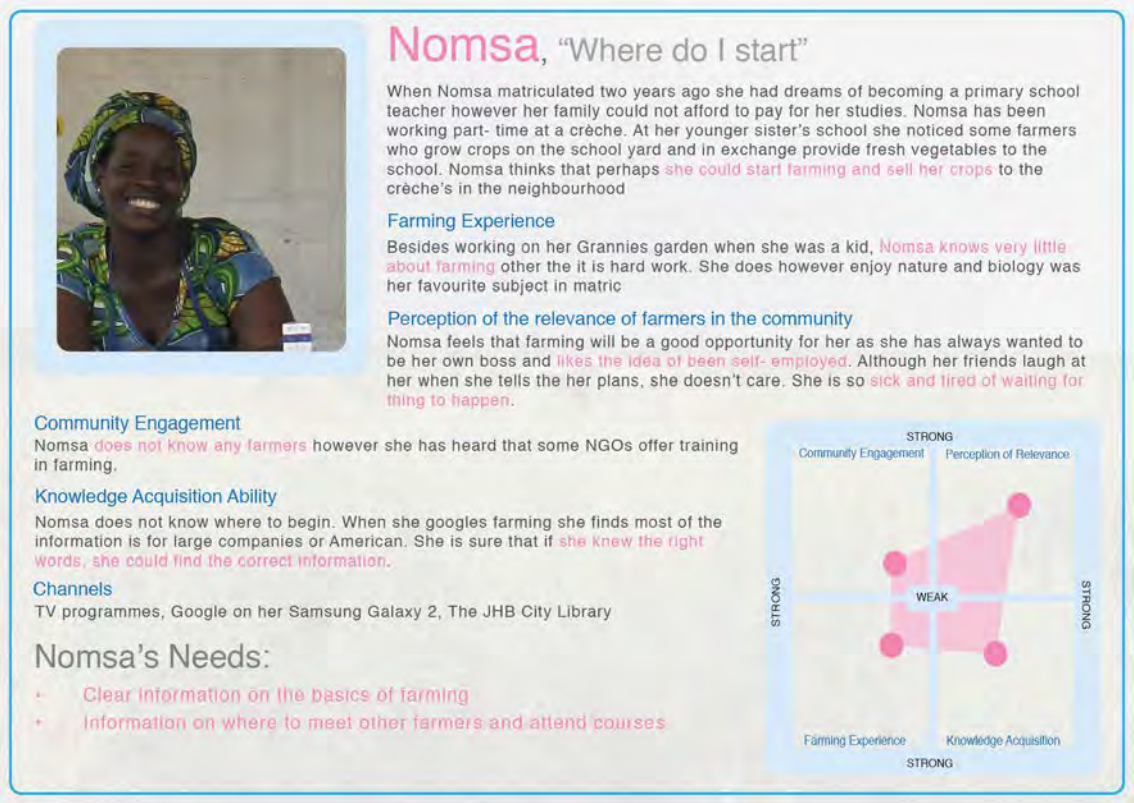


Figure 4.5.6: Nomsa persona diagram.

Figure 4.5.7: Sithole persona diagram.

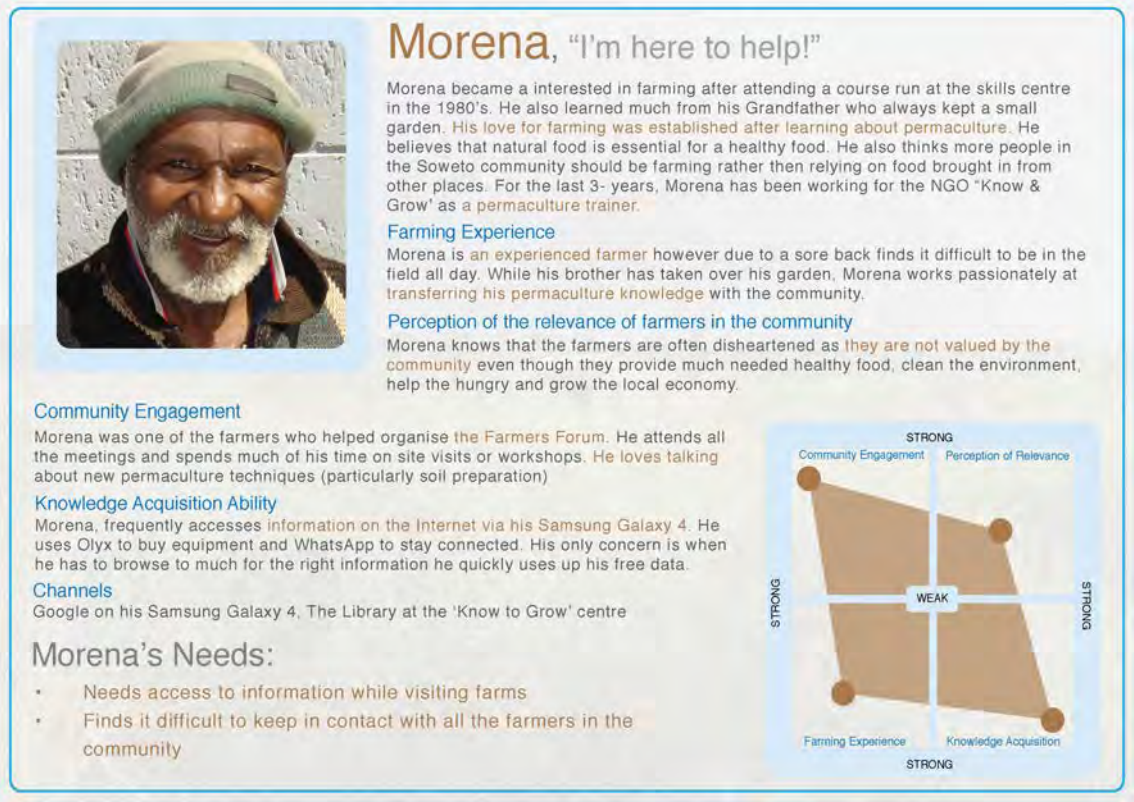


Figure 4.5.8: Morena persona diagram.

The next set of diagrams (Figures 5.5.9-10) discussed and indexed each persona with the type of information they would most likely be interested in accessing. Nomsa, as a first time user would be

more likey to access information on how to plant and grow, while Sithole would as an experienced farmer be more concerned with building and expanding farms- as well as business management.

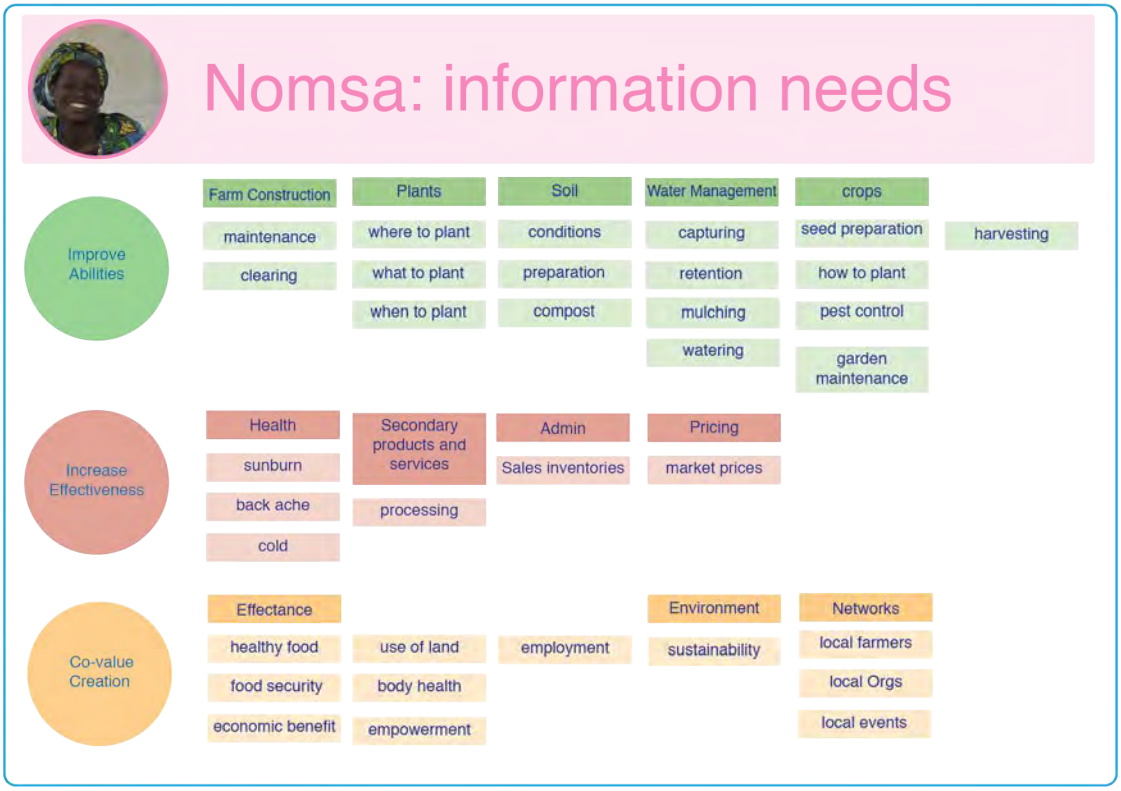


Figure 4.5.9: Nomsa's information needs.

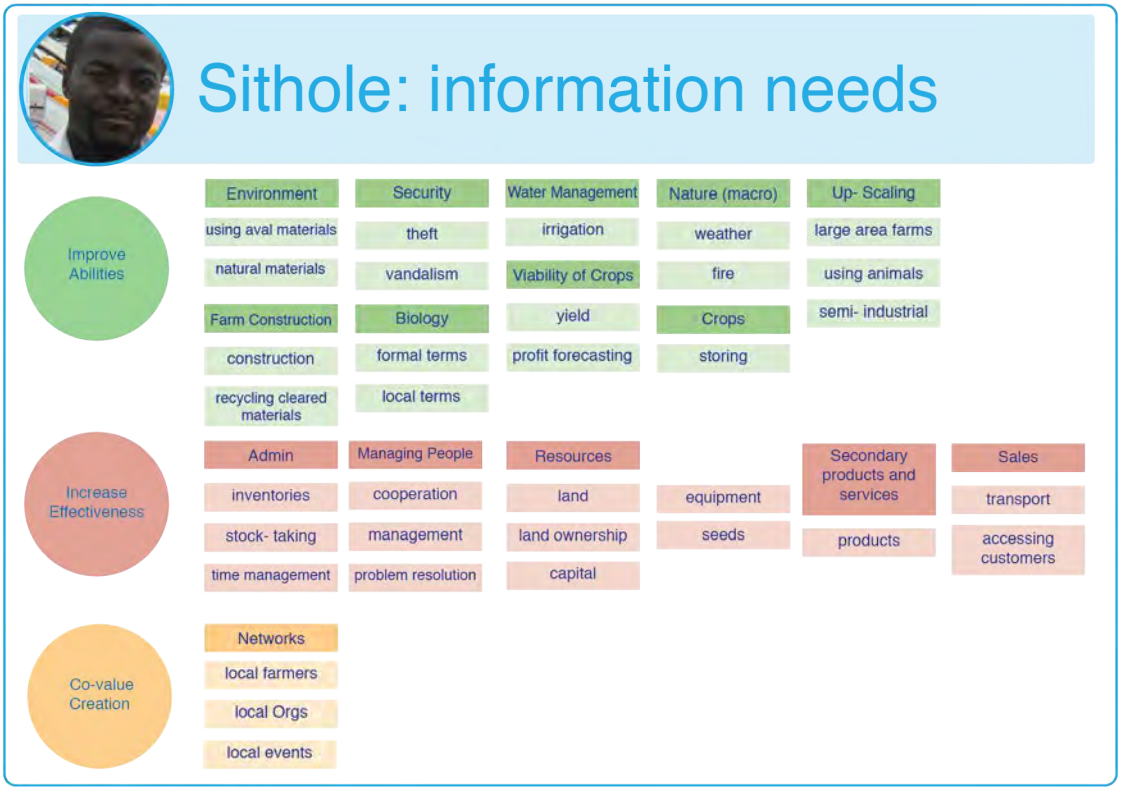


Figure 4.5.10: Sithole's information needs. Morena as a trainer would require access to all information

The information-needs models were primarily used to create a conceptual bridge between the personae and the next set of documents, the user-journey design diagrams.

4.5.6. User-journey design diagrams

User-journeys [49, 67, 68, 69] are schematic representations of the envisioned paths users take through the lifecycle stages, channels, touchpoints, content and functionality of an interactive product or system [68]. User-journey designs are based on user needs [69] and describe the logical progressions of how the user would achieve their intended goal through the use of a design product/s, service or system.

While journeys are often used to map how users experience existing products, they are used in Figures 4.5.11- 13 to map three imagined journeys detailing how the different personae user-types could potentially engage with the mobile app. In essence, the user-journeys depicted here illustrate the design concept and exemplify how the farmers could use the final mobile application. This approach of applying personae driven user-journeys (also known as swimlanes**)** to describe users' envisioned experiences of a product was conceptualised in this project and differs from the more traditional application of user-journeys**,** examples of which are contained in the New Design Concepts section.

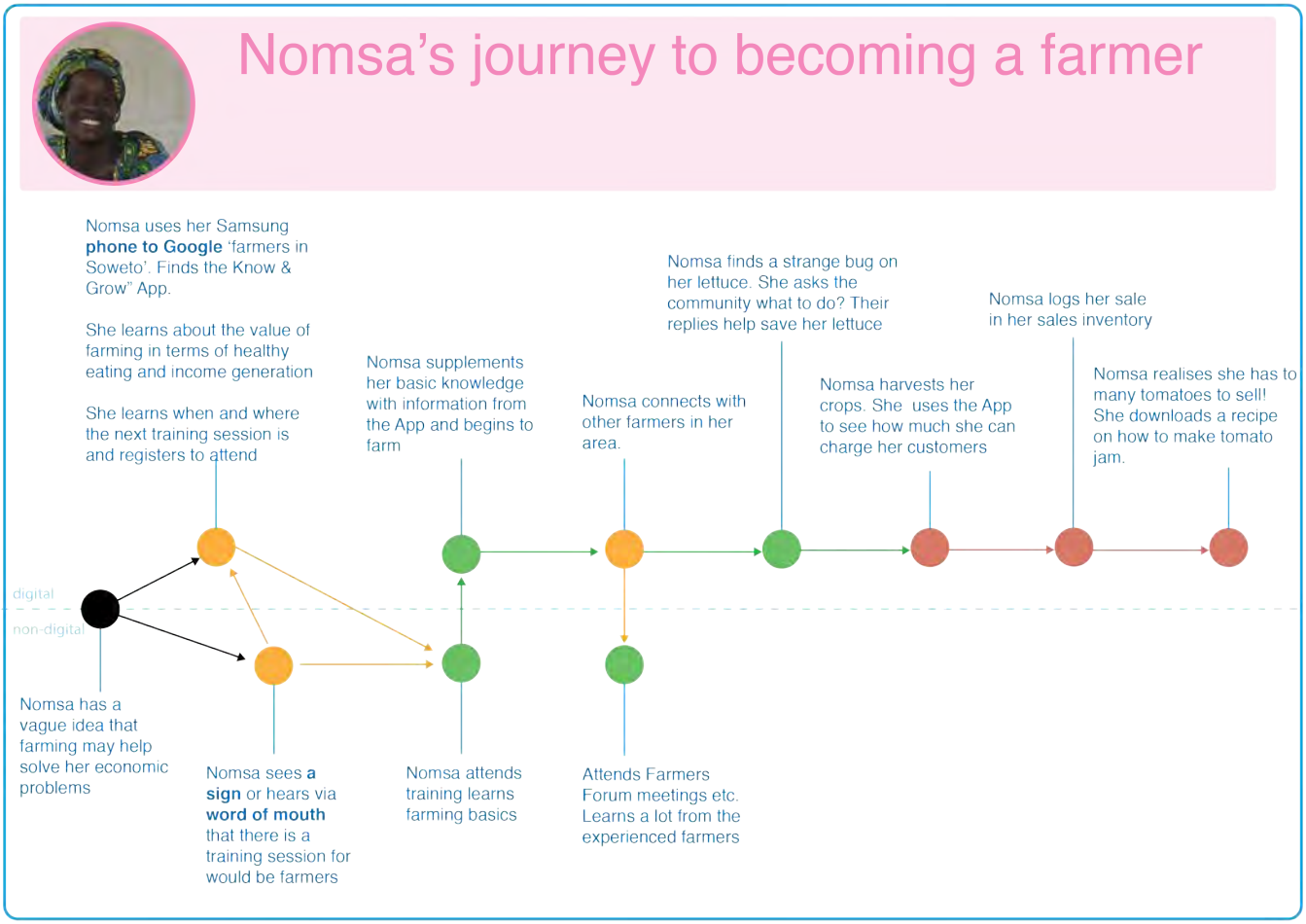


Figure 4.5.11: Nomsa's Journey with the app, to becoming a farmer.

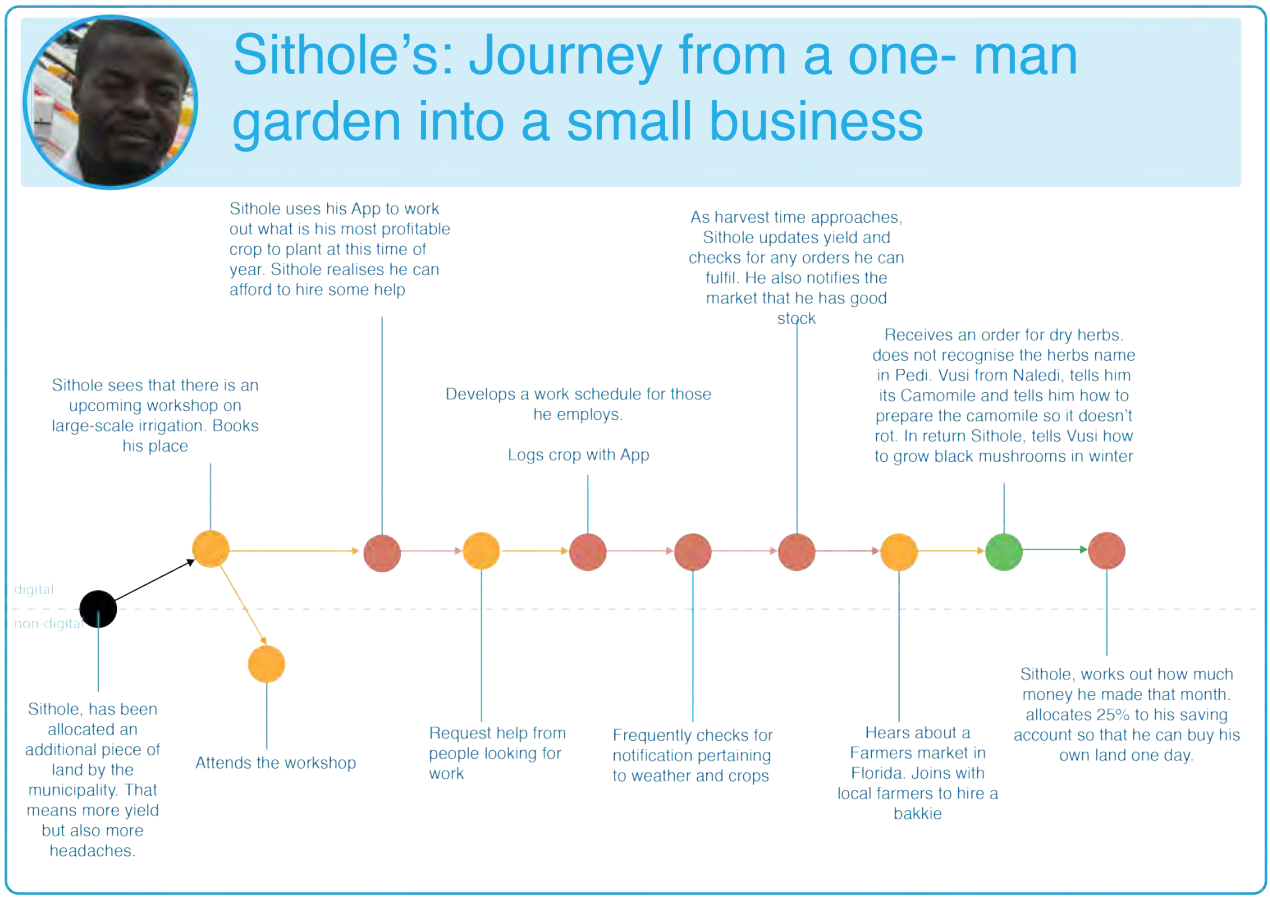
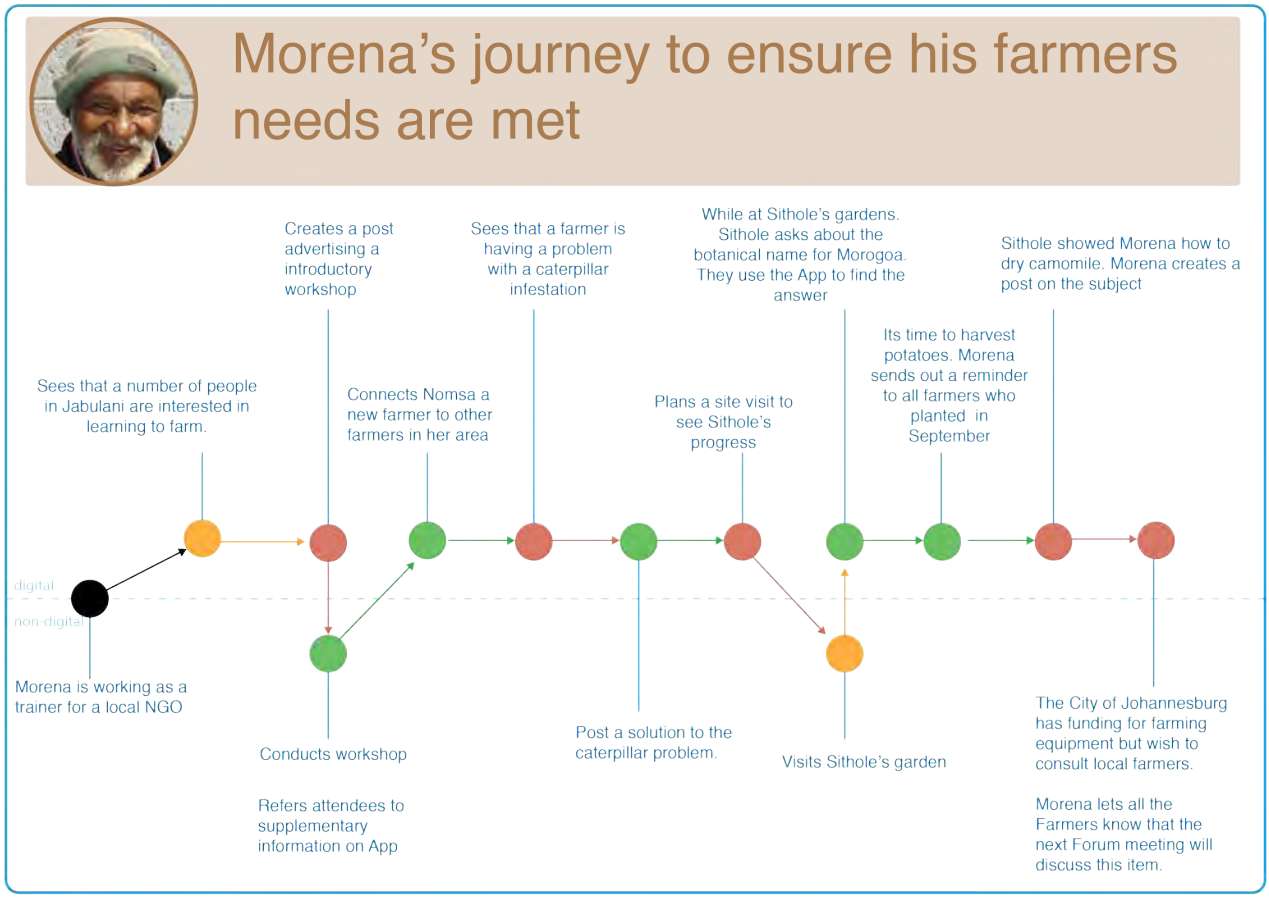


Figure 4.5.12-13: Sithole's and Morena's Journeys with the app



The personae driven user-journeys were designed as an extended scenario, with every touchpoint described as part of a larger story of use. The green, yellow and red colour code refer back to the *Service Solution Model* and to the data itself, and illustrates the close relationship between the research data generated in the participatory workshops and the strategy for the design solution. The diagrams also illustrate which touchpoints would be interacted with in the digital channel and those that would take place elsewhere in the broader service solution such as training workshops.

From the farmers' feedback related to the personae and the user-journeys, it appeared that the farmers began to conceive of how the final application would work, who would use it and what it could be used for. By incorporating the personae into the visual narrations of how the product would work, the farmers could engage with the design concepts presented to them in meaningful ways and provide clear and purposeful feedback about the accuracy of the mapping.

An example of the farmers' level of engagement was the discussion related to the different needs of novices and experienced farmers. One participant commented that he thought that it was important that different types of farmers such as Nomsa and Sithole could use the app to achieve different goals. The farmer thought it was valuable that "*One could go to something that's relevant to him, rather than starting at the bottom [of the learning process]…. when he just needs the other stuff*".

It is worth noting that while the farmers easily understood and related to the personae, the user-journeys only made sense to the farmers once all three had been described. Initially after only describing Nomsa's journey, participants found it difficult to comment. However, once the other two journeys had been described, the participants became very engaged in the discussion.

A last example of evidence that supported my belief that the farmers were comfortable with the concepts presented to them was embedded in the final activity of the Communication workshop. In this activity, I discussed with the farmers the idea of prioritising functionality due to time and resources constraints. During a cardsorting[26] activity, I asked the participants to select what they thought were the important aspects of the design for farmers by rating discrete modules of functionality. These modules were taken from the various journeys and examples included 'community notifications', 'classified section' or 'management knowledge'.

The farmers completed this task effectively with very little discussion or questioning of concepts. This understanding implied that they were comfortable assessing the value of the mobile applications potential functionality in reference to their personal needs and were not constrained by terminology, technological understanding or contexts of application.

[26] For a detailed account of cardsorting techniques see [70]

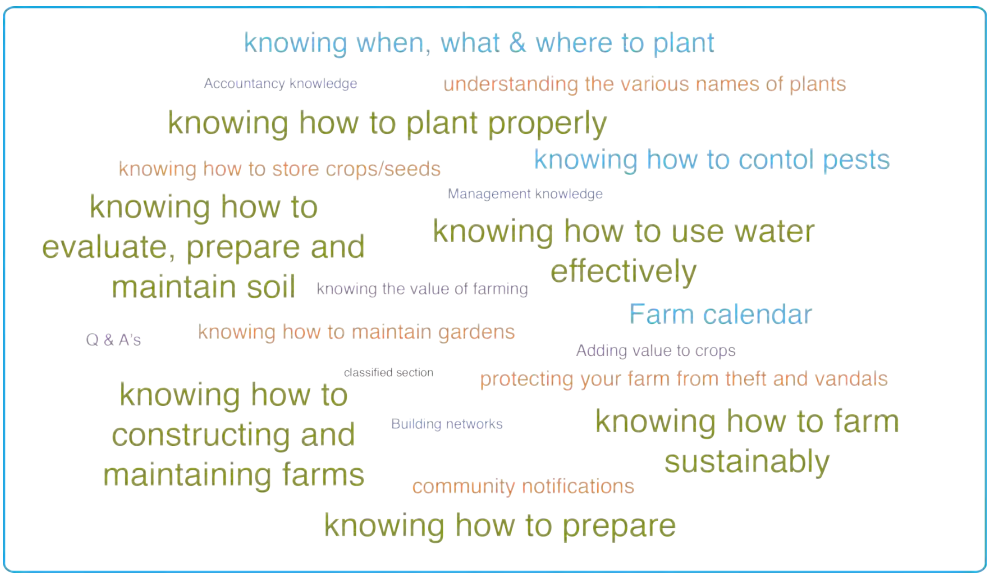


Figure 4.5.14: A word-cloud reflecting the farmer's most popular functionality modules.

4.6 Contextmapping: New Design Concepts Phase

The New Design Concepts Phase of contextmapping is principally concerned with the activities that relate to the resolution of the design problem in reference to the insights and strategies identified and agreed upon in the earlier phases of the contextmapping methodology. As such, the focus of this section is the design of the *Khula* mobile web application prototype.

The discussion does not intend to provide an exhaustive account of the design process but rather illustrates through selected examples of practices, how the design strategy and conceptualisation of the solution defined with reference to insights and feedback generated by the farmers, was applied in the interaction design of the prototype. As such, the key concern of the research is to establish whether the insights gained from the earlier phases were indeed actionable and relevant for interactive design practice.

'Actionable' as used here refers to the direct application of the strategic and conceptual concerns of the design within the form, functionality and experience offering of the design product. 'Relevant' is used to include two aspects of interaction design. The first aspect refers to 'relevant' practice and expects the involved practices to be of the types broadly accepted as belonging to contemporary IXD. The second application of the term 'relevant' is whether or not and to what degree the design product solves the problems, it was conceived to solve.

4.6.1 User-journey design

The initial design activity undertaken was a high-level representation of the service offering of the mobile app solution as modelled in as depicted in Figure 4.6.1. The service journey was constructed by combining the three personae-driven user-journeys created in the Communication

Phase to explain the intended functionality of the application to the farmers into one schematic diagram.

At this stage the user goals were reduced to ten essential requirements that reflected the farmers core needs.

These were:

1. Learning about farming
2. Learning about farming in Soweto
3. Sharing knowledge
4. Identifying what to plant
5. Learning about plants
6. Identifying and learning about pests
7. Learning about secondary products
8. Assessing the viability of crops
9. Creating a profile
10. Viewing a profile

The selection of these requirements was in response to the results of cardsorting exercise in the Communication Phase and in consultation with partner stakeholders.

In Figure 4.6.1, the degree of convergence of the individual journeys to the horizontal centre-line describes the requirements, which would be used (predominantly) by the different users. For example, Goal 8, *Assessing the viability of crops* would be used mainly by established farmers, while Goal 2, *Learning about farming in Soweto* would mainly be used by novice farmers and trainers. Lastly, Goals 5, 9 and 10; *Learning about plants, Creating a profile* and *Viewing a profile,* would be used by all users.

Figure 4.6.1 also describes through the use of colour, how the journeys reflect individual lifecycles of the *Service Solution Model* (Figure 4.4.19). All green journeys relate to *Improving farmers' abilities*, all red to *Increasing farmers' effectiveness* and orange journeys to *Co-creation of value.*

The service-journey orientates the subsequent user-journeys and task-flow diagrams that describe the *operational* and *do goals* of the solution within a cohesive structure.

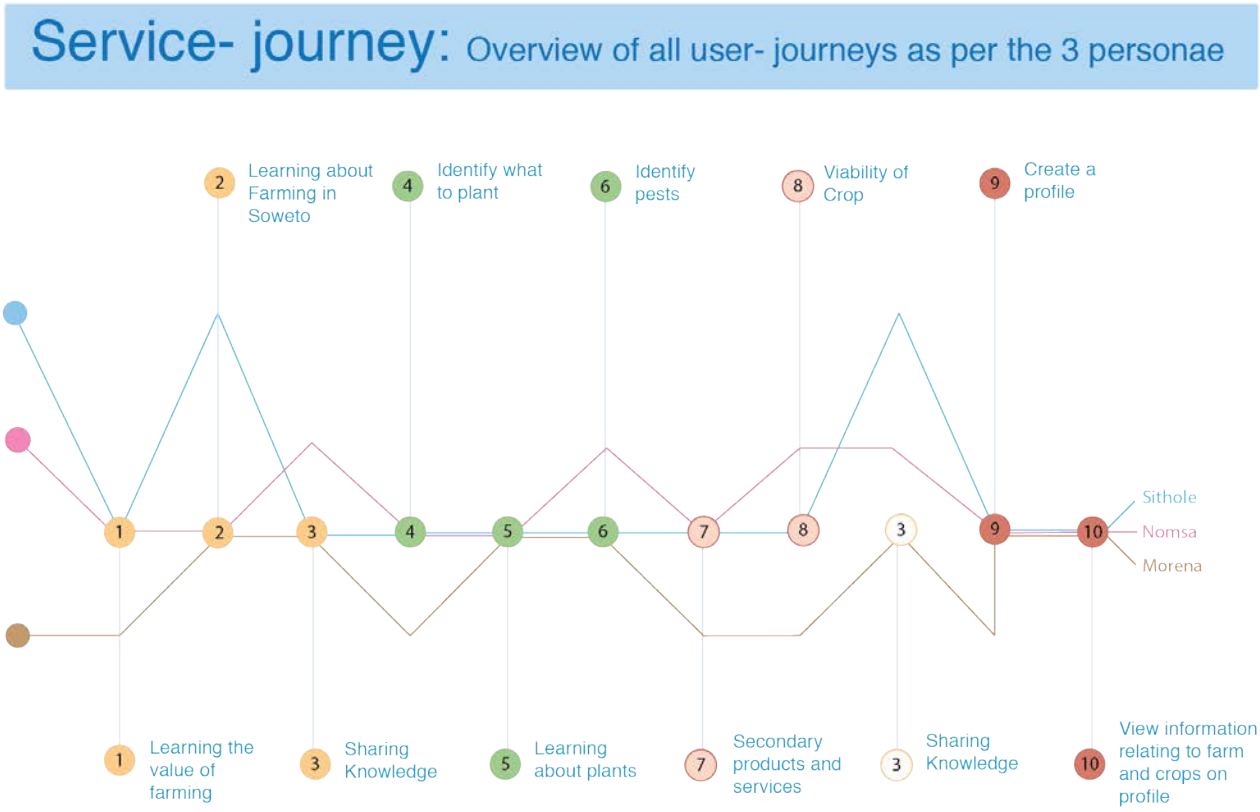


Figure 4.6.1: The Service Journey Model

The ten identified goals that form the service-journey were envisioned as individual user-journey diagrams as shown in Figures 4.6.2-10.

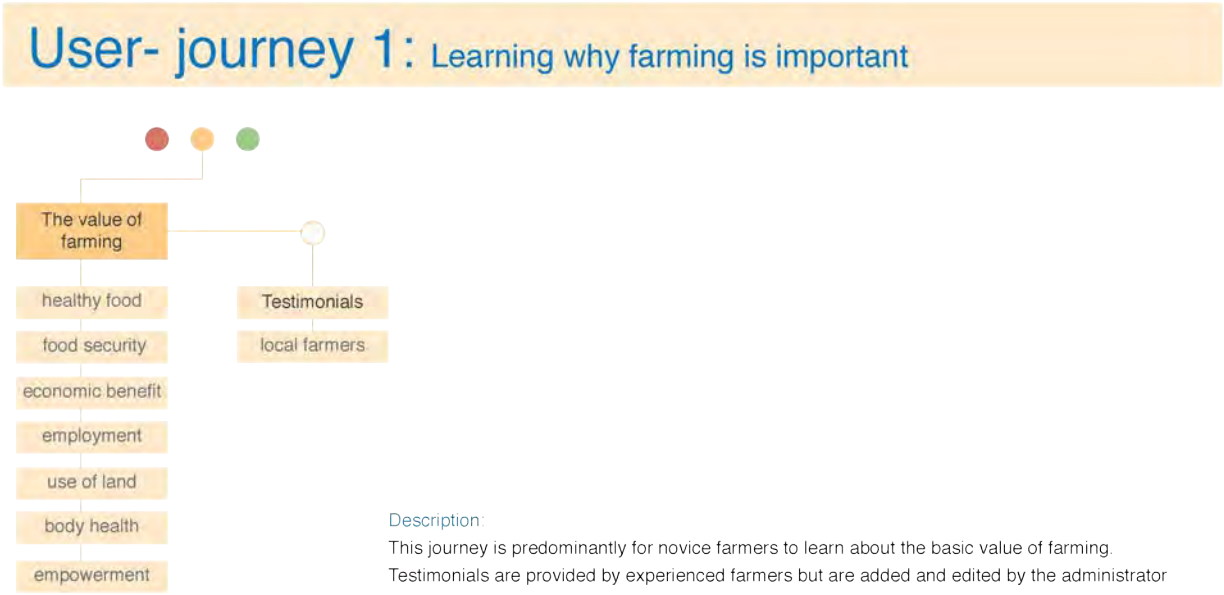


Figure 4.6.2: The *Learning the value of farming* journey. Circles with solid fills indicate external journeys which can be accessed from the current journey while all circles with only solid gradients indicate decision points referring to task-flow diagrams with in the current journey. Square fills indicate categories of information or functional categories within the current journey.

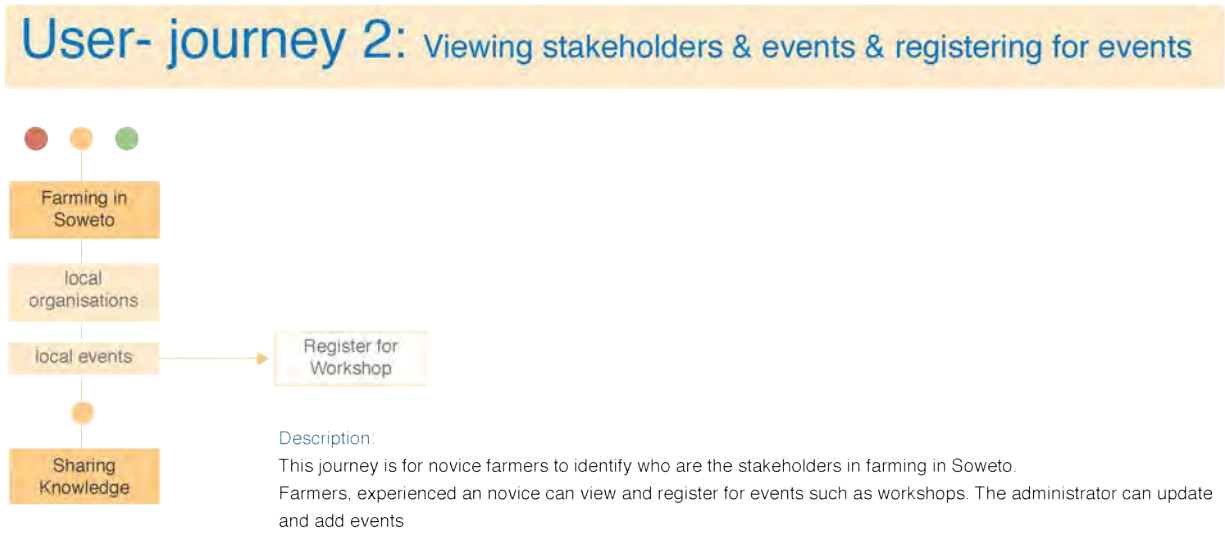


Figure 4.6.3: *Learning about farming in Soweto* journey.

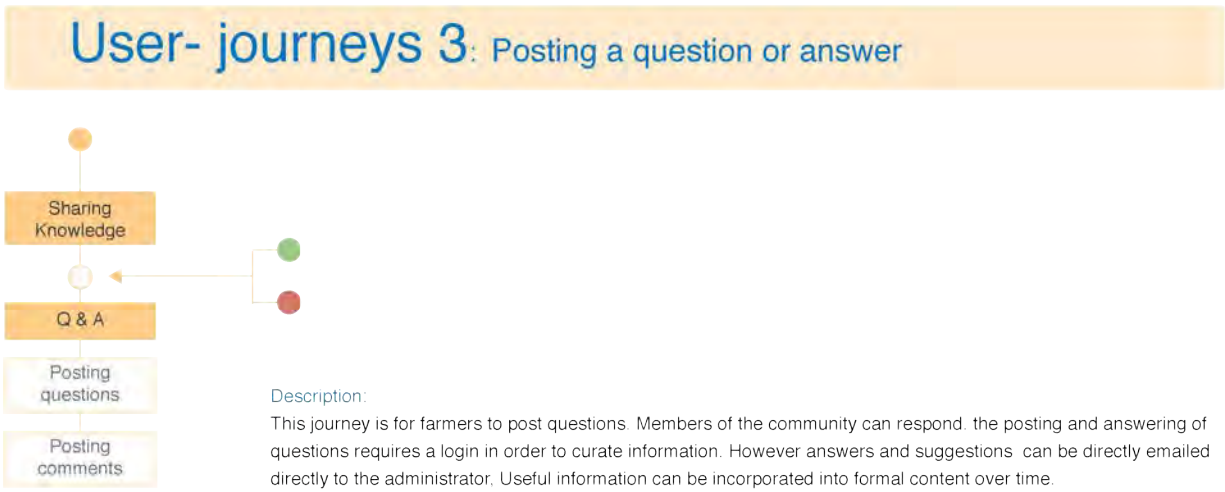


Figure 4.6.4. *Sharing knowledge* journey.

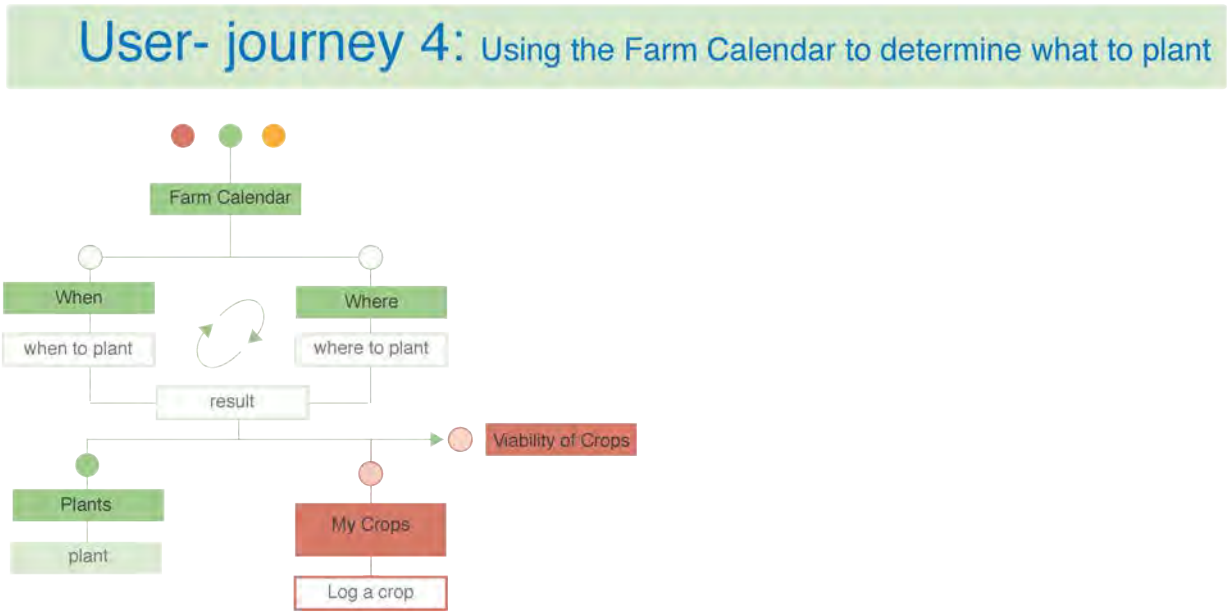


Figure 4.6.5: *Identifying what to plant* journey.

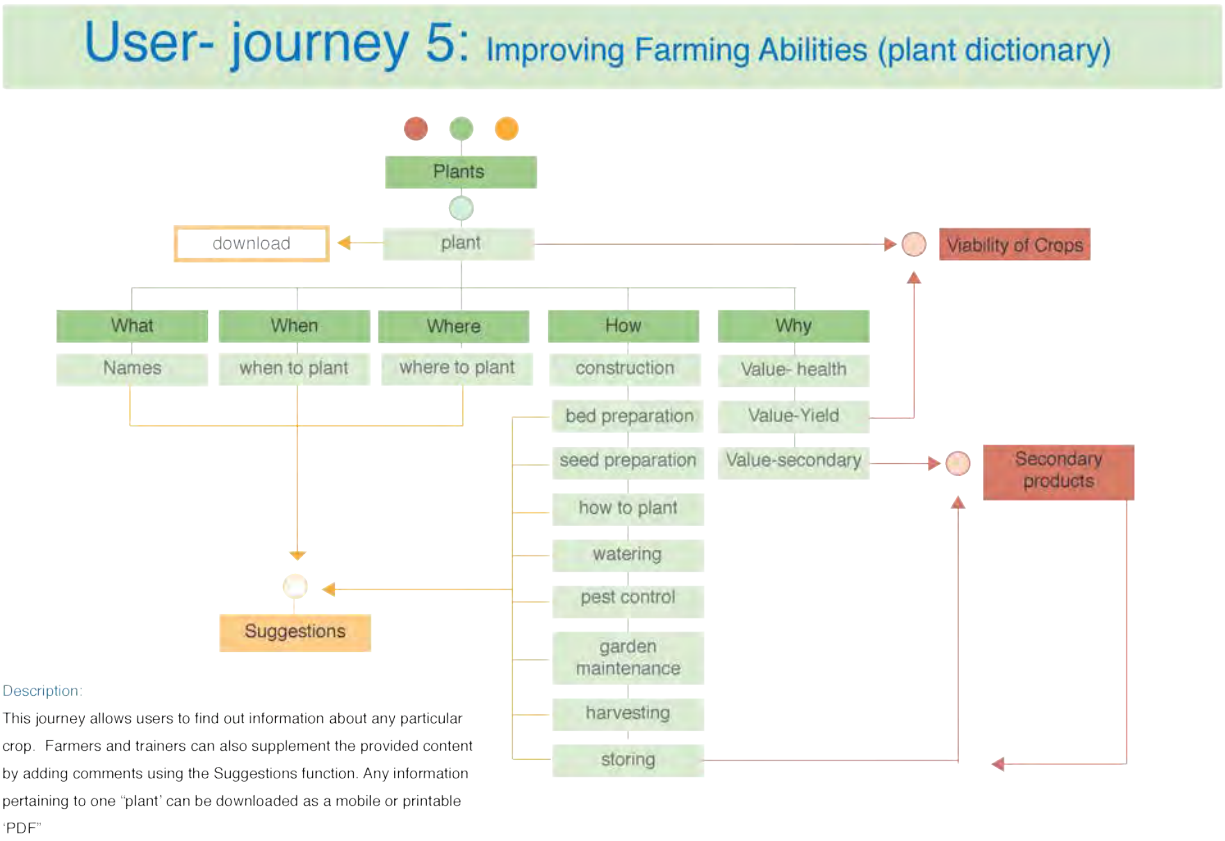


Figure 4.6.6: *Learning about plants* journey.

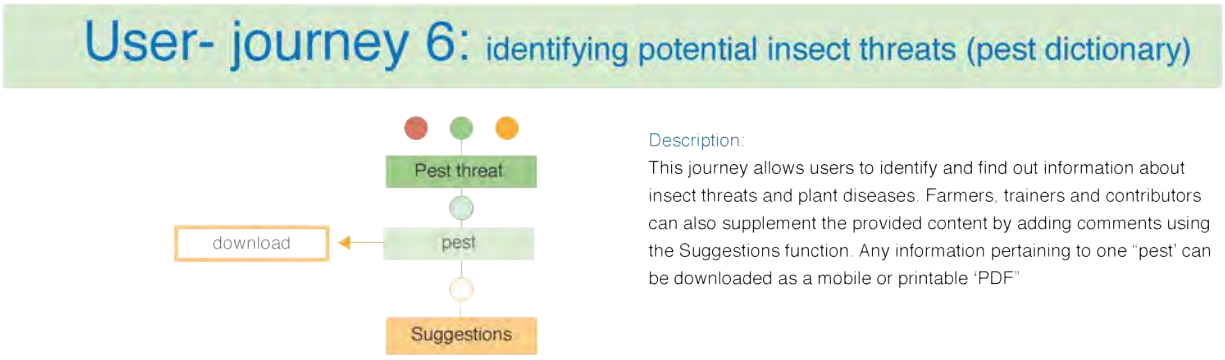


Figure 4.6.7. *Identifying and learning about pests* journey.

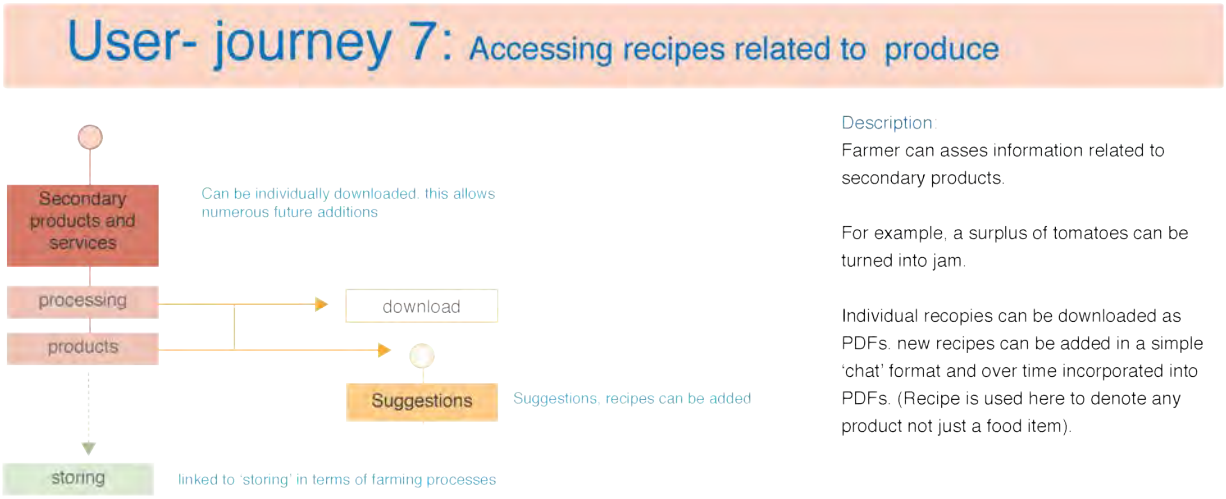


Figure 4.6.8: *Learning about secondary products* journey.

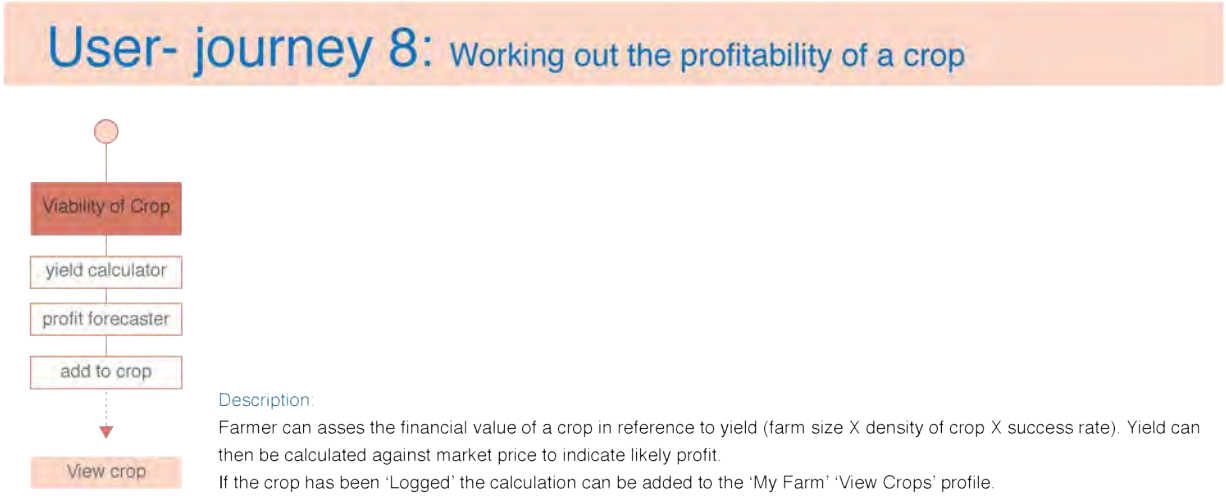


Figure 4.6.9: *Assessing the viability of crops* journey.

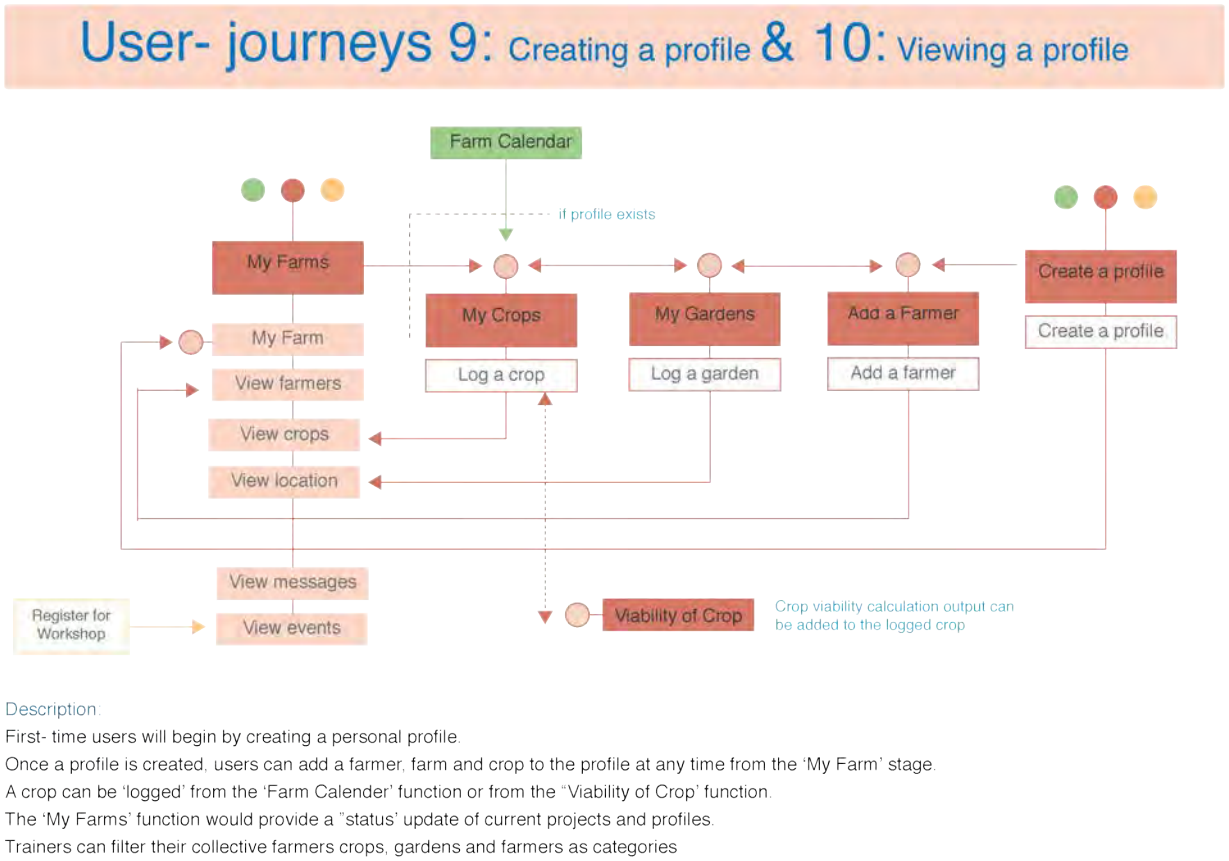


Figure 4.6.10: *Creating a profile* journey and *Viewing a profile* journey.

Once the primary user-journeys were defined, the task-flow diagrams that comprised each user-journey were designed.

4.6.2 Task-flow design

Task-flows are diagrammatic flow models that reflect required interactions and paths through a specific user-journey and as such describe a particular unit of behaviour supported by the system [38]. They help to identify aspects of the user-journey that need to be evident in the final interface as well as describe technical requirements [49].

The process of designing the task-flows began with an assessment of how the information existing in the platform would be generated and accessed, and by whom. Essentially, what drove this consideration was the conceptualisation of the mobile app as an information depository within which users could access information but also allowed for information to be contributed and updated by farmers, trainers or other interested users. While the functional ability to add, edit or delete content is not a concern of this research project, it is important to the holistic design of the prototype and as such needed to be considered to ensure the logical flow of the final system.

To this purpose the design of each set of task-flows began with the modelling of the information flow using use case diagrams. For example, the use case for User-journey 2: *Learning about*

farming in Soweto (Figure 4.6.11) describes how all farmers could access information related to farming in Soweto and potentially input information into the system when registering for a workshop. However, either trainers or the administrator could have had to create the workshop post and be capable of accessing and responding to the farmers input.

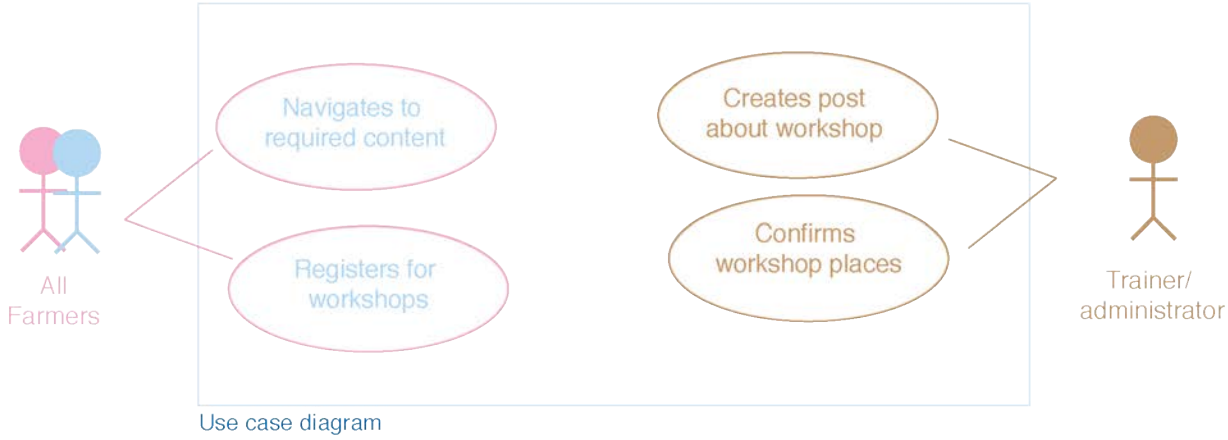


Figure 4.6.11: Use case diagram for User-journey 2: *Learning about farming in Soweto*.

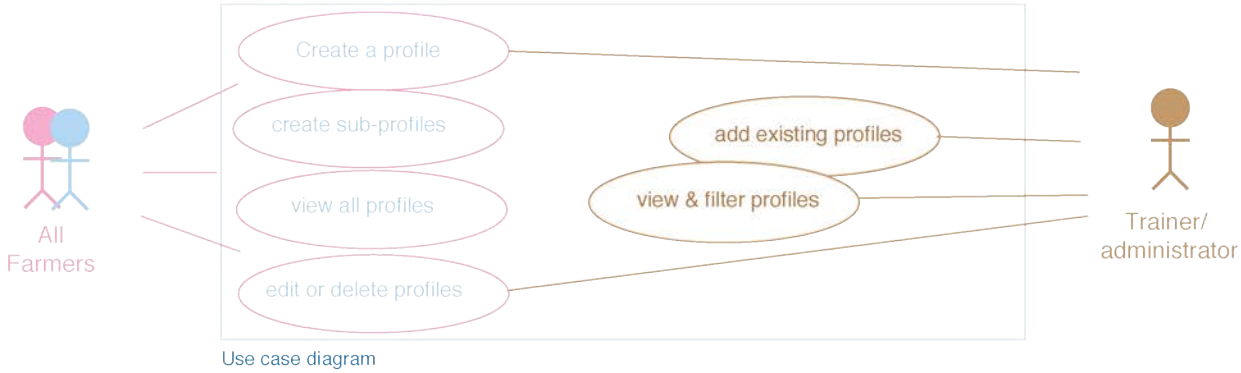


Figure 4.6.12: Use case diagram for User-journey 5: *Learning about plants.*

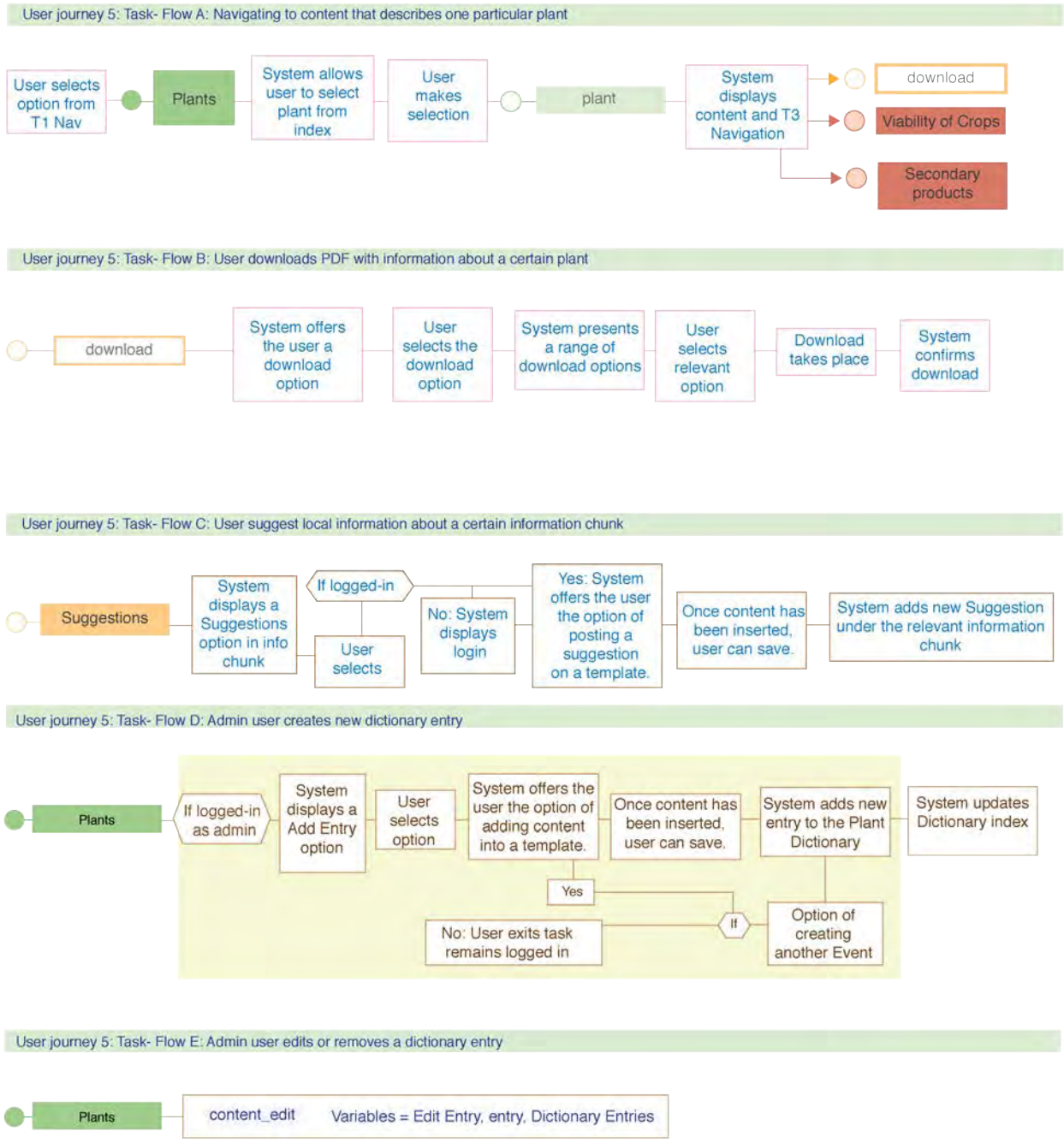


Figure 4.6.13: Task-flow diagrams for User-journey 5: *Learning about plants*

Figure 4.6.12 and 4.6.13 describe the use case and five task-flows for the *Learning about plants* user-journey. Each task-flow focuses on where the task begins, the individual steps required to complete the task, how the system responds to user interaction, the options available to the user at every step and the end state of the task. While only User-journey 5 is shown here, the other task-flows with their related journeys are presented in the Appendix.

The overriding concept that informed the design of the tasks was to ensure that procedures were kept as simple and as focused as possible as the farmers were not expected to be highly experienced digital users. User-journeys and associated tasks tended to focus on one activity at a time and divergent options were only available when absolutely necessary. Primary user-journeys

including the *Plant*, *Pest* and *By-products* dictionaries as well as journeys that focused on inexperienced users were kept as straightforward as possible. Journeys that dealt with more complex activities such *profile registration* and *plant yield* were envisioned as secondary journeys that farmers would engage with after learning the heuristics of the system, in the primary journeys.

4.6.3. Wireframe design

Once the final user-journeys and task-flows had been created, the next phase of the design was the creation of wireframes. Wireframes are diagrammatic interpretations of a system or products proposed content, structure and function. Wireframes depict the information architecture and information design of key interface states. As such, they can be considered as touchpoints between the time/space orientated task-flows and the final user interface designs.

The wireframe examples depicted in Figures 4.6.14-16 are arranged to reflect the key aspect of the user- journeys they relate to. Figure 4.6.14 represents the home page, the primary menu and the sign-in form. The lower central image is a diagrammatic model representing the secondary and contextual information tiers applied to the navigation of the web application.

At this stage the decision was made to develop the digital prototype using *HTML* and the *jQuery Mobile* [71] platform thus the layout and navigation details embedded in wireframes reflect the constraints and affordances of *jQuery Mobil*e and mobile application development in general. Examples of these include the concertina menu/content categories and the search/filter functionality. Examples of the other wireframes designed for the farmer's app are shown in the appendix

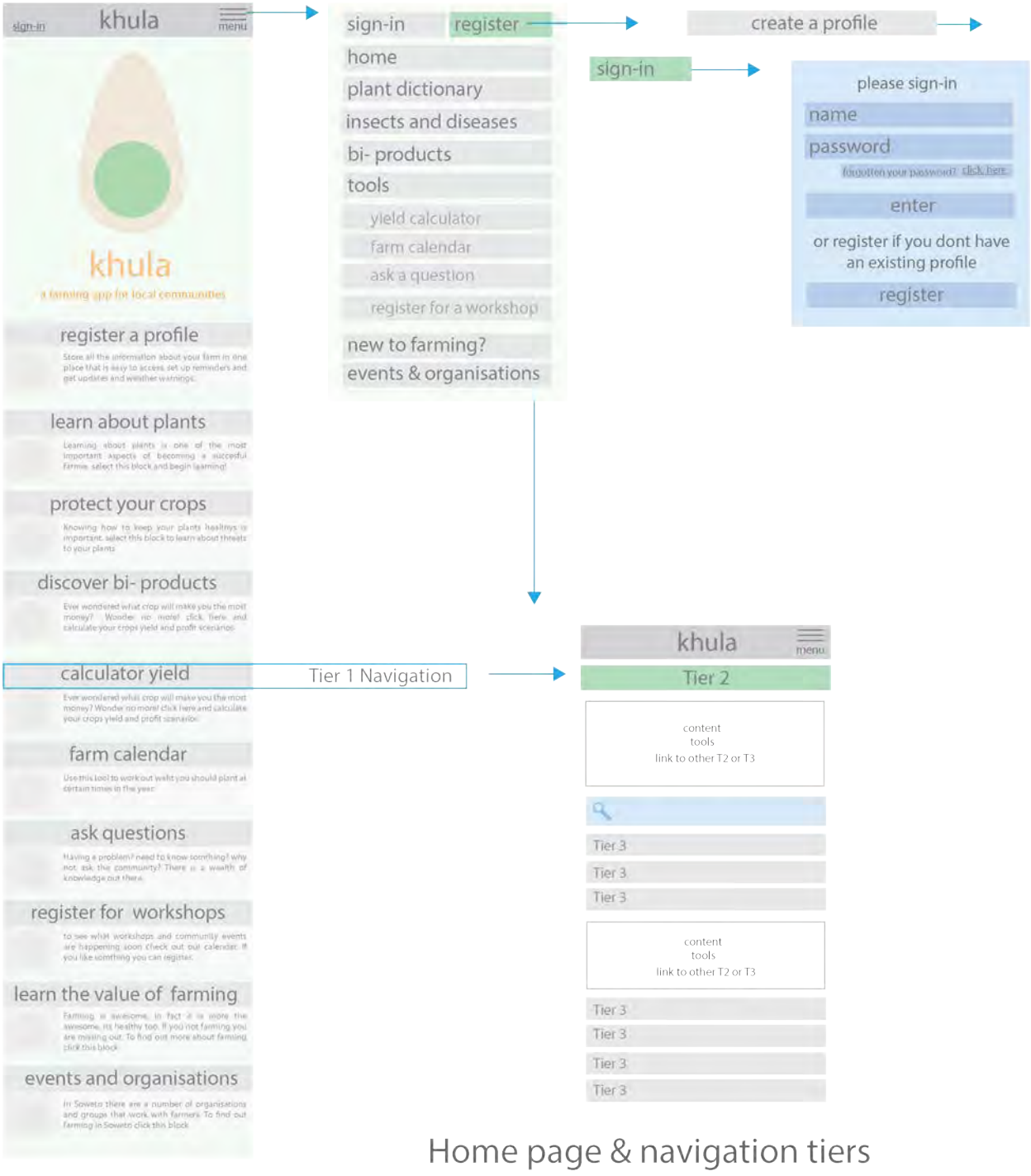


Figure 4.6.14: Wireframe diagrams related to home page, primary menu and sign-in pop-up windows.

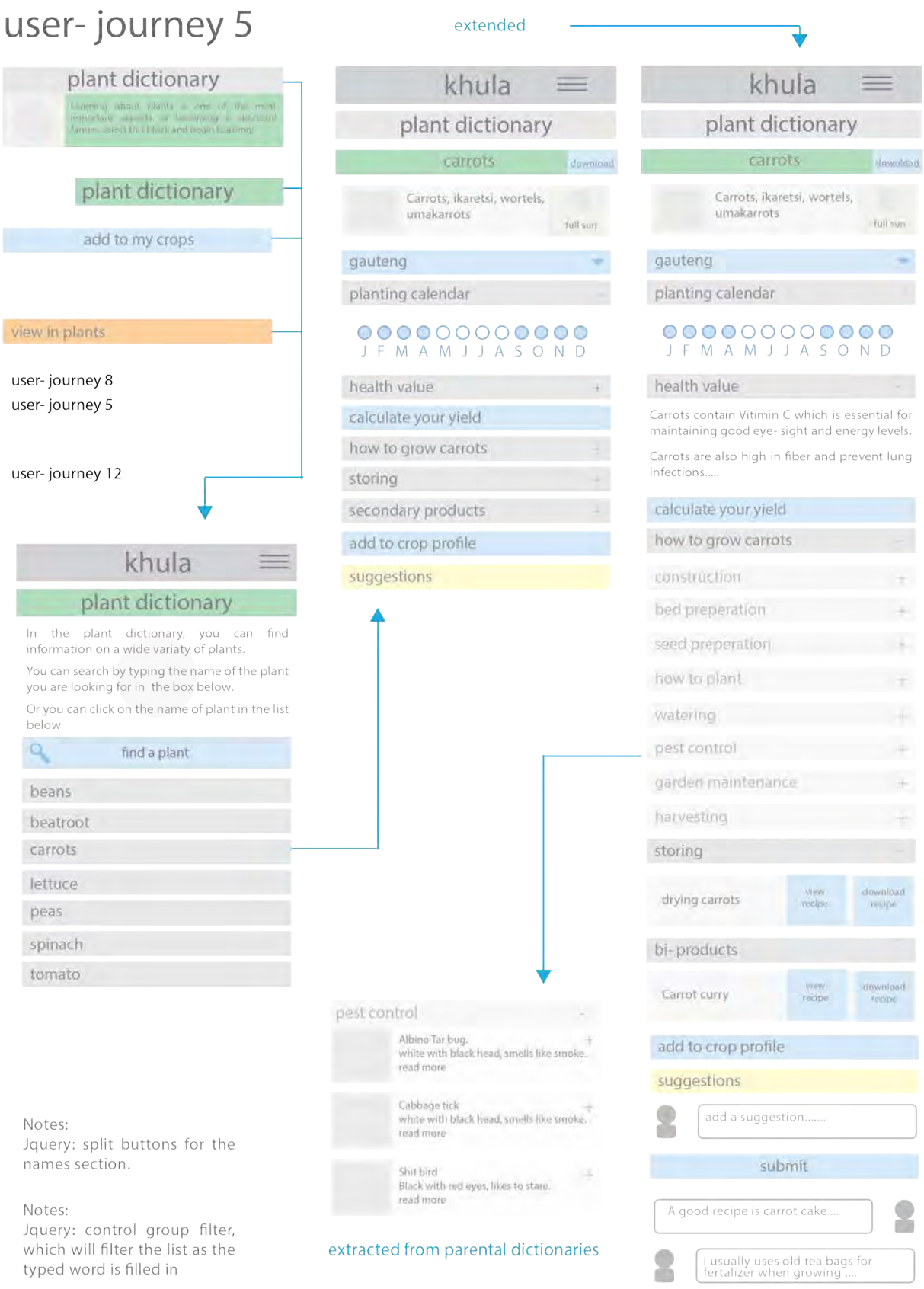


Figure 4.6.15: Wireframe diagrams related user-journey 5. These wireframes relate to the task flows depicted in Figure 4.6.1.

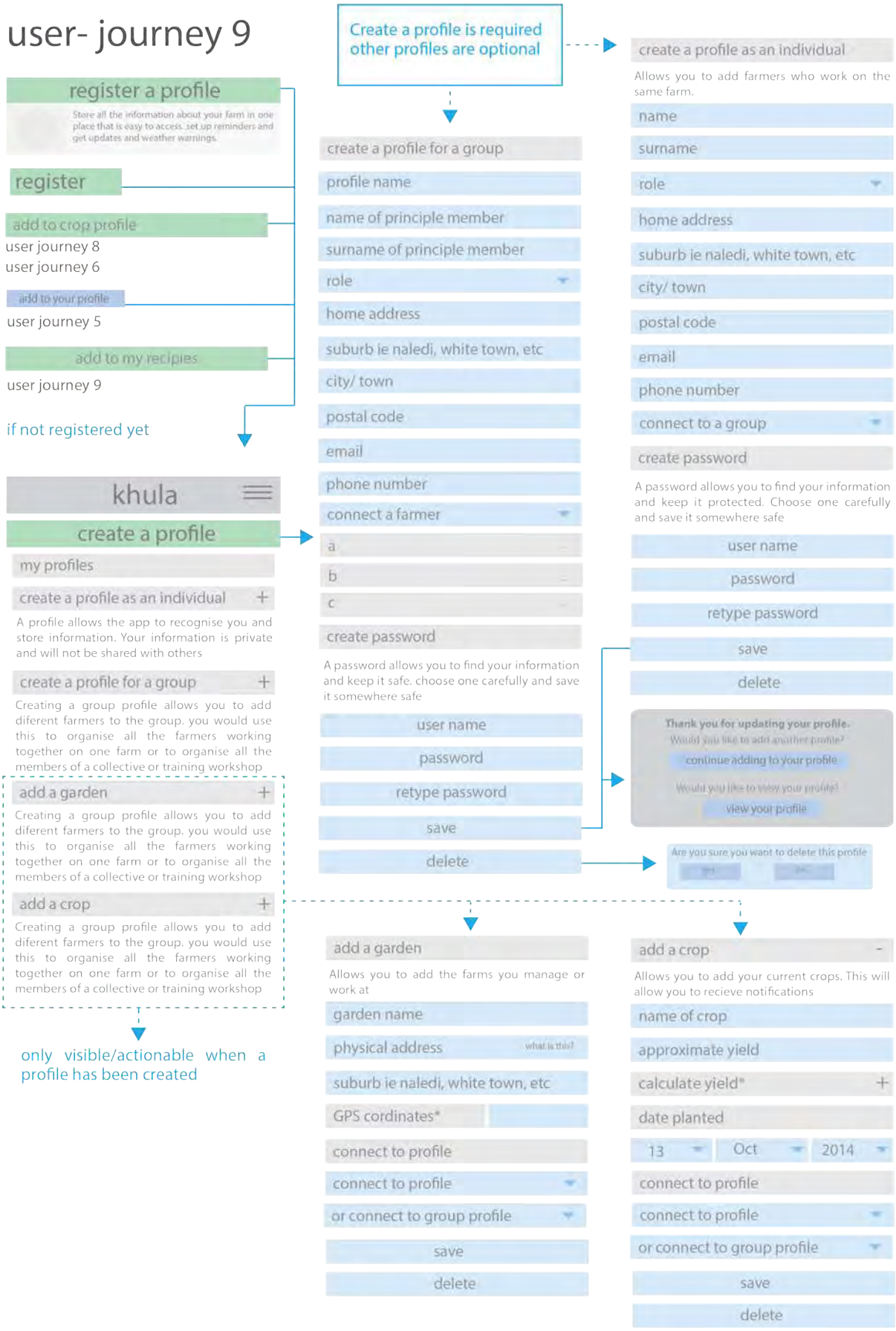


Figure 4.6.16: Wireframe diagrams related to the registration process described in user-journey 9.

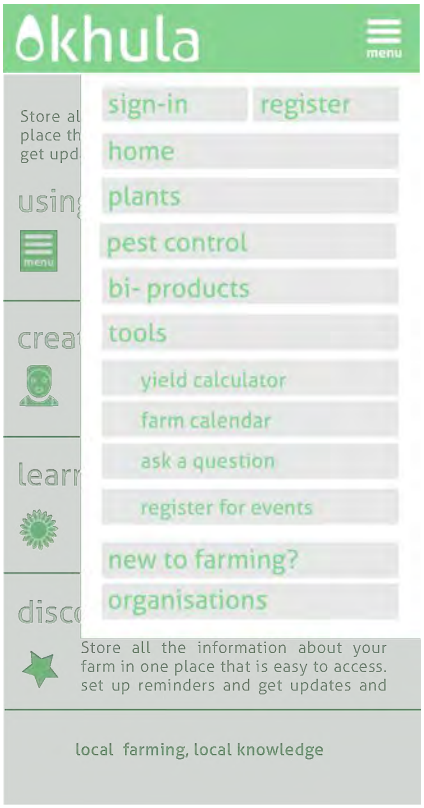
4.6.3. User-interface design

The final design deliverables of the interaction design phase prior to the production of the integrated digital prototype were the user interfaces (UI's). The UI design involved integrating the design decisions articulated in the wireframes with the insights gained in the research related to the farmers' information needs (see Figure 4.5.1) related to clarity and accessibility. As such content was purposefully designed to be clear and concise with a minimum of superfluous information and followed a stripped down flat design aesthetic[27].

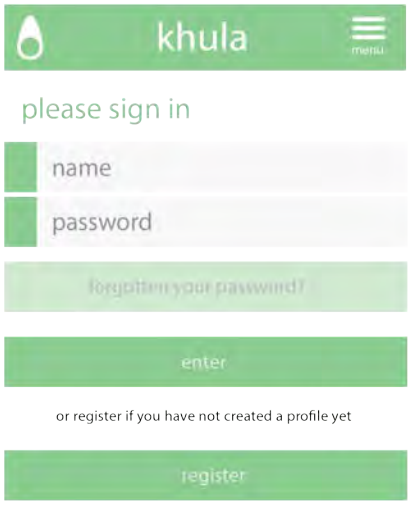
Beyond navigation, signposting information and the information architecture, user orientation of the system was additionally supported by a subtle colour change in the headings and tier-three menu tabs as well as by the category icon in the top left corner. Altogether 38 different UI states were created, as depicted in the Appendix.

[27] See Metro UI/Modern UI in [72]

Figure 4.6.17: (Above), depicts the home page. Each journey is 'sign-posted' in the body content and each content element is 'clickable' linking to the relevant area.



The main menu (above) is accessed through out the site via the menu icon in the top-right corner of the application. The first content element explains this convention, as users may be digital novices.



The sign-in pop-up menu (above) allows users to directly sign in or register if necessary.

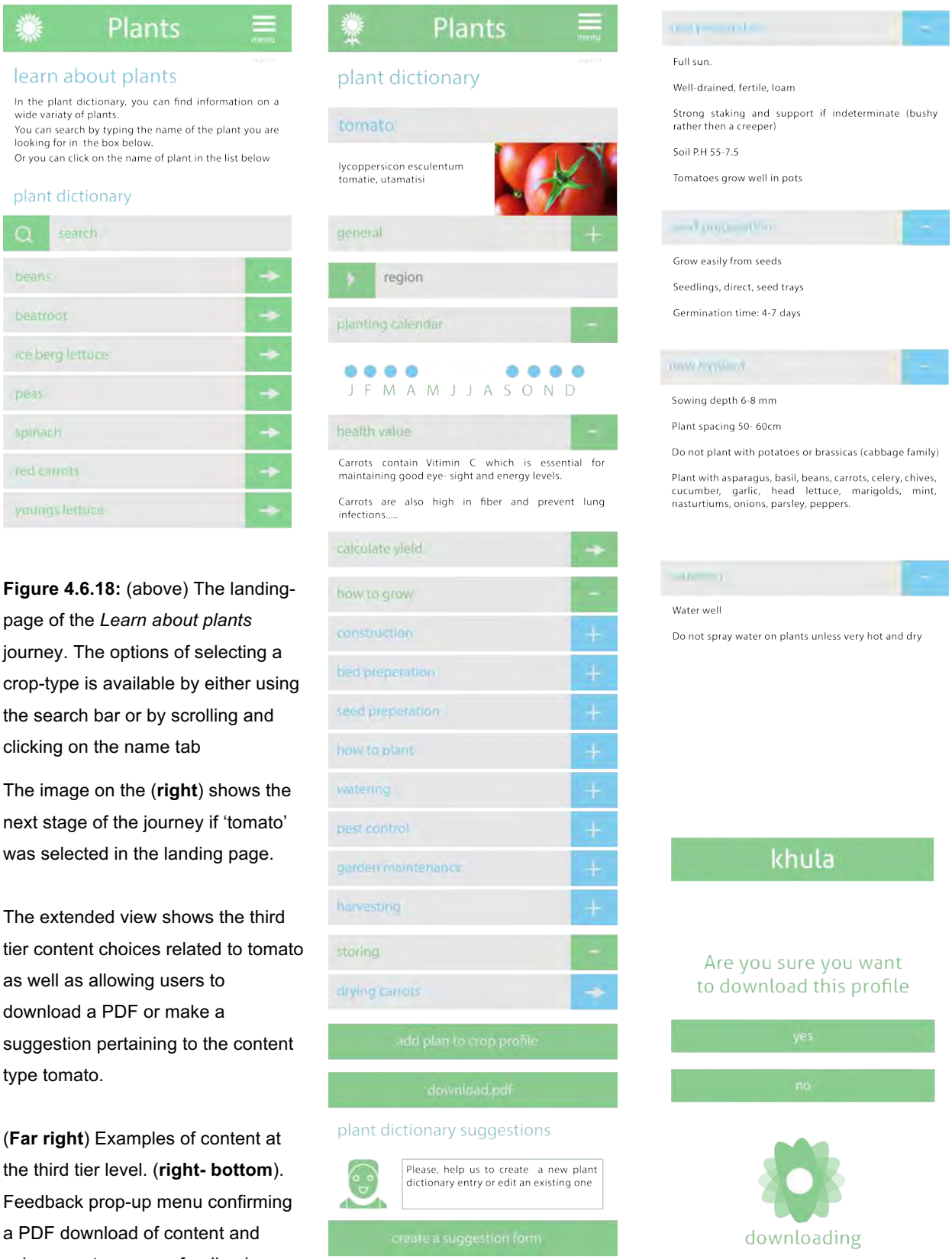
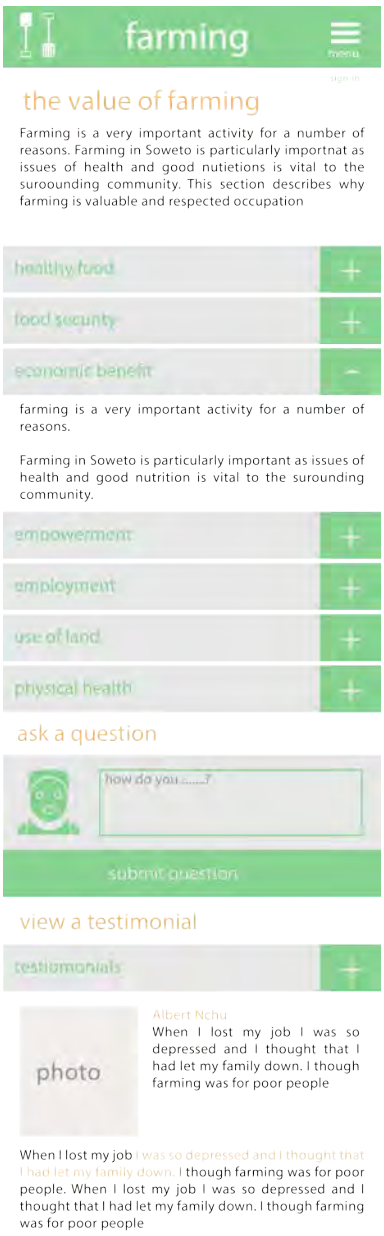


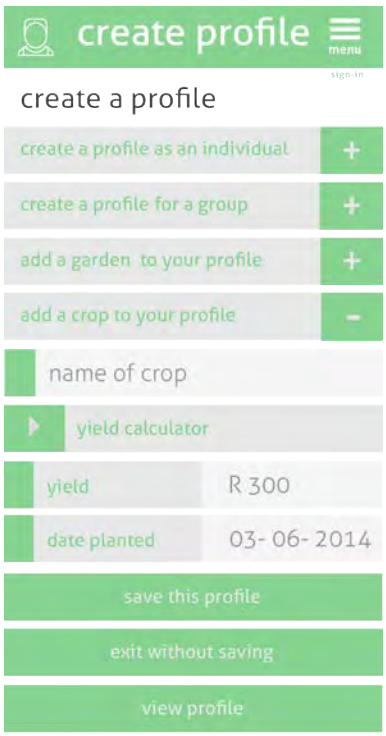
Figure 4.6.18: (above) The landing-page of the *Learn about plants* journey. The options of selecting a crop-type is available by either using the search bar or by scrolling and clicking on the name tab

The image on the (**right**) shows the next stage of the journey if 'tomato' was selected in the landing page.

The extended view shows the third tier content choices related to tomato as well as allowing users to download a PDF or make a suggestion pertaining to the content type tomato.

(**Far right**) Examples of content at the third tier level. (**right- bottom**). Feedback prop-up menu confirming a PDF download of content and subsequent progress feedback indicator.





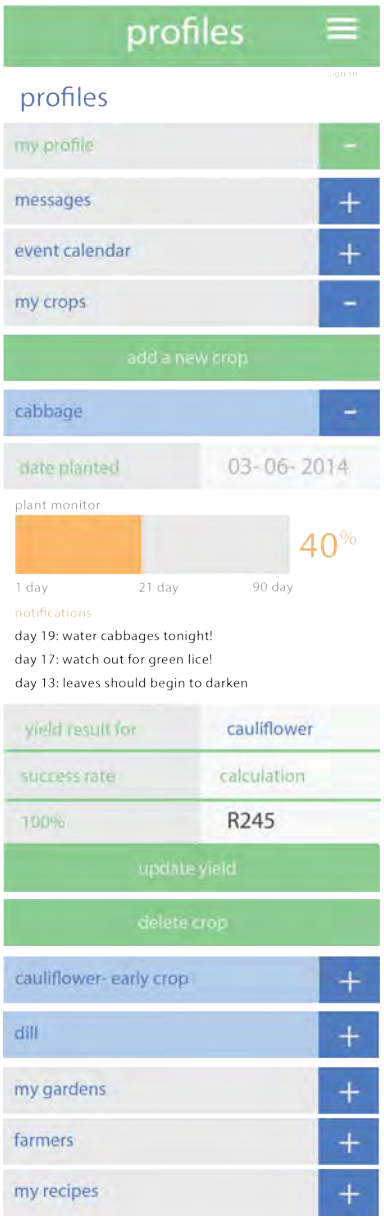


Figure 4.6.19: (Left) shows the UI for the *Value of farming journey.*

(Middle) displays the initial stage of *the create a profile* journey. The various profile options available are indicated

(Right) shows the default state of the *view my profile journey. The* 'cabbage' crop profile is open showing a summary of the crop with an info-graphic indication of the crops progress, reminder notification and results of a yield calculation. This content would be returned from inputted user information processed by the system.

4.6.4. Concept testing with the farmers.

To evaluate whether the interaction design solution was 'relevant' to the farmers in the sense that it could potentially resolve identified problems within the expectations of the farmers, three forms of prototype evaluation were undertaken namely expectancy testing, paper prototype evaluation and prototype observational study.

Testing was limited and informal, taking place in Soweto. The evaluations were not considered as summative but merely a first round of testing. The focus of the testing was to determine whether the prototypes provided the appropriate types of solutions for the farmers to meet their experiential needs. As such, the testing was largely concerned with 'proof of concept' and focused on the *be* and *do* goals of Hassenzahl's hierarchy model. While operational goals were tacitly tested in these evaluations it was expected that further research related to usability would need to be conducted in this area, but at this stage this type of testing was not the focus of this project.

The testing took the following format:

- Pilot study with one farmer who undertook an expectancy test and the paper prototype test.
- Follow-up testing with four farmers who participated in expectancy tests and low-fi prototype testing.

Expectancy tests [73] are used to evaluate whether users' conceptual understanding of a products use are congruent with the model of use envisioned by the designer. In the testing sessions, four farmers where presented with the *home page* (see Figure 4.6.20) and asked to explain what type of content or functionality they would expect to appear if they clicked the specific category filter tab. The farmer's explanations of the categories present in the interface indicated that they recognised and described the broad type of features contained with in the apps design. However, there were particular aspects in the feature categories that were identified as problematic or missing.

These included:

- The inclusion of basic information explaining what 'farming' is and what a 'farmer' does.
- The inclusion of basic biological information about plants
- The need to include a dictionary of farming and processing terms. For example, what is '*ph* balance' when measuring soil acidity.
- Confusion over the word 'by-product' or 'secondary-product'. Final decision was to use the phrase 'processing plants' in the menu

Paper prototyping testing

The paper prototype evaluation was undertaken as pilot test with one farmer over a three-hour period prior to the prototype evaluation**.** This testing was done prior to completing the technological development of the application to ensure that there were no obvious flaws in the design logic.

The paper prototype testing [38] involved simulating how the digital application would work by printing on paper card various states of the UI. The UI cards were manually changed by hand to reflect the systems state as per the farmer's 'interaction' with them.

The farmer was given a series of scenarios reflecting journeys and goals embedded in the design and then, starting from the *home page*, navigating through the journey towards the required outcome by touching on navigational elements present in the paper UIs. During the process the farmer provided a narrative explanation of his decision-making.

The journeys (and scenarios) tested included:

- User-journey 2: *Learning about farming in Soweto* (register for the next Farmers Forum meeting)
- User-journey 4: *Identifying what to plant* (It's October, what crops can you plant at this time of year in Gauteng?)
- User-journey 5: *Learning about plants* (How deep should you plant tomato seeds?)
- User-journey 8: *Assessing the viability of crops* (Your plant bed is 5m x 7m. What's more profitable, cauliflowers or lettuce?)
- User-journey 9: *Creating a profile* (create a profile for yourself, and link to the Farmers Forum group?)
- User-journey 10: *Viewing a profile.* (Last month you planted cabbages. You haven't yet seen any sign of plant shoots growing. Use your profile to assess weather your cabbage crop has failed?)

The participant achieved all the goals embedded in Journeys 2, 4, 5, 9, and 10 with ease. Small changes such as adding additional text 'sign-posting' functionality to certain elements were identified such as explicitly stating that both group and individual profiles can be accessed from the 'profile' menu tab.

The most problematic aspect of the design was Journey 8, relating to assessing the potential yield of a particular crop. The participant struggled to understand how the 'calculator' worked and was confused by the process. After discussing potential solutions with the participant, the improvements identified included clearer explanations of requirements of use and how to utilise a more procedural task-flow.

My reflection of the paper prototypes session was that as a method it worked well on simple 'select and click' activities, but at times it struggled to communicate the difference between default

content, information returned by the system and simulated user-input. The abstract nature of these processes in the paper prototyping method recalled issues reported by Molapo and Marsden [24].

At this stage it was decided that as the expectancy testing indicated a strong understanding and appreciation of the embedded features of the app, but, that rather than proceeding with further paper prototype testing to move straight to product prototype testing- so as to avoid problems related to the abstract nature of the paper medium.

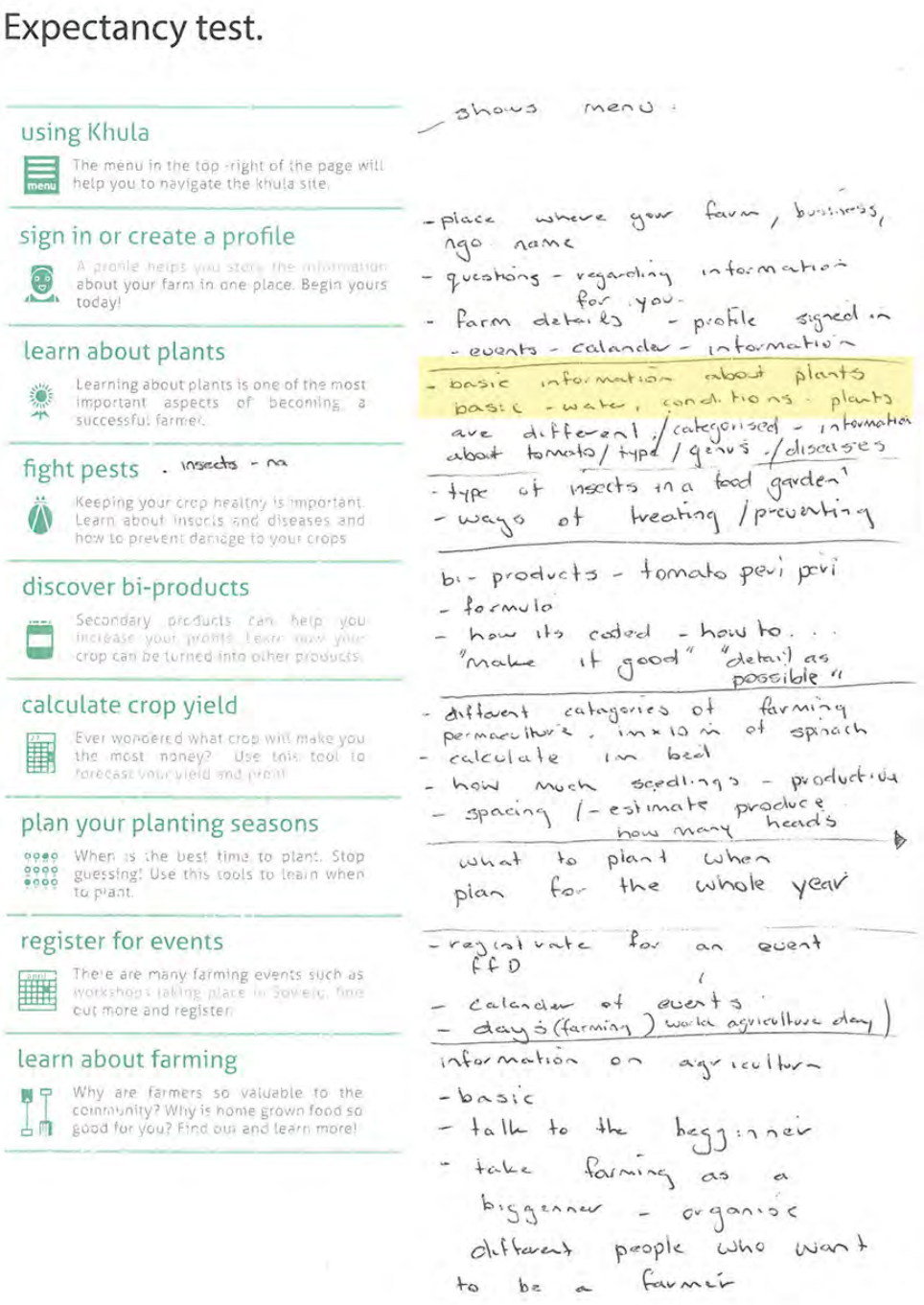


Figure 4.6.20. Example of an expectancy test interview guide with notes on user feedback.

Prototype observational studies

The final evaluation of the study was an observation and feedback session using a basic digital prototype. The prototype, which was a 'live' *jQuery Mobile* site the participants could access off their own phones. The primary journeys that most strongly adhered to the three lifecycle stages of the design strategy were directly observed and evaluated. These journeys related to learning about plants, farm pests, by-products and the value of farming.

The observational study consisted of two phases. The first phase was purely observational during which the farmers were given the *Khula* app to explore on a test phone[28]. The farmers were initially assigned specific user-goals related to the primary journey such as 'How deep should you plant a tomato?',

In addition to the test phone, the farmers proceeded to use their own phones to access the url[29] of the site. The farmers that switched to their own phones did so due to impatience at waiting for a turn or enthusiasm to try the app on their phone as opposed to any issues related to using the test phone. The farmers used the application in a confident and relaxed manner.

The conversation between the farmers focused on the content of the plant, pests and by-product categories. As these content areas were at the deepest level of the site, it was inferred that the farmers were navigating the site well in terms of the intended functionality and that the structure and technology were unobtrusive, supporting the farmers' engagement with farming' concerns rather then battling with access.

In the concluding discussion on the app, farmers reinforced this view stating the app was "*good at teaching you*" and "*everything you need for starting a good garden*". The farmers were also asked directly if they felt that the app was easy to use to find information and if the categorical labelling was reflective of content. The farmers affirmed that the application was not difficult for them to use and that the category naming and taxonomy was logical.

The one issue that was raised by the farmers was the use of terminology in the content. The content used was 'filler' content sourced from gardening books and Internet sites with the intended purpose of exemplifying a final product. However, identifying the need for a careful consideration of the appropriate level of written content in future iterations was a valuable reminder of earlier user-research findings.

Results of the expectancy test and the prototype observations evaluations strongly suggested that the design of the *Khula* mobile web app did anticipate the experience needs of the farmers and that these experience needs were manifested in a meaningful and usable manner. They were

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28 A four-year old iPhone 4 was used, which was older than and less sophisticated than the majority of phones owned by the farmers. A back-up low-end Samsung smart phone was also made available, but never used. Two test phones were provided as a precaution to ensure that for the evaluation there would be an Internet connection and that the farmers would not have to pay for the testing by using their own data

29 app.khula.mobi (This is a live and working site, thus the development state of the app may differ to the time of the described user testing)

recognised as meaningful as the farmers demonstrated an understanding of why the app could be used and what it could be used for. They also agreed and physically demonstrated that they could use the app. Lastly, all the farmers agreed that the app was something they would like to use.

Therefore, in reference to the aims of the study which were to ascertain the viability and value of integrating the contextmapping methodology in the co-design of meaningful and useful interactive products for and with farmers in Soweto, it was considered at this point that this had indeed taken place

However, it is recognised that in order to create a final product a number of issues will have to addressed and tested.

These include:

- The journeys tested were straightforward in structure, similar to each other and required a simple browse/select interaction. Other journeys such as the *profile creation* contain more complex interactions and may be more difficult to use.
- Adding the additional functions may also make general use more complex as the farmers may get lost in the multiple services.
- The final design allows for movement between journeys, for example; jumping from a plant dictionary crop entry to the *yield calendar* to measure the profitability of the crop to the saving of the crop yield result in a personal profile. Again, this complexity may require more extensive testing.

These issues are important but fall outside of the scope of the study. The more complex journeys such as *profile creation* are concerned with the capturing of data and relate to needs more specific to stakeholders for management and admiration purposes. Other concerns raised here are specifically *operational* and relate to usability. While these issues are addressed in the interaction design blueprints presented in the Appendix, it was considered sufficient in this user testing cycle to focus of the *be* and *do* goals of Hassenzahl's Hierarchy model

Figure 4.6.21: Farmers using the *Khula* App during the observation sessions.

4.7 Conclusions of the *Process*

In the Process, the six phases of contextmapping were discussed in reference to aims of this research project. Collectively, the phases were used to describe and reflect on how the theoretical framing of HCI presented in the Literature Review and concerned with designing interactive solutions in a participatory manner were applied in the specific case of the *Khula* prototype.

This description also explicitly answered the research questions that the study was designed to address. These were:

- Question 1, which addressed whether or not contextmapping enabled community participants to make a valuable contribution to the decision-making processes of an IXD project.

  This question is answered in the affirmative as the farmers' contribution was clearly demonstrated. Firstly, by the use of the data generated from the farmers' participation in the Sensitization and Session Phases to develop the design strategy as articulated in the Analysis Phase and embodied in the *Service Solution Model.* Secondly the effective use of the experience prototypes to communicate and create discourse around potential solutions is clearly demonstrated in the Communication Phase narrative. These contributions clearly impacted the IXD of the final solution.

- Questions 2.I-III aimed to establish whether or not using a contextmapping methodology could generate insights relating to the aspirations, information needs and information seeking behaviours of Soweto farmers. The evidence of this occurring is evident in the affinity diagrams (Figure 4.4.5- 4.4.16) and articulated in the corresponding discussion. The affinity diagrams were the summative result of the collection, analyses and synthesis of user data generated in the earlier contextmapping phases.

Questions 2.IV, which sought to examine whether insights gained from a contextmapping process could meaningfully impact the interaction design of the solution was answered in the discussion and the corresponding diagrams of Section 4.6: New Design Concepts. This section describes how the insights gained in the earlier contextmapping activities were applied within contemporary IXD practice. The IXD culminated in the creation of a range of prototypes that articulated the intended features and user experiences of the final product.

The following chapter of this thesis discusses the value and contribution that answering these questions adds to the discipline of HCI and IXD.

Chapter 5:
Discussion

The Discussion chapter of this thesis is organised with reference to the three evaluation criteria of the Research through design methodology namely, *Invention, Relevance* and *Extensibility*.

Each section of Chapter 4: Process reflected on the approaches, practices and feedback that emerged during the research and design activities. The value of applying the Research through design criterions is it provides a framework for the critical evaluation of the reflective design practice and as such ensures that the contribution can clearly be regarded as research [10][30].

5.1. Invention.

Evaluation in the Invention criteria relates to the novel integration of various subject matters to address a specific situation. While one could argue that applying the particular selection of research and design methodologies and tools while working with the specific group of farmers in Soweto at a particular time is, in itself, novel and thus contributes novel insights, this research project generated a number of distinctly unique approaches to IXD and HCD.

Firstly, and originating in the Literature Review, the integration of Hassenzahl's *Three Level Hierarchy of Needs* model with McCarthy and Wright's qualitative, dialogical and participatory approach to xD into one framework adds a new approach to contemplating users' experience in IXD practice. This integrated framework was applied, and within the context of this research project appeared to make a successful contribution towards applying participatory practice for IXD specifically and ICT4D generally. This focus could ensure time and resources are not wasted while still maintaining the value of a participatory process.

A second novel outcome arising from this research was the successful incorporation of Hassenzahl's *Top Ten Psychological Needs* into the Sensitization workbook questionnaire. This act extended the *Psychological Needs* from an analysis tool for categorising experiences into a research tool for focusing exploration of users' life-motivations. This outcome also extends the Sensitization Phase of contextmapping as it adds to the body of knowledge related to the Sensitization Phase, a new technique.

A third aspect of the research that can be identified as original is the design of the application embodied in the digital prototype, which is a unique solution originating from the complexity of the farmers' situation, the affordance of contemporary digital technologies and the participatory design processes. While sharing aspects of concepts and functionality with other products, the app is essentially a bespoke product. As a tangible artefact, the *Khula* mobile web app adds to the body

30 Without a framework for critical evaluation a narrative of a design process may easily seem subjective or even self-indulgent [10].

of knowledge of the discipline of IXD.

5.2. Relevance.

The notion of relevance in the Research through design methodology relates to the articulation of why the transformed state made possible by the design is preferable to the original state. In this explanation the 'state' that the evaluation refers to can be considered from three aspects.

- The first state is that related to the farmers and the potential impact of the design on their lives.
- The second state is that of the participatory impact, and debates to what extent the contextmapping methodology, as applied, has enhanced the community participants' ability to meaningfully contribute in the decision making process.
- The third state relates to advances in the application of participatory processes for IXD. This aspect questions whether contextmapping, as applied, has generated the insights capable of guiding interaction design practice within the broader scope of ICT4D.

5.2.1. The improved state of the farmers.

As the *Khula* application is at the prototype stage, the 'improved state' of the farmers can only be discussed in respect to the opportunities it could afford the farmers and the extent to which these affordances appear to meet farmers needs. The exploration and consideration of the farmers' lived-experience allowed for a formulation of a design strategy that placed at its centre the motivations most important to the farmers. These motivations were:

- The need to improve knowledge of farming
- The need to turn farming activities into sustainable businesses
- The need of farmers to be valued within the Soweto community.

Consequently, the design strategy called for a digital product that included the appropriate content and functionality related to farming, business and social capital that was easily accessible, but still embedded the existing social interactions of farming.

Content and functional elements included:

- Plant and insect dictionaries to help improve farming production
- A by-product dictionary, yield calculator and planting calculator to help farmers run more sustainable farms
- Content related to the value of farming, workshop registration tools, question input menus and the ability to add additional content. All of these elements insured that local knowledge was included and farmers felt connected to each other and local agricultural networks

In testing, the functionality offering and experience of using the prototype were viewed as favourable by the participants. However, the testing was limited and early in the development cycle. At this stage, the best claim the prototype can make is that as a concept it contains many aspects that the farmers feel would help them to improve their capabilities across all three motivational areas.

5.2.2. The improved state of participatory design decision-making.

This research makes a contribution to the contextmapping methodology in that it provides, in Chapter 4: Process, a clear and detailed description of the application of the methodology within an interaction design process in a development context. Previous descriptions of contextmapping [1-4] predominantly focused on industrial design in a commercial context. By locating contextmapping within a development context, and as part of an IXD practice a number of innovative strategies were applied that could enhance the applicability of contextmapping as a design research methodology. These include:

- By utilising generative tools to stimulate narrative discussion with the Soweto farmers, this thesis clearly demonstrates the applicability of contextmapping in order to generate an understanding of users experiences within a development context.
- The second contribution is the exemplification with the use of contemporary IXD tools such as affinity diagrams, service solution models, life-cycle stage mappings of how a design strategy can be modelled from data generated in the Sensitization and Sessions Phases of contextmapping.
- The third contribution is the act of returning to the participants in the Communication Phase as opposed to other designers, in order to confirm the strategy and concepts for the solution. This increases the participatory nature of the design and validates the designer's interpretation of the participants' experiences.
- Lastly, the use of personae and user-journeys provides an effective method for communicating IXD product concepts to community participants negating the more abstract nature of schematic low-fidelity prototypes commonly used in IXD. Enhancing shared understanding can contribute to meaningful discussion around design concepts. This was evident in Chapter 4 within the insightful level of feedback during the Communication and Testing Phases of the design project, which reflected a mature understanding of the affordances and goals of the *Khula* design. Therefore, the farmers' contributions orientated design-decisions indirectly through the generative tools activities but also directly in response to the presentation of design concepts in the user-journeys.

5.2.3. Advancement in the application of participatory processes for IXD

Participatory design has been criticised for a lack innovative or applicable outcomes [23]. This research contributes by providing an approach that incorporates the concepts embedded in Hassenzahl's *Three Level Hierarchy of Needs* model within the qualitative and organic explorations of participatory design. Using Hassenzahl's model is valuable as it is based on activity theory, an influential and accepted approach to designing for human activity within both IXD and HCI. Participatory design, on the other hand, is well regarded for developing products and services that match people's needs and practices. Combining both positions heightens the chance that that participant's insights during the design process will be of value to interaction designers and result in final products will be found by users to be useful, usable and meaningful.

The application of the hierarchy goals in the research and design processes is articulated in the design deliverables. Firstly, the *be goals* were utilised in the Sensitization worksheets to generate data from users and then used in the series of affinity diagrams culminating in the final *Categorisation of the farmers' psychological needs* diagram*,* Figure 4.4.18. The *do goals* and *operations* were embedded in the generative tools workshop activities, which again generated data that was analysed and synthesised into the *Model of the farmers' information* needs, Figure 4.4.5 and the *Model of the farmers' knowledge seeking behaviours,* Figure 4.4.6. These three models clearly contribute to the final design strategy as articulated in the service solution model, Figure 4.4.19, which orientates the digital solution.

While many of the needs identified by the farmers in the research are literally expressed in the final apps functionality, for example the *Plant, Insect* and *By-product* dictionaries as well as the *Plant Calendar* and *Yield Calculator,* many of the more aspirational qualities such as the farmers need to feel respected by the community are manifested indirectly through narratives embedded in the apps content, the visual branding and in the symbolic presence of the application itself as a marker of progress and importance.

Thus, this research project presents a clear example of how the application of Hassenzahl's *Three Hierarchy of Needs* can focus participation research activities to ensure a more likely relevance and application in IXD.

5.3. Extensibility.

The value of this research to other research and practical applications is that while contextmapping's value to design is established, there is little prior evidence that it has been successfully applied in an IXD project situated within development contexts in Southern Africa. This project application of contextmapping presents the methodology as a viable approach to co-designing interactive products with and for developing communities.

In addition, the integration of a number of innovative techniques such as the application of the *Top Ten Psychological Needs* as a research tool and the personae-user-journeys approach to explaining concepts can be considered useful techniques for others practicing IXD, contextmapping or other forms of HCD.

And lastly, as an explicit case study of an IXD practice that demonstrates, discusses and exemplifies the application of a variety of commonly used or innovative techniques and methods in the resolution of a complex societal problem.

5.4 Limitations of the study

While the evaluation of this research project attests to the rigor of the process described in Chapter 4, and clearly identifies the work presented as adding to the body of knowledge, there are clear limitations evident in the study that could be overcome in subsequent work.

- Firstly, the user group was small in number. Although the selected number of participants was inline with that recommended by the literature the research could benefit from further studies with different groups.
- Secondly, all participants had an affiliation with the Farmers Forum. Although farmers run the Forum it is still an institution of sorts with its own agenda, biases and power dynamics. The effect of this is exemplified for example in the manner in which certain participants initially described the value of farming in a rote uniform manner rather then describing their own personal interpretation of farming.
- Thirdly, the scope of the project ended with the testing of the concept. Additional testing focused on usability and high-fidelity prototypes would still need to be undertaken.
- Fourth, as the farming content in the final product is intended to be ‘co-created’ by the farmers, using pre-created content was necessary but not ideal. While the ‘filler’ content was well curated and local in nature, it was non-the less not specifically considered for the Soweto farmers. Although the farmers outside of one or two terms understood the content, in application the ‘real’ content provided by the farmers in use may not be as thorough and that may lead to usability and experience issues in future use.
- Lastly, a long-term impact evaluation of a final product would be required before any claim that the application can transform the lives of the farmers can be made.

Chapter 6:
Conclusions

6.1 Concluding remarks

This thesis is concerned with the interaction design of meaningful and useful digital products for and with developing communities. As such it focused and reflected on the effectiveness of applying contextmapping, a co-design methodology, with the interaction design of the *Khula* mobile application.

As discussed in the Literature Review, co-design is a relevant and useful method for designing digital products that fit in and add value to the life experiences of the people for whom the products are intended. Involving users in the design process is especially necessary when the users are novice users of digital technology and whose contexts are unfamiliar to the design. Narrative storytelling is a valuable device in co-design for bridging understanding between the users and designers.

Contextmapping was identified as an appropriate methodology of co-design as while incorporating the general participatory characteristics of co-design, contextmapping specifically includes techniques that support narrative enquiry, visual mapping and fictional enquiry.

To support the technological aspirations of the project, IXD was introduced and discussed. While contextmapping has been described as being applied to a comprehensive range of design products there is little textual descriptions of how it has been applied in IXD, or within contexts similar to the Soweto farmers.

In order to negate ineffective participation, experience design- a sub-discipline of IXD, was identified as capable of framing and focusing the contextmapping co-design process. This framing was orientated by Marc Hassenzahl's *Three Level Hierarchy of Needs* model which suggests user-needs can be best understood through the application of three integrated but distinct lenses, namely psychological drivers, behaviour actions and operational motor skills.

In order to test the effectiveness of firstly, applying Hassenzahl's model within a co-design methodology and secondly, the ability of co-design to facilitate the bridging of understanding between the farmers and the designer, the research study took the form of a Research through design project. This involved the actual co-design of a mobile application prototype with farmers in Soweto which was reported on and critically reflected in the written thesis.

Within the limitations of the study that included small focus groups and limited testing contextmapping presented itself as a viable approach to co-design digital technologies with communities such as the Soweto Farmers.

The effectiveness of contextmapping is described in this thesis. Firstly, its effectiveness is described in relation to the extent which contextmapping enables participants in the co-design process to contribute meaningfully to the decision making process. Secondly, it is described in the degree to which the insights generated through the co-design process are relevant and actionable in an IXD process

A meaningful contribution by the participants to the decision making process was supported by the contextmapping methodology in a number of ways including:

- Data generated by users in the Sensitization and Session Phases of the contextmapping methodology informed the design strategy, culminating and embodied in, the *Service Solution Model.*
- The mapping and presentation of the designer's interpretation of the participants' experiences in the Communication Phase allowed participants to validate the designer's interpretation of their experiences. This evaluation insured that the participant's insights generated in the early phases of the methodology were accurately captured. This testing also ensured that the design strategy was inherently defined by participant contributions.
- The meaningfulness of the contribution was evident in the final concept testing of the prototype with the participants. During the tests it was evident that the design concept met the users' expectation and was viewed positively.

The relevancy of the participant's insights and the inclusion of these insights in the final interaction design are evident in the design deliverables and prototypes. This is clearly demonstrated, for example, in the way the key aspirational needs of the farmers were incorporated in the final product, as detailed below:

- **Key Aspiration 1: Improving Farming Abilities**
  Khula application features:
  - Plant dictionary
  - Pest dictionary
- **Key Aspiration 2:** Increasing Effectiveness
  Khula application Features:
  - By-products dictionary
  - Yield Calculating
  - Planting Calendar
- **Key Aspiration 3:** Co-value creation: features
  Khula application Features:
  - Event registration
  - Learning the value of farming
  - Ability to ask and answer questions

- Ability to communally enlarge the knowledge contained in the *Khula* application.

The relevance of these contributions has been demonstrated through the value which contextmapping offers to participatory IXD activities, as well as, the reciprocal application of selected design tools used in IXD to enhance the contextmapping process. The effectiveness of integrating these design approaches, when designing with and for developing communities, is evident in the account of the design of the *Khula* application.

While the study was limited in the number of users included and the focus on only a single project, the processes, practices and rationale described in the narrative account of the design practice, present a holistic account of a viable approach for co-designing interactive products with and for developing communities.

6.2 Future work

Some of the possible applications of this work are included in sections 6.21- 6.2.3.

6.2.1 Development of a full prototype

The further development of more refined digital prototypes that incorporate the complete interaction design and reflecting the changes identified in the initial concept testing could indicate more conclusively, the value of the design methods, tools and practices applied in this study to meet the information needs of small-scale urban farmers in Soweto.

6.2.2 Application of the integrated design method to other ICT projects that seek to co-design solutions in development contexts

While this study focuses particularly on the needs of farmers in Soweto, many of the tools, methods and practices incorporated in the study could be applied to other ICT projects that aim to use a co-design or participatory approach to resolve problems facing developing communities. The primary contribution made in this area is the applicability of *contextmapping* for co-designing interactive products.

6.2.3. Application of the integrated design method to other participatory design projects that seek to resolve complex societal problems

Lastly, while this study focused on design solutioning within a digital context, many of the tools, methods and practices incorporated in the study could be applied to other design activities that are not intentionally digital but that aim to apply a qualitative human centric approach. These fields could include Service Design, Industrial Design, Architecture and urban design. The primary contributions made in this area are the amendments to the *contextmapping* methodology, predominantly through the integration of interaction design theory and practices. Foremost, would

be the inclusion of Hassenzahl's *Three Level Hierarchy of Needs* as a framework for guiding effective participatory design engagement and the use of personae and user- journeys to effectively communicate design concepts to participants from developing communities.

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Appendix

Appendix: Section 1, additional contextmapping content.

Appendix: Section 2, IXD.

Appendix: Section 3, final interface.

Appendix: Section 1, additional contextmapping content.

(Above), innitial mapping of the problem ecology for small-scale farmers in Soweto.

(Following pages 2-3), The different worksheets of the sensitization worksheet. The questions were based on Hassenzahls Top Ten Psychological Needs [11]. In addition, a simple three-day diary cultural probe was also included in the worksheets.

Hello, Sawubona, Dumela, Molo, Thobela!

These cards are made to help us at the university, understand what it is like to be a farmer.

You can write what you like, anywhere on the cards.

Your cards will not be shown to anyone else and your information will remain private

Do you feel that you are independent ?

Instruction: In the space below, write down some of the things that helps a farmer to be independent

Independent - (Ozimele) - not to have to rely on other people; free to do what you would like to do

Are you an independent farmer?

Instruction: In the space below, write down some of the things that stop you from been more independent

As a farmer, what are you good at doing ?

Instruction: Write down activities you are good at, and that you enjoy doing

What do you find difficult about farming ?

Instruction: Write down activities you find difficult or you do not like doing

Instruction: Write down all the names of the people or organisations that help or support you

Instruction: Do you feel there is somebody who should be helping you more? Write down your thoughts, in the space above

Instruction: write down, who you help, and how you help

Instruction: Do you feel you could help others more? If yes, how?

What are the things you can control ?

Instruction: Please, write down all the things that you feel you have control over in terms of your farming

What are the things you cannot control ?

Instruction: What are the things you cannot control? Write them down. Describe how they make you feel?

Are farmers respected in the community ?

As a farmer do you feel respected in the community?
Instruction: Write down your view of how farmers are valued by the community

Do You feel that other farmers respect you ?

Instruction: Do you feel you make a contribution to the Farmers Forum**?** Write down how you think other farmers understand and listen to you?

Why are farmers important in South Africa ?

Instruction: Please write down the reasons why you think farmers are important

What do you enjoy most about farming ?

Instruction: Please write your reasons down anywhere on the page

What do you enjoy doing when you are not farming ?

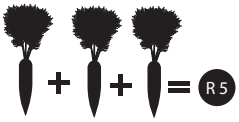
Instruction: Please write your reasons down anywhere on the page

Does your work make you feel healthy ?

Instruction: Write down the good or the bad effects of your work on your health

Does your work make you feel healthy ?

Instruction: Write some words that describe how you spend the money, you earn from farming?



Do you think farming is a good career ?

Instruction: If 'yes' or 'no', please, state why

Why did you become a farmer ?

Instruction: Please write reasons here.

FARMING DIARY

Instruction: In order to better understand a farmers day, we would like you to keep a record of your daily activities for 3 days.

Please write down your activities and the times they took place on the 3 cards that have the 'Day' headings that look like this:

DAY 1 **DAY 2** **DAY 3**

Example:

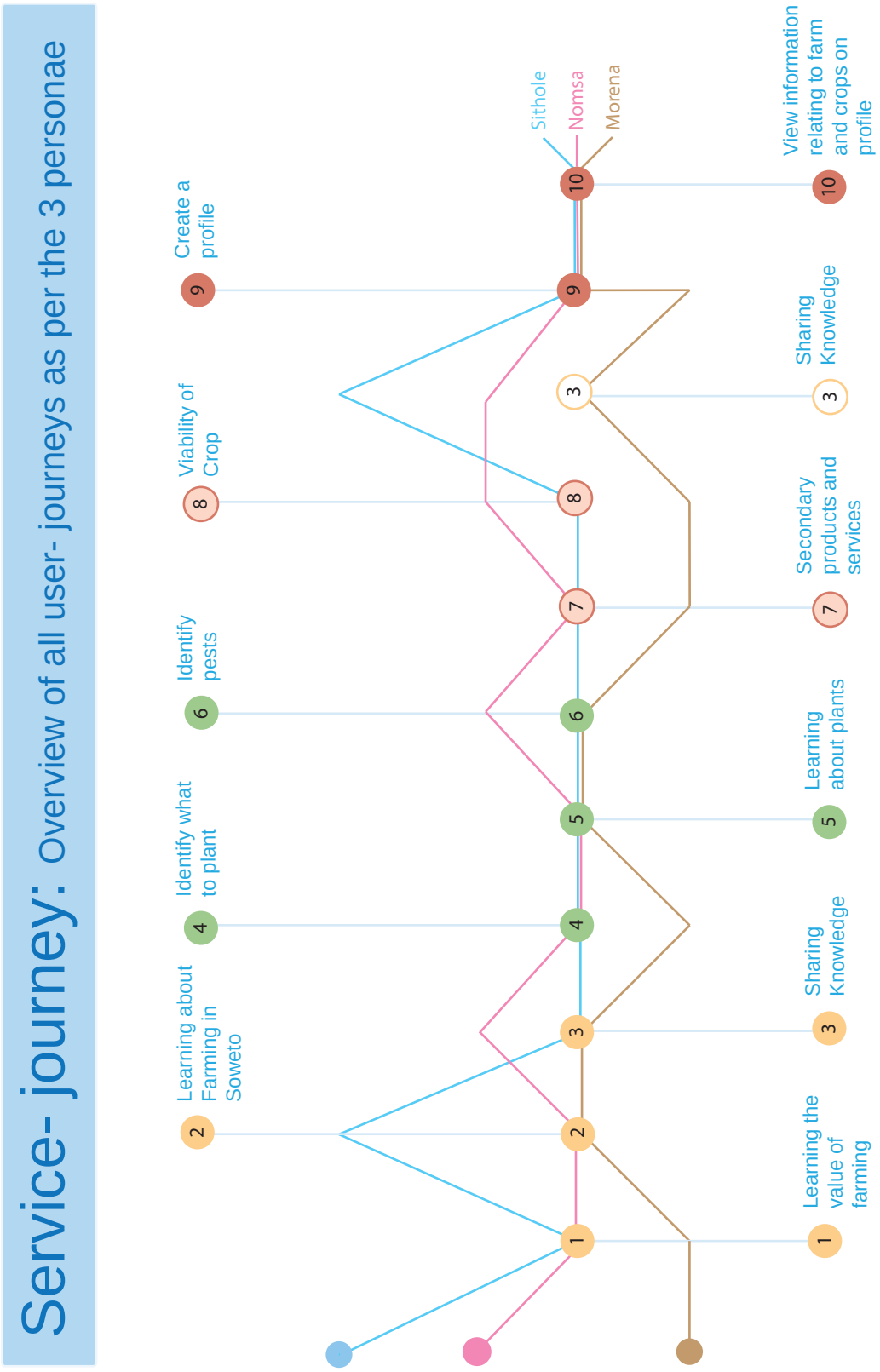
Things I did today:

7:30am – Harvested all the lettuce in the northern section

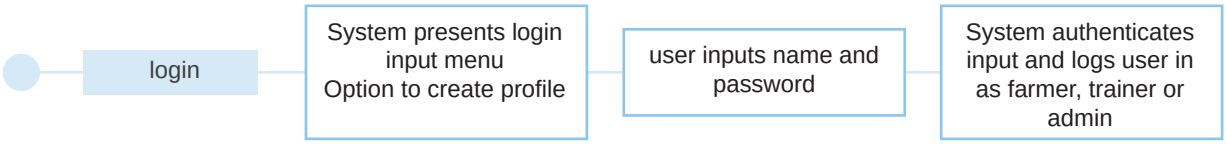
8:30 – Planted tomato seedlings

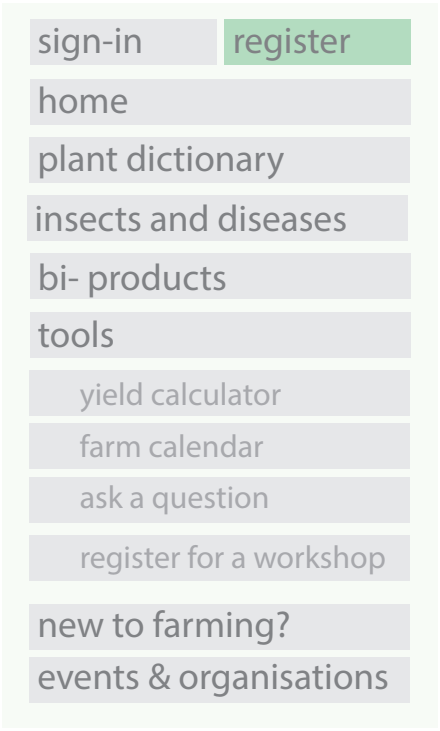
Appendix: Section 2, IXD

This section contains all the user-journeys, use case diagrams, wireframes and user interface designs (UI) diagrams related to the design of the Khula App. All diagrams are arranged in relationship to the main user journey which can be indexed to the *Service-journey diagram* (below) and subsequently all the way back to the insights gained from the affinity diagrams.



User- journey: generic login





(Top) User-journey: generic login.

(left) Wireframe depicting *home page*.

(Above) Pop-up menu. This menu is the primary menu for the application, accessible from the icon in the header.

(Right) Sign-in form. Signing-in would navigate the user to the *View Profile* state (User-Journey 10). Register would take the user to Create Profile (User-Journey 9)

khula

menu

sign-in

using Khula

Khula is a Zulu word which means grow.

The kula mobile site aims to help farmers to grow their own farming business' by connecting, learning and sharing.

using Khula

menu

The menu in the top -right of the page will help you to navigate the khula site.

Sign in or create a profile

A profile helps you store the information about your farm in one place. Begin yours today!

learn about plants

Learning about plants is one of the most important aspects of becoming a successful farmer.

fight pests

Keeping your crop healthy is important. Learn about insects and diseases and how to prevent damage to your crops

discover bi-products

Secondary products can help you increase your profits. Learn how your crop can be turned into other products.

calculate crop yield

Ever wondered what crop will make you the most money? Use this tool to forecast your yield and profit

plan your planting seasons

When is the best time to plant. Stop guessing! Use this tools to learn when to plant.

register for events

april

There are many farming events such as workshops taking place in Soweto, find out more and register.

learn about farming

Why are farmers so valuable to the community? Why is home grown food so good for you? Find out and learn more!

soweto farming community

Who is involved in the Soweto farming community? View all the n.g.o's organisations and community groups

contact details

If you would like to learn more about Khula, farming in Soweto please contact us

khula

menu

Store all
place th
get upd

usin

menu

creat

learn

disco

sign-in

register

home

plants

pest control

bi- products

tools

yield calculator

farm calendar

ask a question

register for events

new to farming?

organisations

Store all the information about your farm in one place that is easy to access. set up reminders and get updates and

local farming, local knowledge

khula

please sign in

name

password

forgotten your password?

enter

or register if you have not created a profile yet

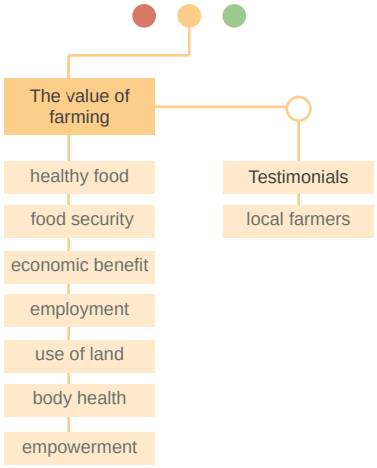
register

(Left) UI design for *home page*

(Top) UI design for the primary menu .

(Above) UI design for *sign in form*

User- journey 1: Learning why farming is important

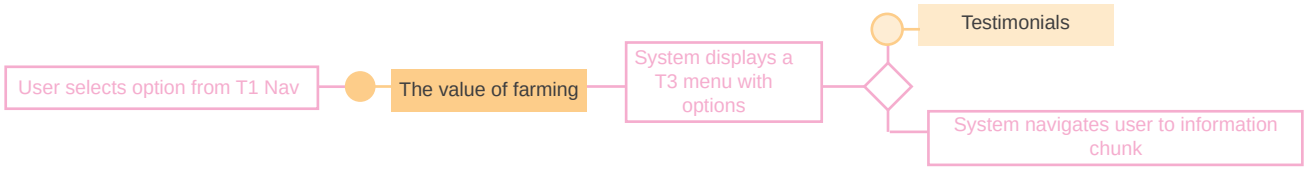


Description:

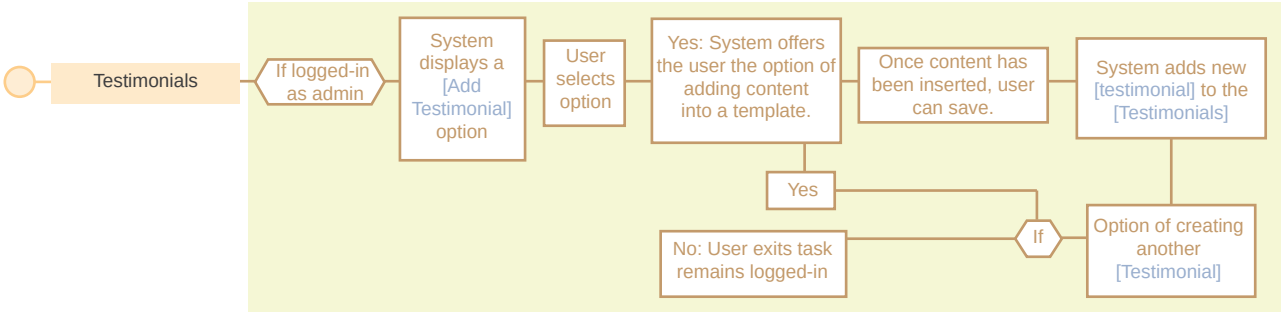
This journey is predominantly for novice farmers to learn about the value of farming. Testimonials are provided by experienced farmers but are added and edited by the administrator

Use case diagram

User journey 1: Task- Flow A: View content related to the value of farming



User journey 1: Task- Flow B: Creating a new testimonial

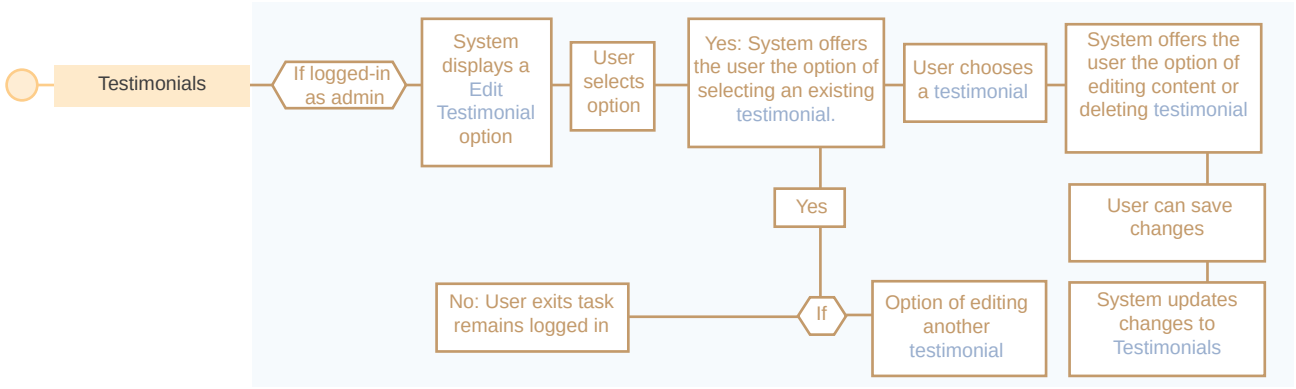


Pattern for creating a new content element

New_content Variables= [1= Add Testimonial, 2 = testimonial, 3 = Testimonial]

(From Top) User-Journey 1; corresponding use case diagram; and task-flows

User journey 1: Task- Flow C: Editing or deleting an existing testimonial



(Top) Task-flow for editing testimonials

(Left) Wireframe for Journey 1

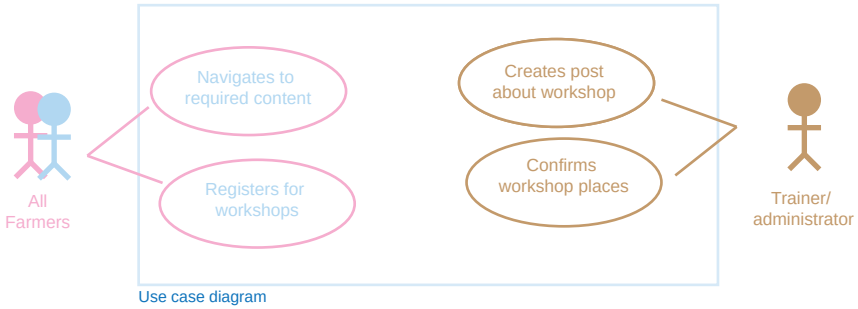
(Right) UI design for *Journey 1*

User- journey 2: Viewing stakeholders & events & registering for events

Description:

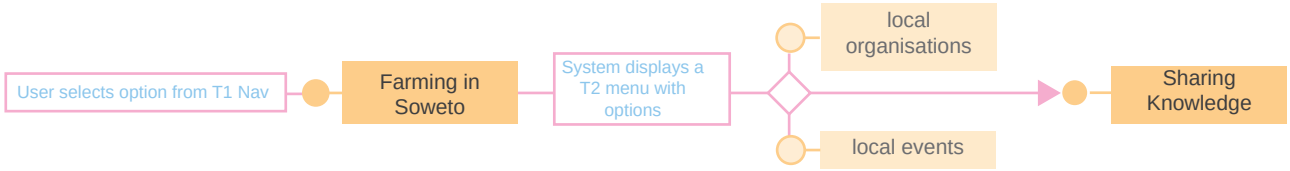
This journey is for novice farmers to identify who are the stakeholders in farming in Soweto.

Farmers, experienced an novice can view and register for events such as workshops. The administrator can update and add events

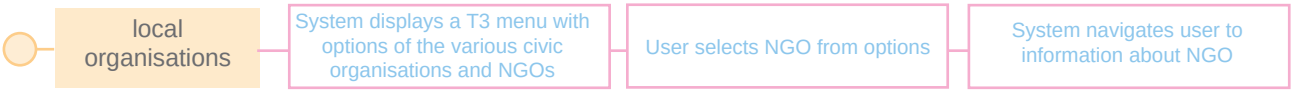


Use case diagram

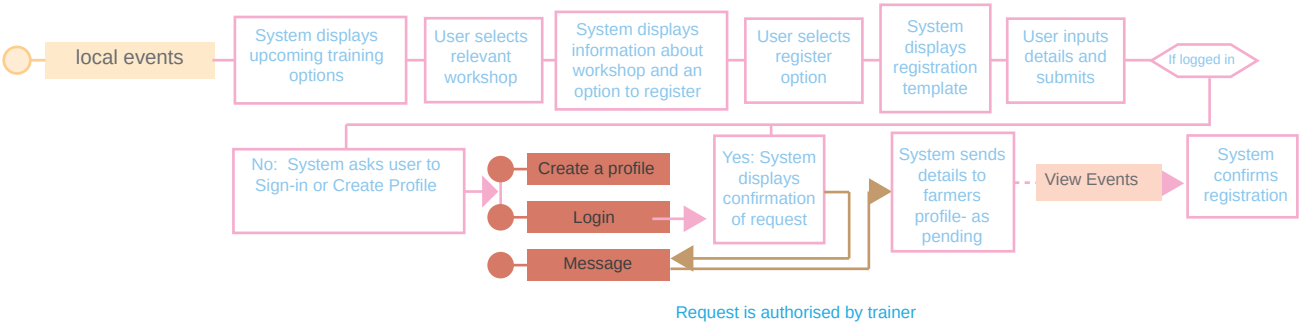
User journey 2: Task- Flow A: Viewing who is involved in the Soweto farming community



User journey 2: Task- Flow A: Finding information about an NGO working with farmers



User journey 2: Task- Flow C: User registers for workshop

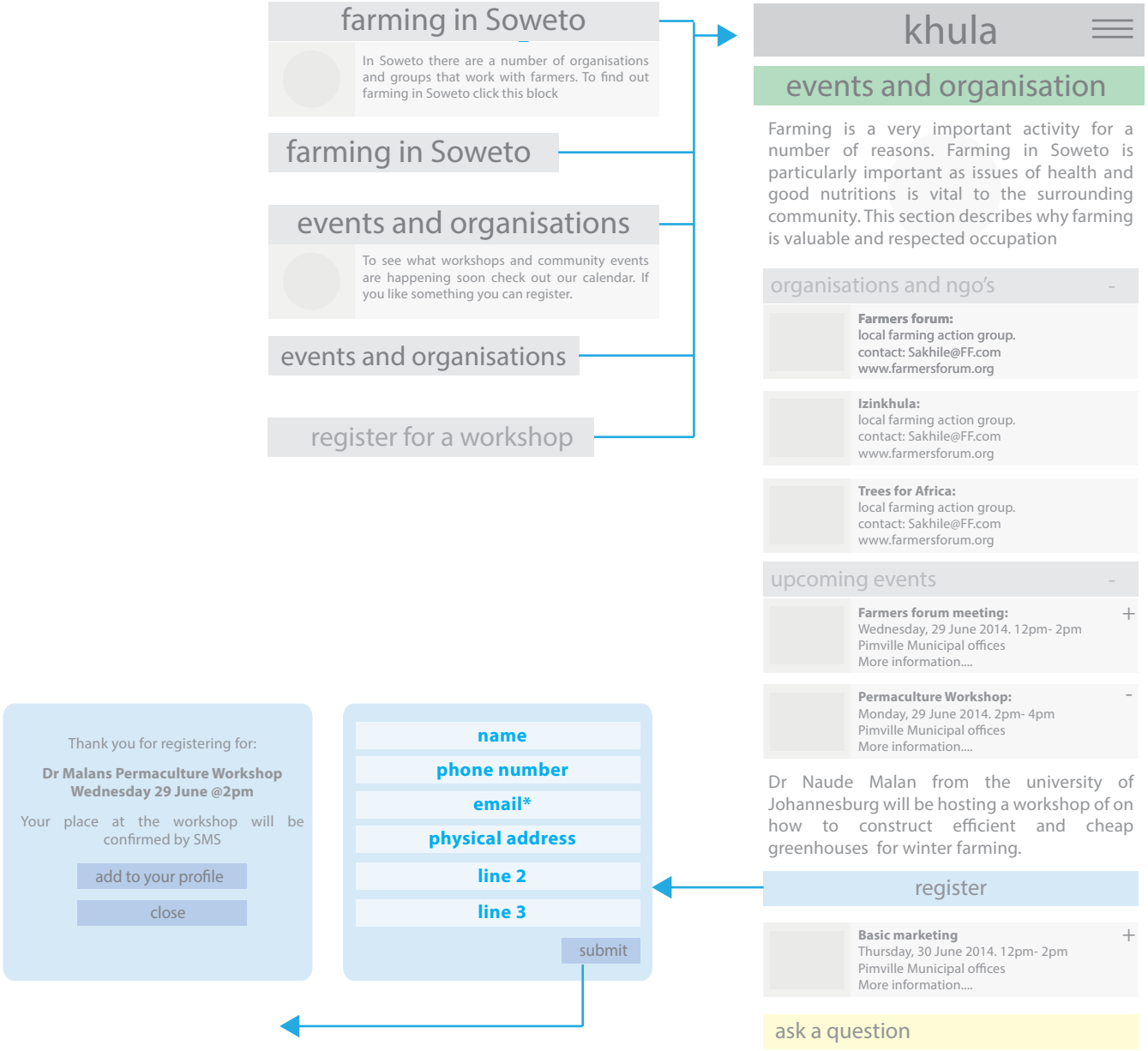


Request is authorised by trainer

(From Top) User-Journey 2; corresponding use case diagram; and task-flows

User journey 2: Task- Flow D: Admin user creates new event

User journey 2: Task- Flow E: Admin user edits event



(Top) Task-flows D and E

(Left) Wireframes for Journey 2, depicting point of entry, main state, registration input form, and confirmation feedback pop-up.

community

menu

sign-in

the soweto farming community

farming is a very importnat activity for a number of reasons. Farming in Soweto is particularly important as issues of health and good nutietions is vital to the suroounding community.

community organisations

farmers forum -

logo

email: sakhile@farmers forum
phone: 011 559 1092
web: www.foarmersforum.org
address: 30 10th st, Naledi, soweto

The Region D Farmers Forum was set up by local farmers in the Soweto area to bring farmers together to collectively organise and coordinate effots to improve the sustainability of farming in the Soweto region

izindaba-zokudla +

n.g.o's

africa for food +

eat for now +

habitat for humanity +

trees for africa +

government organisations

city of johannesburg +

local officers +

ask a question

????

pose a question.....

submit question

events

menu

sign-in

register and view events

Farming is a very important activity for a number of reasons. Farming in Soweto is particularly important as issues of health and good nutritions is vital to the surrounding community. This section describes why farming is valuable and respected occupation

upcoming events -

farmers forum meeting -

logo

date: Wednesday 29 June 2014
time: 12pm- 2pm
contact: sakhile@gmail.com
address: Pimville Municipal offices

details:

The agenda for the meeting consists of a number of items:

- Planning
- City of JHB planing
- Farmers Market

register

permaculture workshop +

register

events

menu

sign-in

events registration

marketing workshop

name

phone number

email (if available)

home address

type here.....

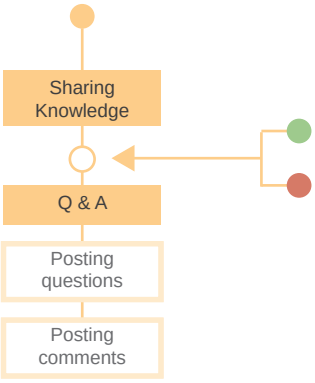
comments are questions

type here.....

submit registration

(Left) UIs displaying Soweto farming organisations
(Right) UI related to event registration
Notes: As evident in these UIs, a decision was made to seperate the organisation information and the events registration into descrete sub-sections.

User- journeys 3: Posting a question or answer



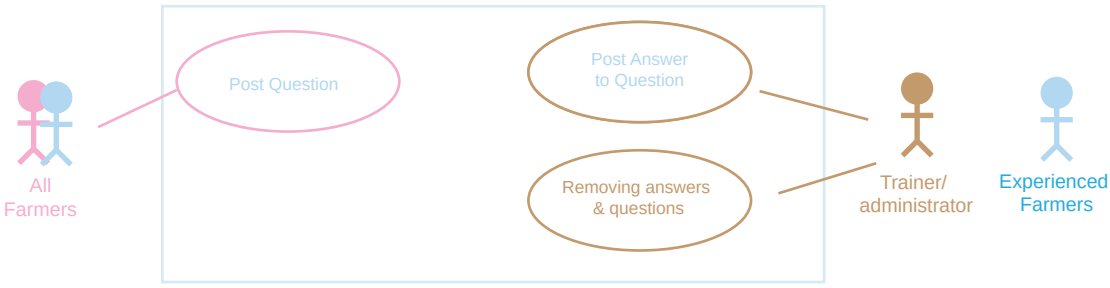
Description:

This journey is to allow farmers to post questions to which members of the community can respond.

The posting and answering of questions requires users to be logged on order to curate information.

However answers and suggestions can also be directly emailed to the administrator.

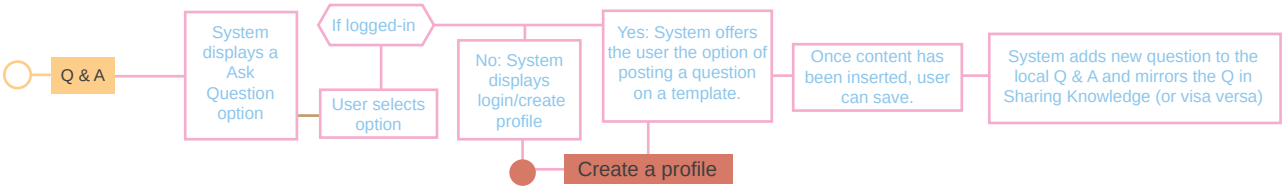
Useful information can be incorporated into formal content over time.



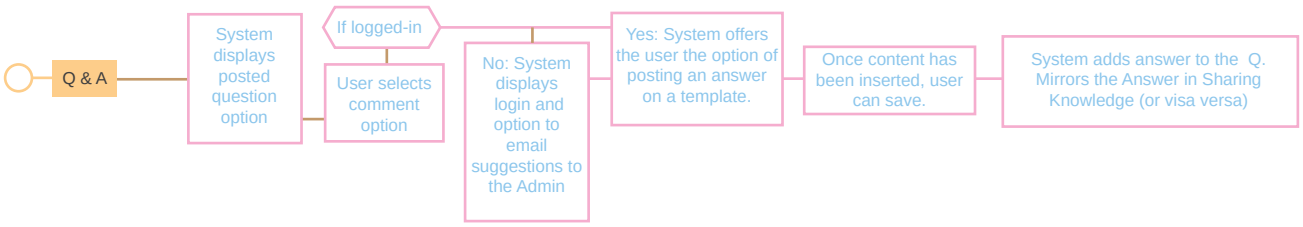
Use case diagram

User journey 3: Task- Flow A: Viewing current question posted on the site

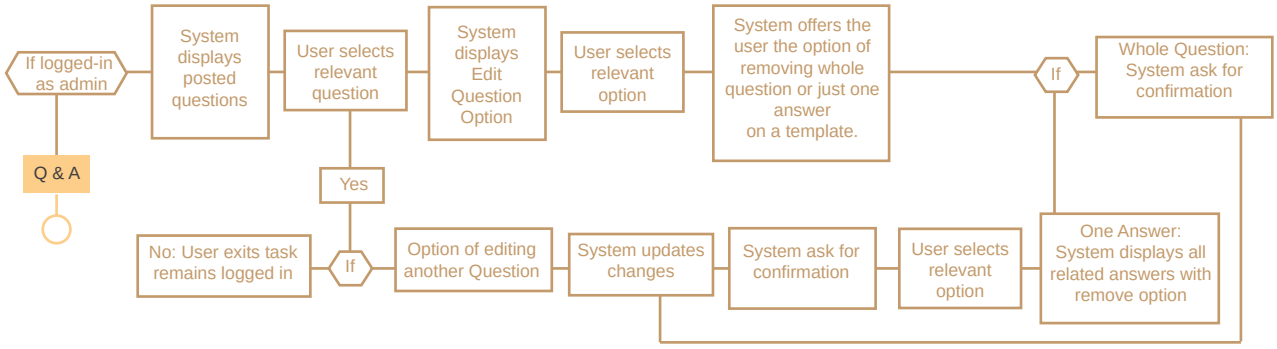
User journey 3: Task- Flow B: Posting a question about a farming technique

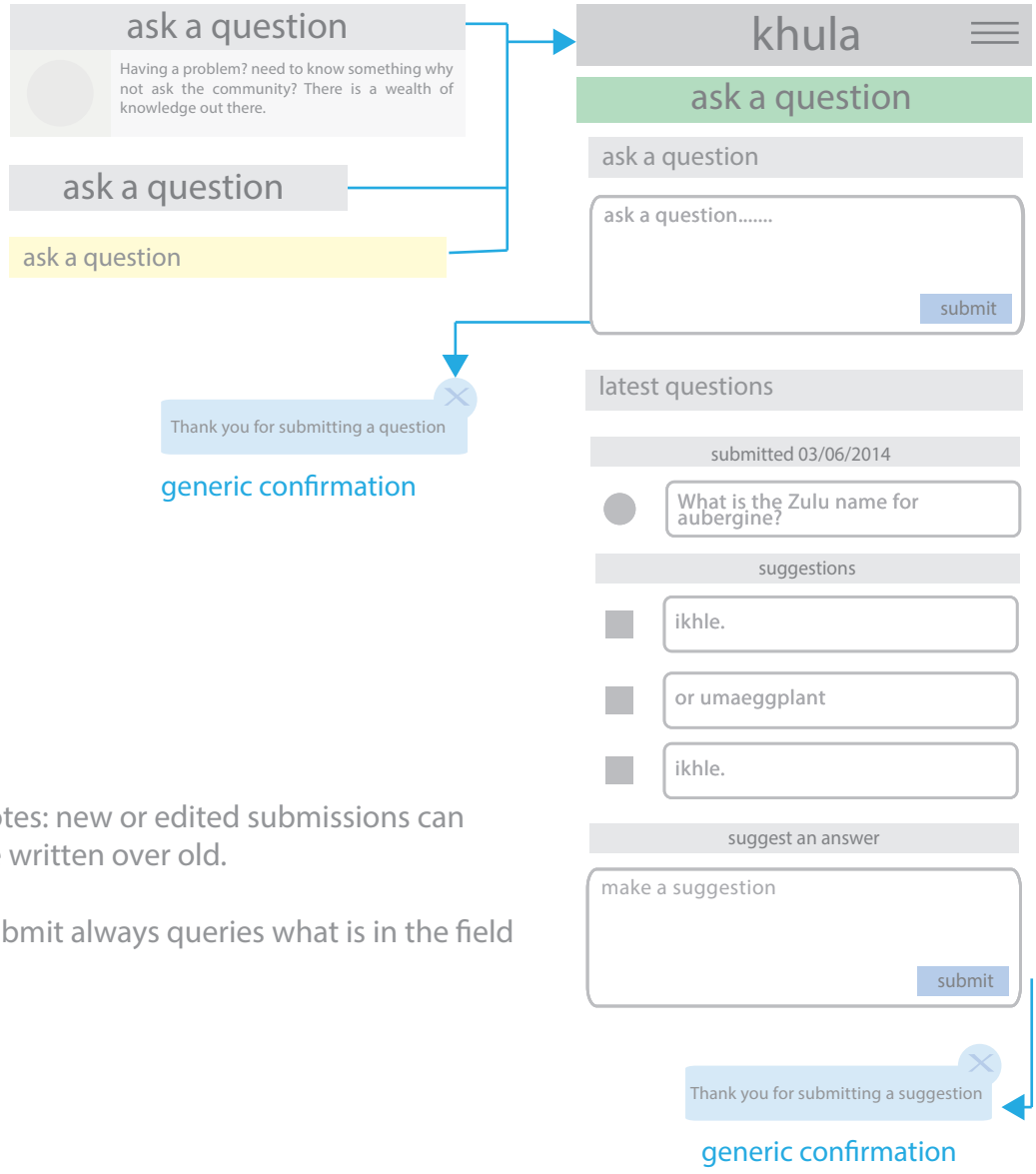


User journey 3: Task- Flow B: Posting an answer to an existing question



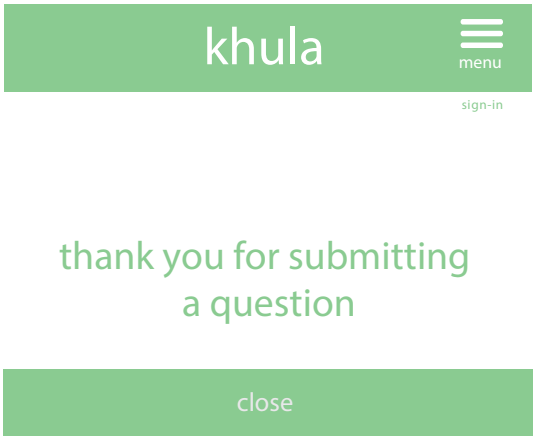
(From Top) User-Journey 3; corresponding use case diagram; and task-flows





(Top) Task-flow for editing questions

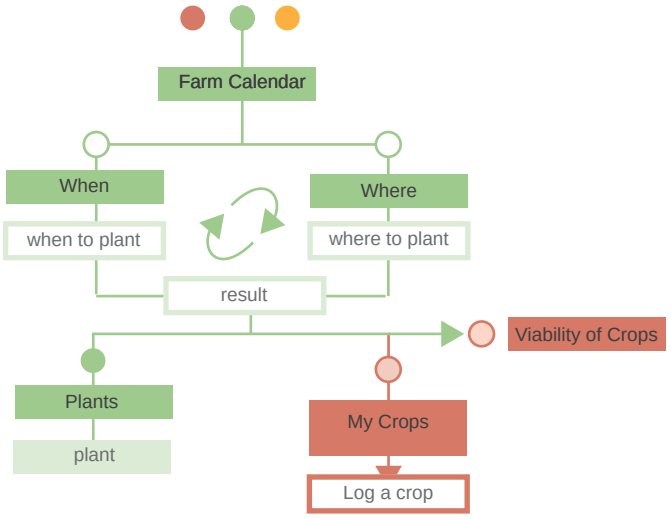
(Above) Wireframe depicting the process of submitting and answering questions



(Left) Wireframes simulating the question/answer nature of Journey 3

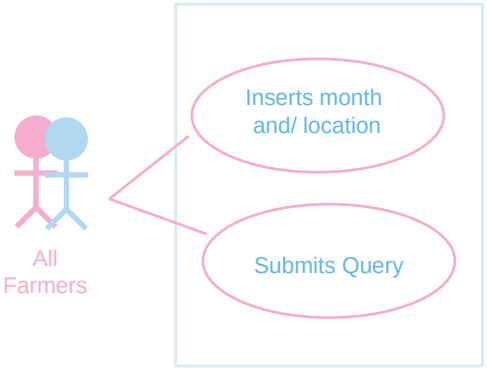
(Right) Wireframe depicting feedback confirmation

User- journey 4: Using the Farm Calendar to determine what to plant



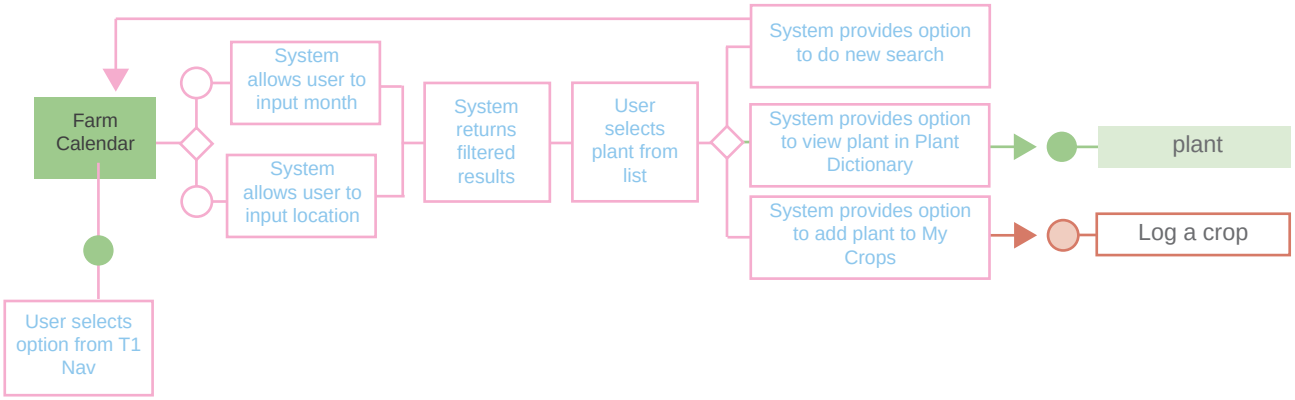
Description:

The goal of this journey is for farmers to determine what crops, they should plant at any given time of year, depending on their location. The system returns a selection of plants that meet the search criteria. The farmer can then find further information about the plant, work out the viability of the crop and log the crop, in their farm profile.

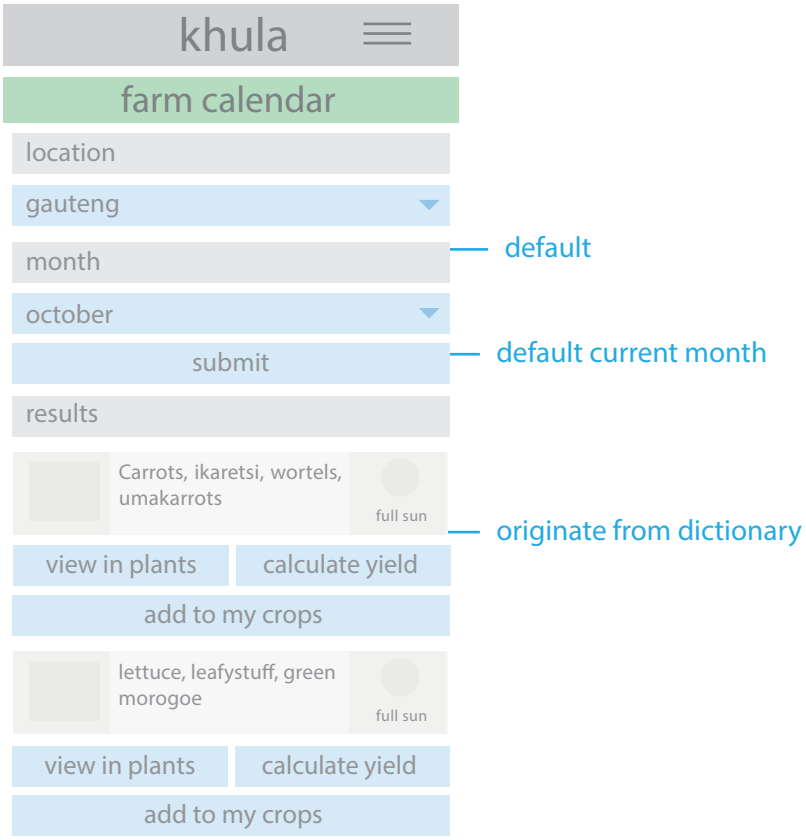


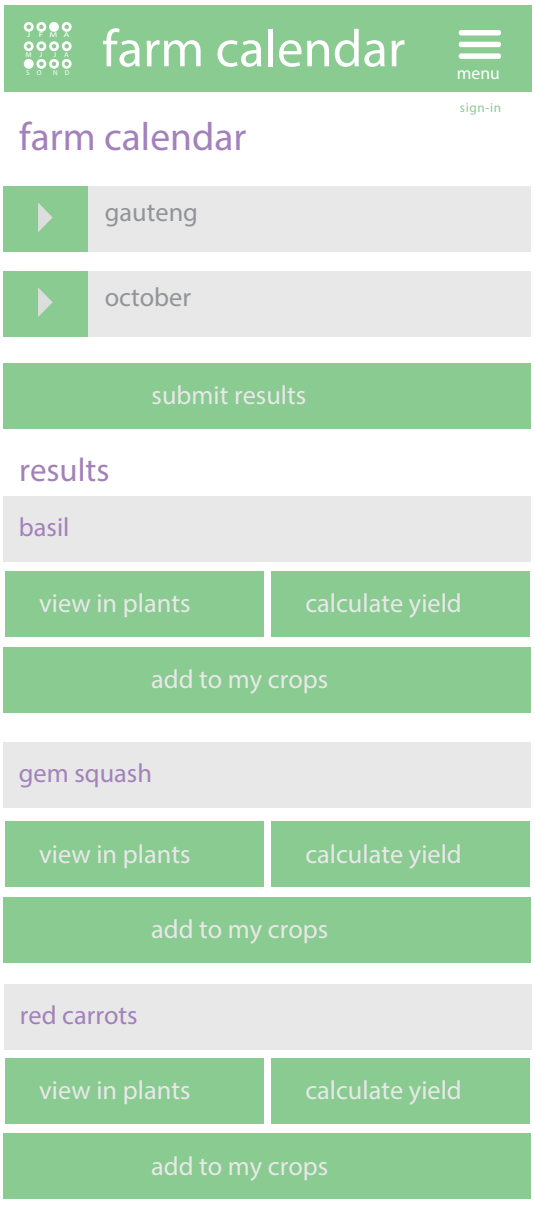
Use case diagram

User journey 4 Task- Flow A: Using the calender to determine what crops to plant at a certain time of year in Soweto



(From Top) User-Journey 4; corresponding use case diagram; and task-flows

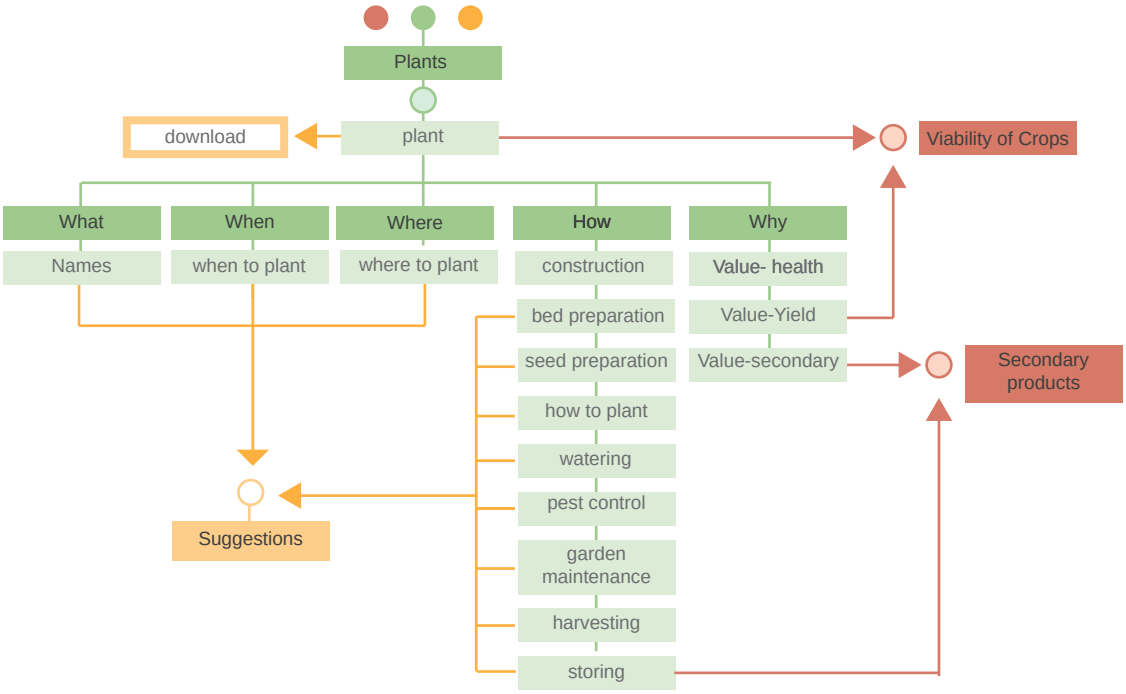




(Left) Wireframe representing the Farm Calendar Tool
(Right) Wireframe depicting the process of submitting and answering questions.

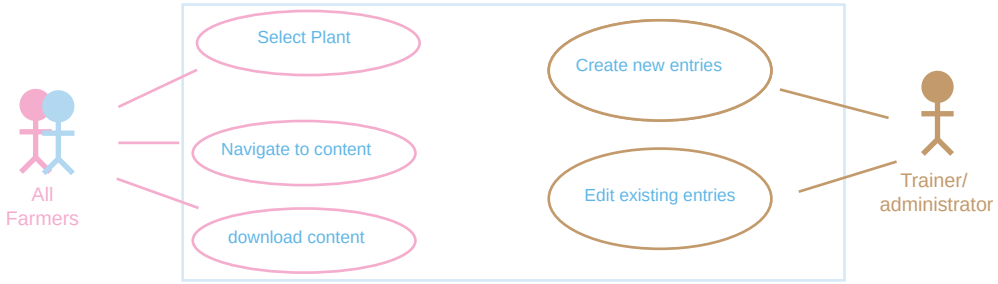
Notes: Once relevant crops are displayed the user is presented with the options of learning more about the crop (user-journey 5), calculating the financial feasibility of the crop (user-journey 8) or add the crop to their profile (user-journey 9)

User- journey 5: Improving Farming Abilities (plant dictionary)



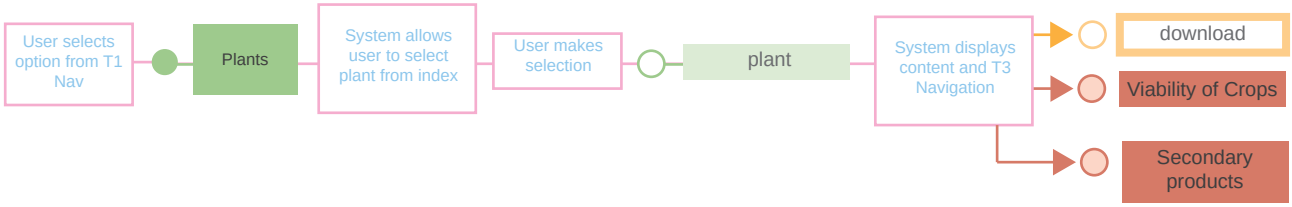
Description:

This journey allows users to find out information about any particular crop. Farmers and trainers can also supplement the provided content by adding comments using the Suggestions function. Any information pertaining to one "plant' can be downloaded as a mobile or printable 'PDF"



Use case diagram

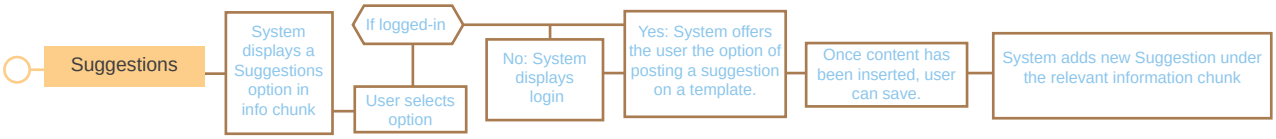
User journey 5: Task- Flow A: Navigating to content that describes one particular plant



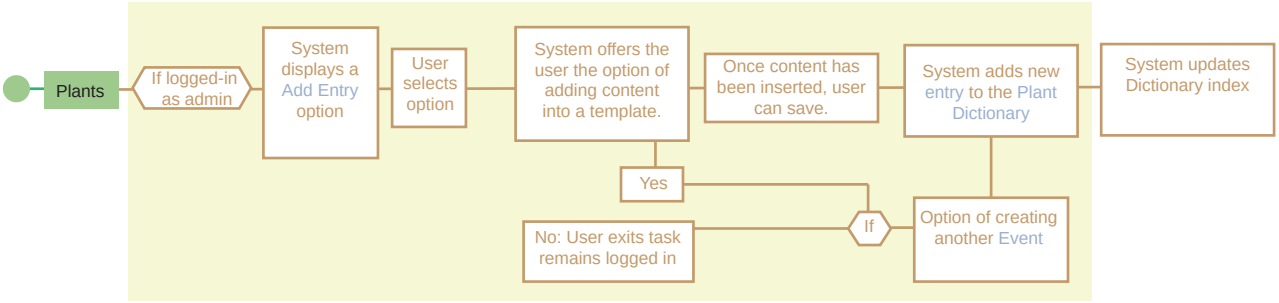
(From Top) User-Journey 5; corresponding use case diagram; and task-flow related to finding a particular crop

User journey 5: Task- Flow B: User downloads PDF with information about a certain plant

User journey 5: Task- Flow C: User suggest local information about a certain information chunk



User journey 5: Task- Flow D: Admin user creates new dictionary entry



User journey 5: Task- Flow E: Admin user edits or removes a dictionary entry

(From Top) User-Journey 5 task-flows

khula

plant dictionary

In the plant dictionary, you can find information on a wide variety of plants.

You can search by typing the name of the plant you are looking for in the box below.

Or you can click on the name of plant in the list below

find a plant

- beans
- beetroot
- carrots
- lettuce
- peas
- spinach
- tomato

khula

plant dictionary

carrots

download

Carrots, ikaretsi, wortels, umakarrots

full sun

- gauteng
- planting calendar -

J F M A M J J A S O N D

- health value +
- calculate your yield
- how to grow carrots +
- storing +
- secondary products +
- add to crop profile
- suggestions

khula

plant dictionary

carrots

download

Carrots, ikaretsi, wortels, umakarrots

full sun

- gauteng
- planting calendar -

J F M A M J J A S O N D

- health value -

Carrots contain Vitamin C which is essential for maintaining good eye- sight and energy levels.

Carrots are also high in fibre and prevent lung infections.....

- calculate your yield
- how to grow carrots -
  - construction +
  - bed preparation +
  - seed preparation +
  - how to plant +
  - watering +
  - pest control +
  - garden maintenance +
  - harvesting +
- storing -
  - drying carrots — view recipe — download recipe
- bi- products -
  - Carrot curry — view recipe — download recipe
- add to crop profile
- suggestions

add a suggestion.....

submit

A good recipe is carrot cake....

I usually uses old tea bags for fertilizer when growing ....

(From left-right) Wireframes representing user-journey 5 at various levels of expansion, revealing the information categories.

Plants

menu

sign-in

learn about plants

In the plant dictionary, you can find information on a wide variety of plants.
You can search by typing the name of the plant you are looking for in the box below.
Or you can click on the name of plant in the list below

plant dictionary

search

- beans
- beetroot
- ice berg lettuce
- peas
- spinach
- red carrots
- youngs lettuce

Plants

menu

sign-in

plant dictionary

tomato

lycoppersicon esculentum
tomatie, utamatisi

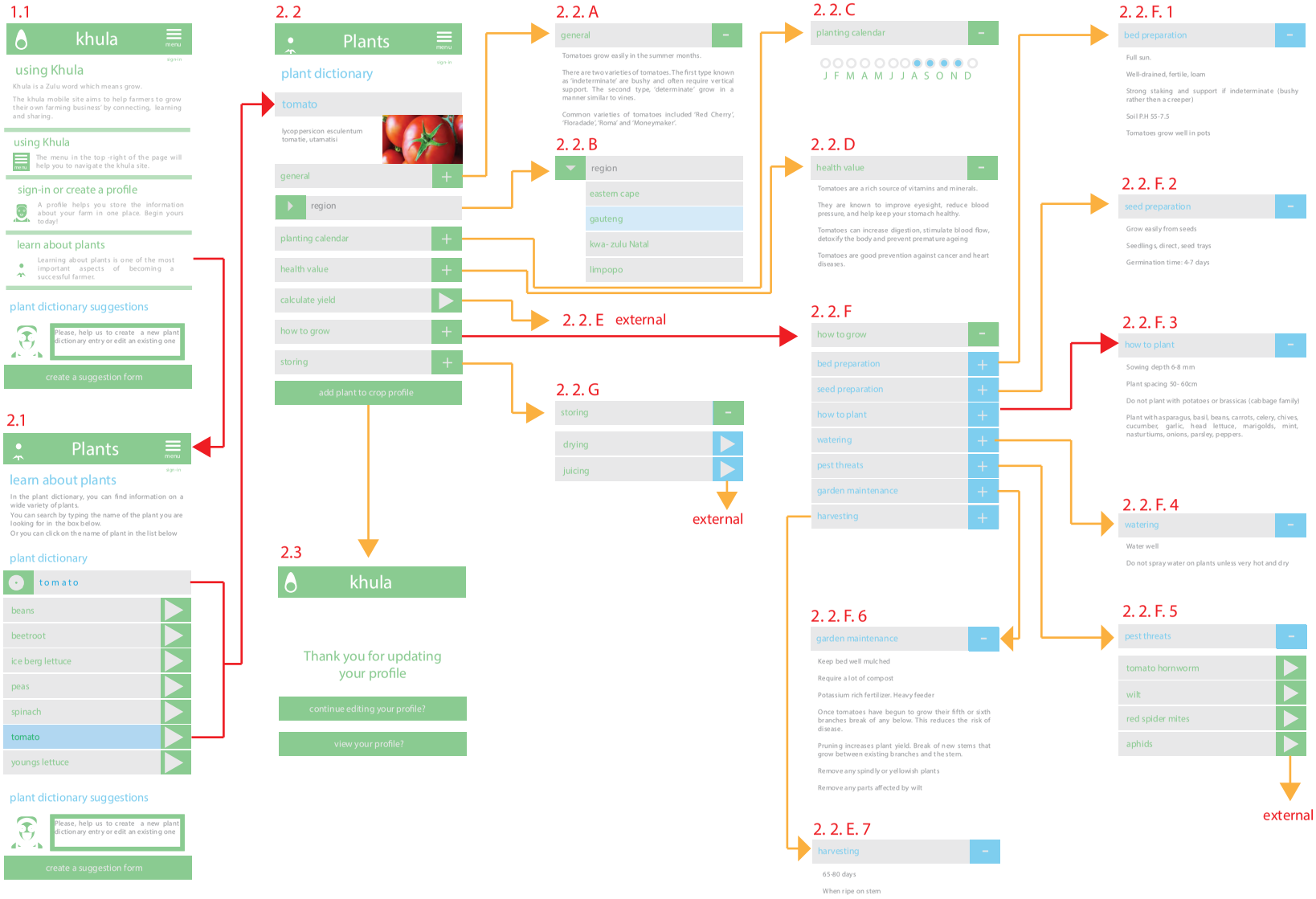
- general +
- region
- planting calendar +
- health value +
- calculate yield →
- how to grow -
  - bed preparation +
  - seed preparation +
  - how to plant +
  - watering +
  - pest threats +
  - garden maintenance +
  - harvesting +
  - storing +

add plant to crop profile

download.pdf

(From left-right) UI representing user-journey 5 at various levels of expansion, revealing the hierarchy of information.

User-testing scenario: 1-



(From left-right) Complete overview of journey 5, depicting all the possible paths through the stage structure. The red goals were the ones tested in the paper prototyping tests.

Plants

menu

sign-in

plant dictionary suggestion

help us to create entry by filling in the form below. This will added to the pest control offering.

common name

alternative name 1

alternative name 2

genus (if known)

upload image.

description

type here.....

gauteng

planting calendar

J F M A M J J A S O N D

health value

type here.....

bed construction

type here.....

bed preparation

type here.....

seed preparation

type here.....

how to plant

type here.....

watering

type here.....

main insect and disease threats

type here.....

garden maintenance

type here.....

harvesting

type here.....

main methods of storing

type here.....

email (voluntary)

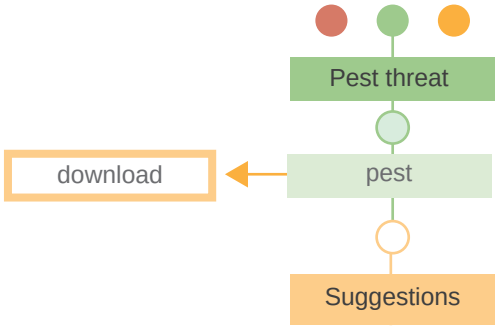
All content on this site will be published under a creative commons licence.

by submitting this entry, I declare that to the best of my knowledge that this information is not the property of someone else.

submit recipe

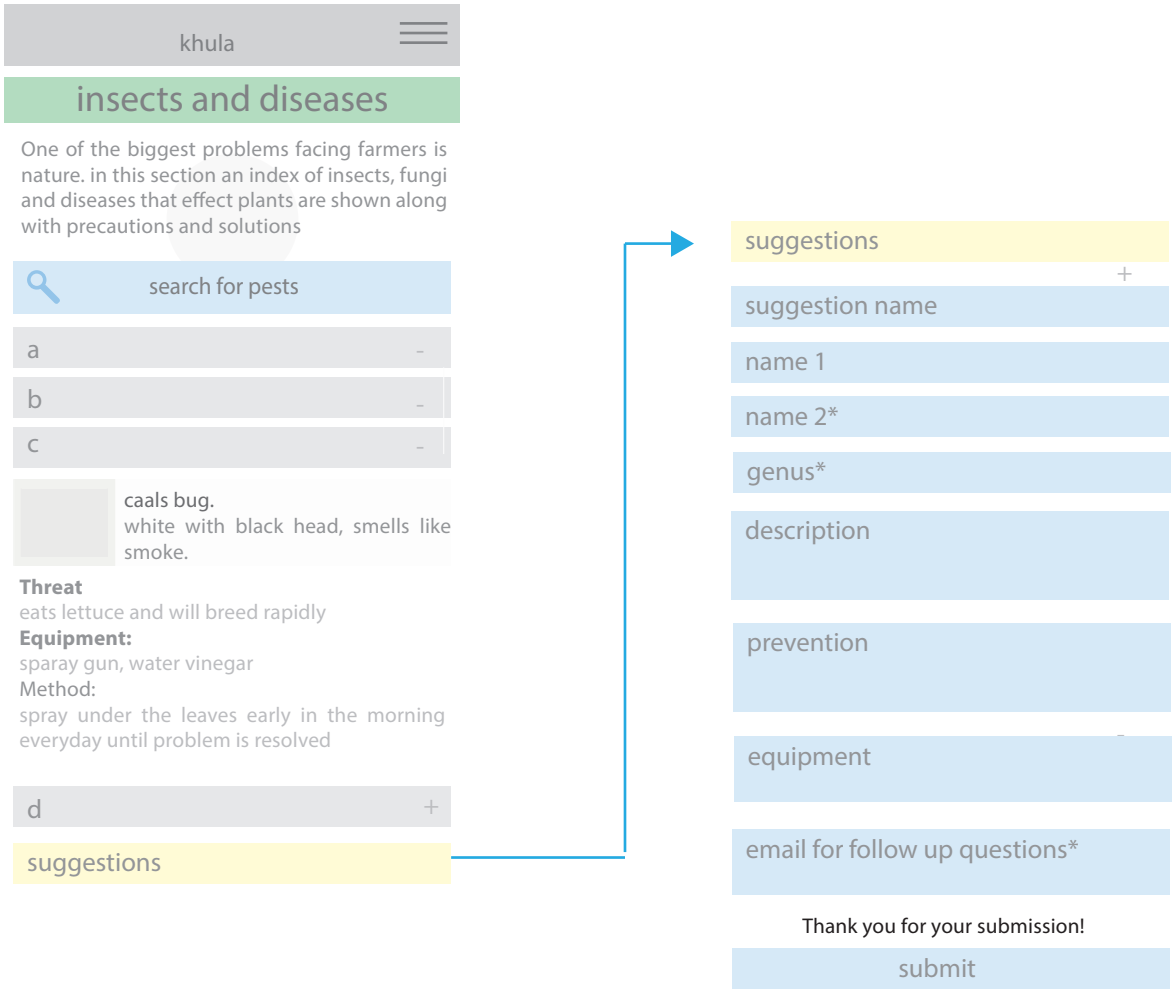
(Left and right)) UI representing a suggestion for the plant dictionary input form

User- journey 6: identifying potential insect threats (pest dictionary)



Description:

This journey allows users to identify and find out information about insect threats and plant diseases. Farmers, trainers and contributors can also supplement the provided content by adding comments using the Suggestions function. Any information pertaining to one "pest' can be downloaded as a mobile or printable 'PDF"



(Top) User-journey describing the process of identifying and resolving problematic pests

(Above) Wireframes depicting the *insect dictionary* and the *suggestion* input form

pest control

menu

sign-in

protect your crops.

One of the biggest problems facing farmers is nature. in this section an index of insects, fungi and diseases that effect plants are shown along with precautions and solutions

search for a pest

anthrax +

cooper's mite +

lettuce mites +

malta lice -

photo

Description:
white with black head,
smells like smoke.
read more

Threat:
eats lettuce and will breed rapidly

Equipment:
sparay gun, water vinegar

Method:
spray under the leaves early in the morning everyday until problem is resolved

download pest.pdf

suggestions

add a suggestion.....

submit suggestions

terrace roach +

add a new pest entry

pest control

menu

sign-in

create a new entry

help us to create entry by filling in the form below. This will added to the pest control offering.

common name

alternative name 1

alternative name 2

genus (if known)

upload image.

description

type here.....

equipment

list equipment.....

prevention method

describe method.....

email (voluntary)

All content on this site will be published under a creative commons licence.

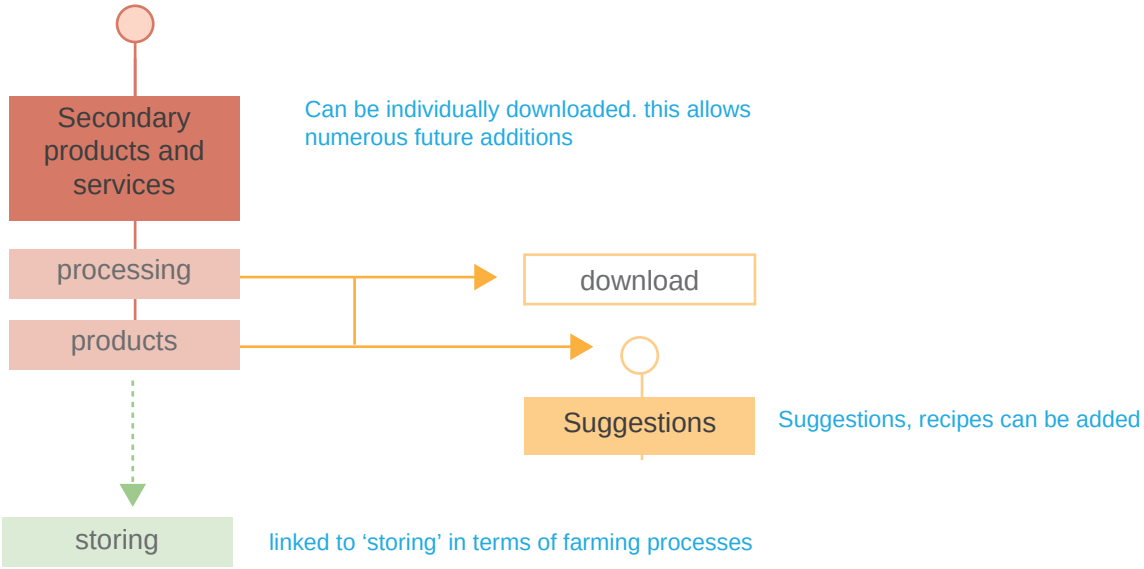
by submitting this entry, I declare that to the best of my knowledge that this information is not the property of someone else.

submit recipe

(Left) UI depicting user-journey 6 content requirements

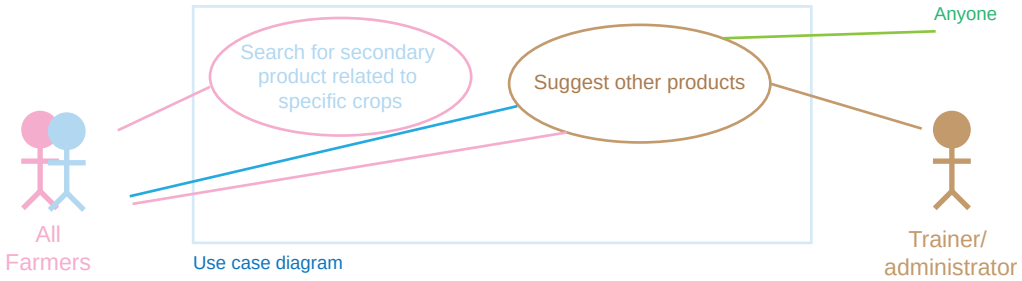
(Right) UI showing the *suggestions* input field

User- journey 7: Accessing recipes related to farming produce

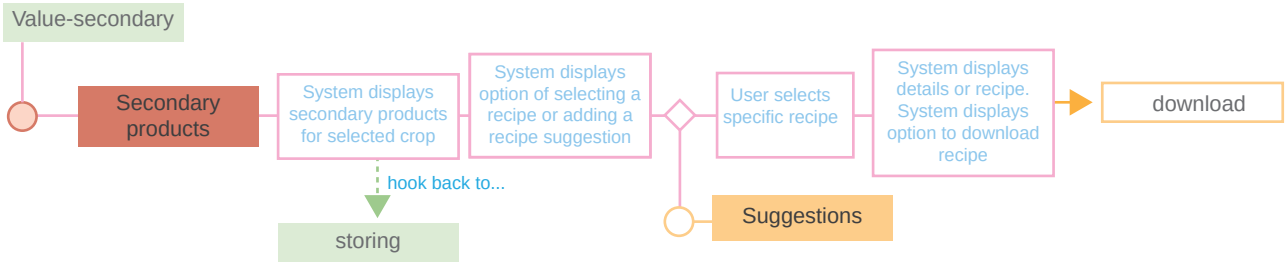


Description:

Farmer can asses information related to secondary products. For example, a surplus of tomatoes can be turned into jam. Individual recpies can be downloaded as PDFs. new recipes can be added in a simple 'chat' format and over time incorporated into PDFs. (Recipe is used here to denote any product not just a food item).



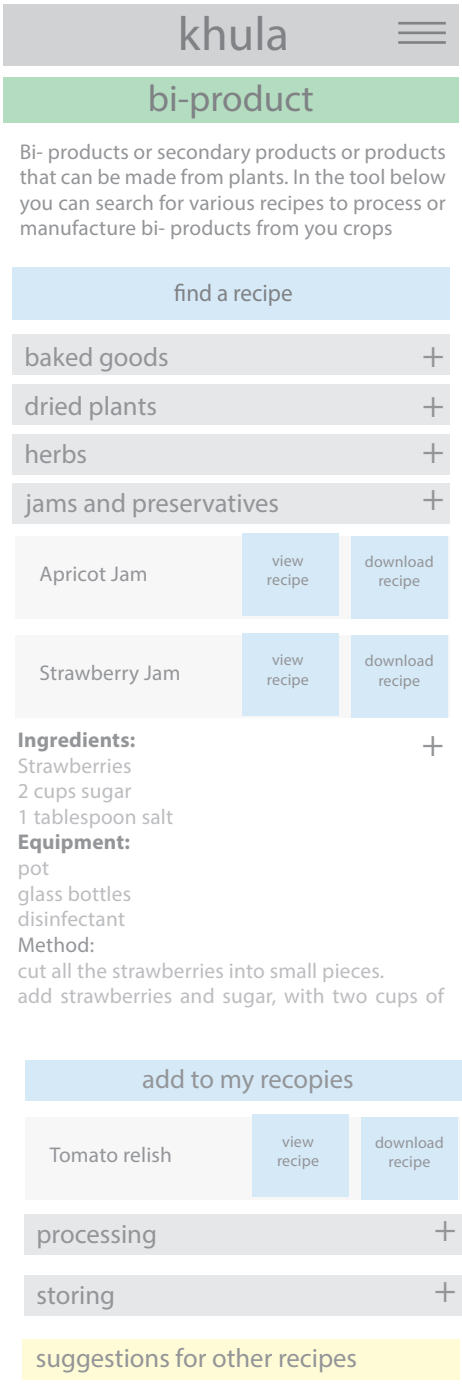
User journey 7: Task- Flow A: Choosing a secondary product recipe to download



(Top) User-journey 7

(Middle) Use case diagram depicting the input and output of information in the journey

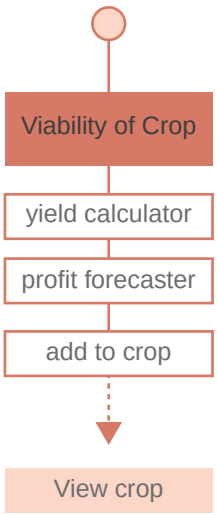
(Bottom) Task-flow related to finding and downloading information on a pest element



(Left) Wireframes showing the Bi-products content requirements

(Right) UI showing final design of the bi-products state

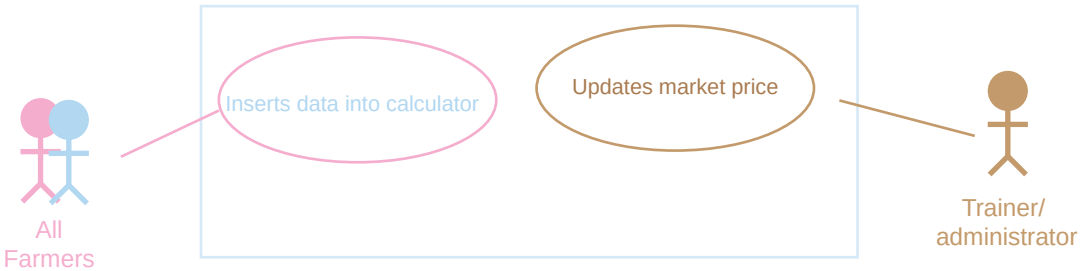
User- journey 8: Working out the profitability of a crop



Description:

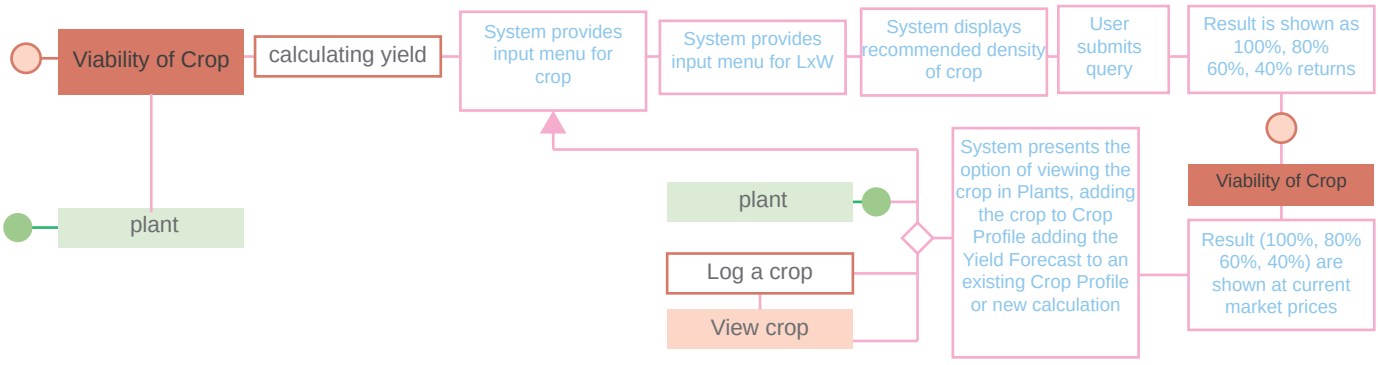
Farmer can asses the financial value of a crop in reference to yield (farm size X density of crop X success rate). Yield can then be calculated against market price to indicate likely profit.

If the crop has been 'Logged' the calculation can be added to the 'My Farm' 'View Crops' profile.



Use case diagram

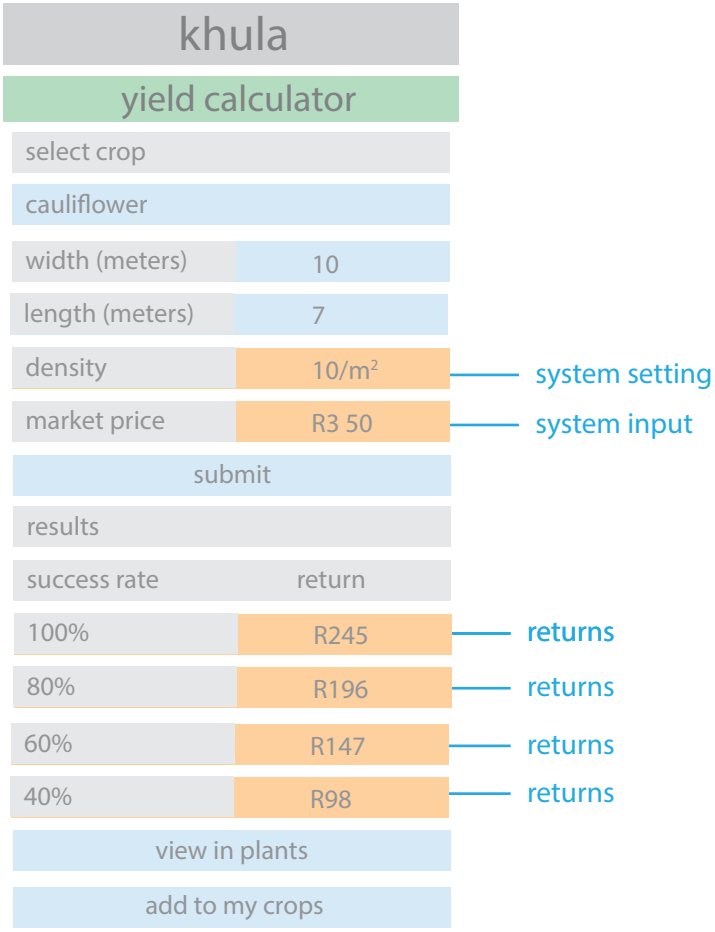
User journey 8: Task- Flow A: Calculating the financial viability of a crops yield



(Top) User-journey 8

(Middle) Use case diagram depicting the input and output of information in the journey

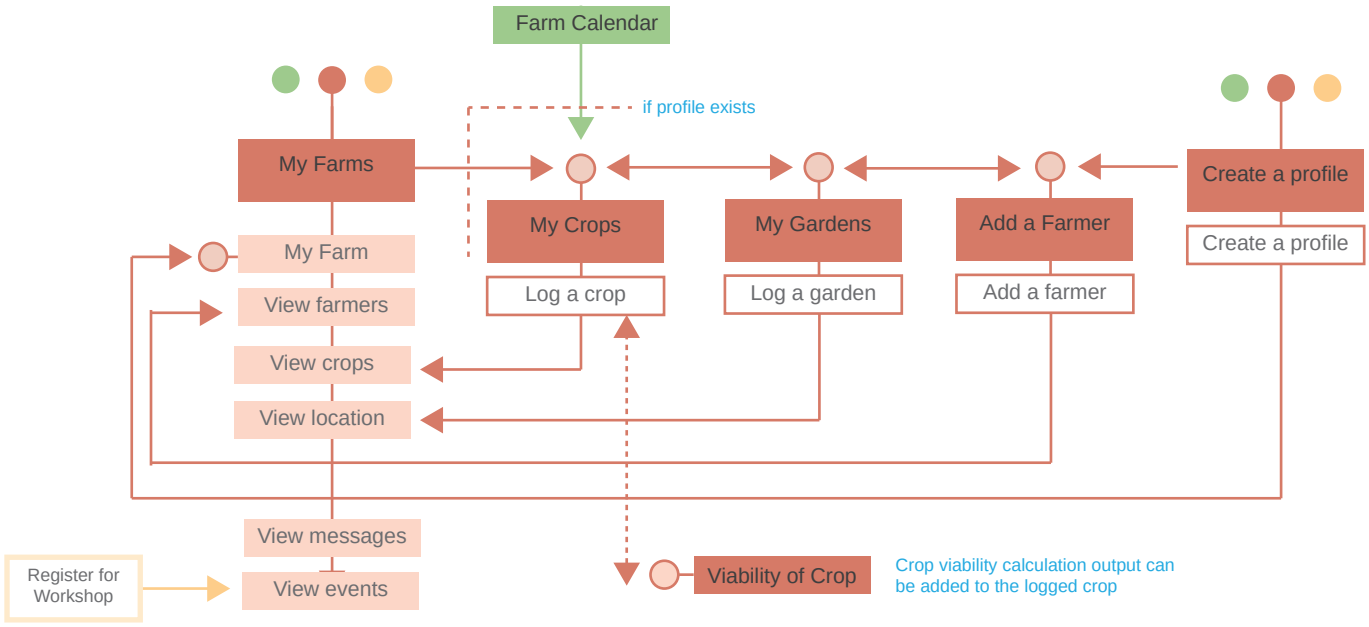
(Bottom) Task-flow related to finding and downloading information on a pest element



(Left) Wireframes showing the *Yield Calculator* tool

(Right) UI showing the Yield Calculator with associate input fields

User- journeys 9: Creating a profile & 10: Viewing a profile



Description:

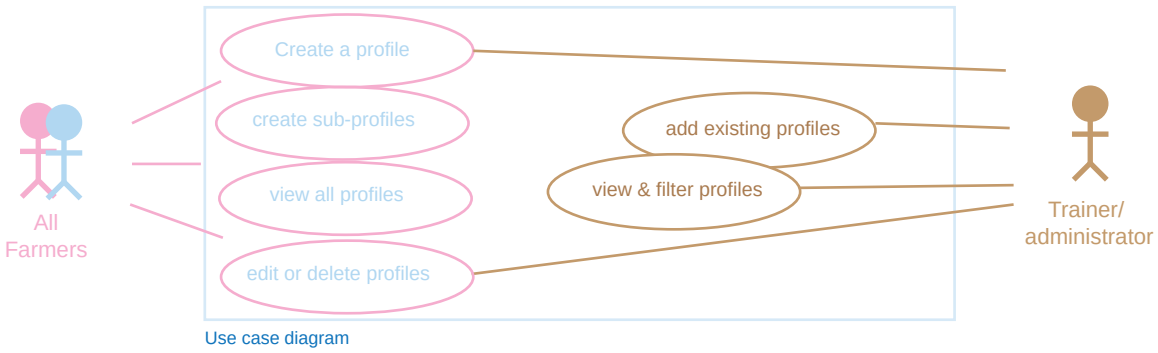
First- time users will begin by creating a personal profile.

Once a profile is created, users can add a farmer, farm and crop to the profile at any time from the 'My Farm' stage.

A crop can be 'logged' from the 'Farm Calender' function or from the "Viability of Crop' function.

The 'My Farms' function would provide a "status' update of current projects and profiles.

Trainers can filter their collective farmers crops, gardens and farmers as categories

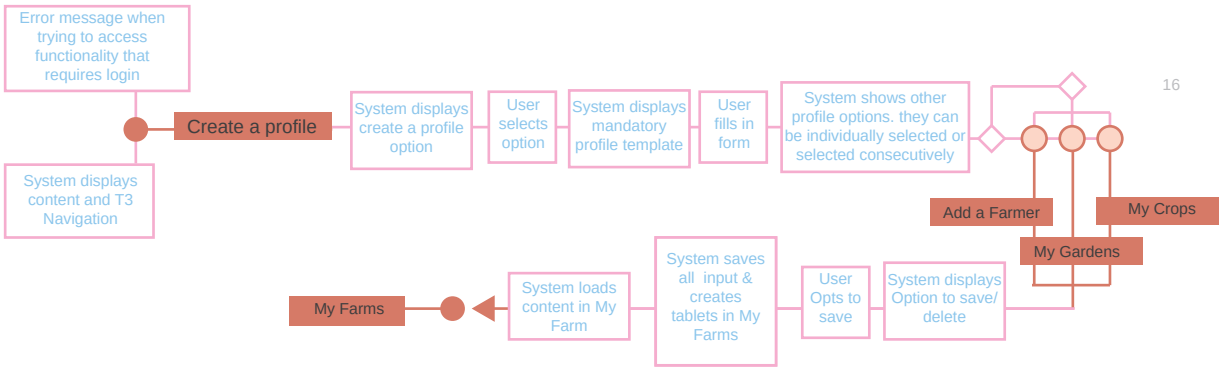


Use case diagram

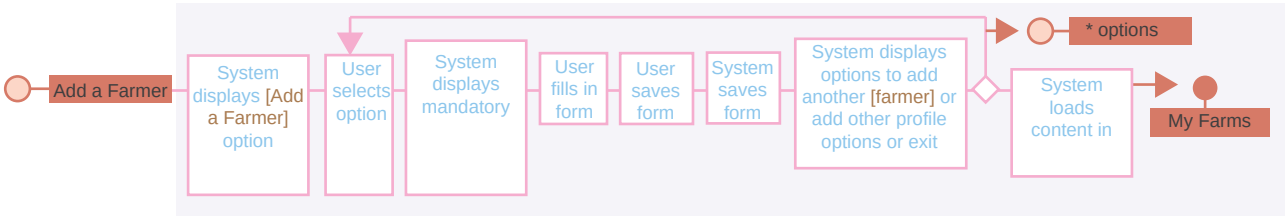
(Top) User-journeys describing both the process of creating and then viewing a profile

(Above) Used case diagram representing how the different users would create and access content

User journey 9: Task- Flow A: Creating a profile



User journey 9: Task- Flow B: Adding a Farmers sub- profile to a Profile



This task can be used to create any group of farmers. For example can be used for a group of farmers working on one farm or for a

Pattern adding sub- profiles | sub_profile | Variables = [1 = Add a Farmer, 2 = farmer]

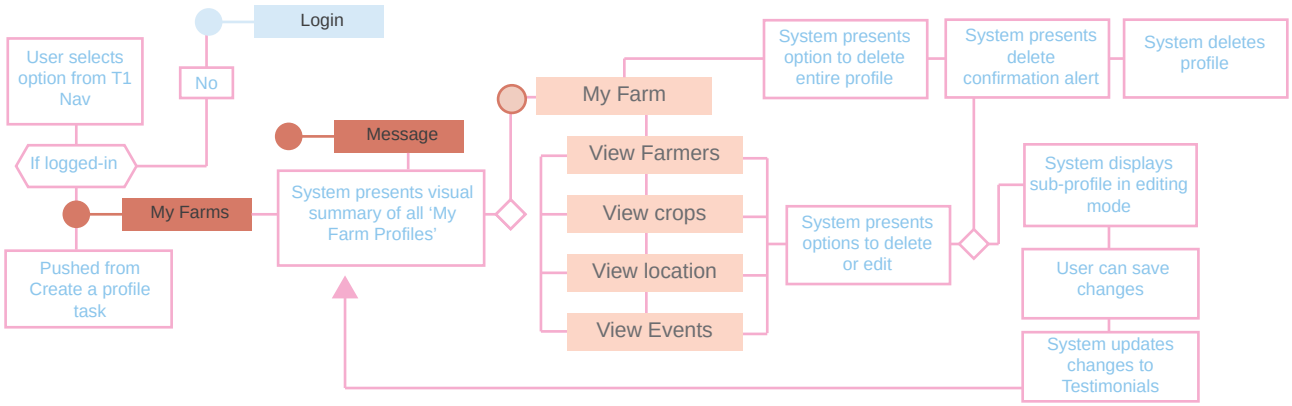
User journey 9: Task- Flow C: Adding a Garden sub- profile to a Profile

This task can be used to create any group of gardens. For example one farmer will have on or two gardens while a trainer may be responsible for many garden- farms, run by different farmers

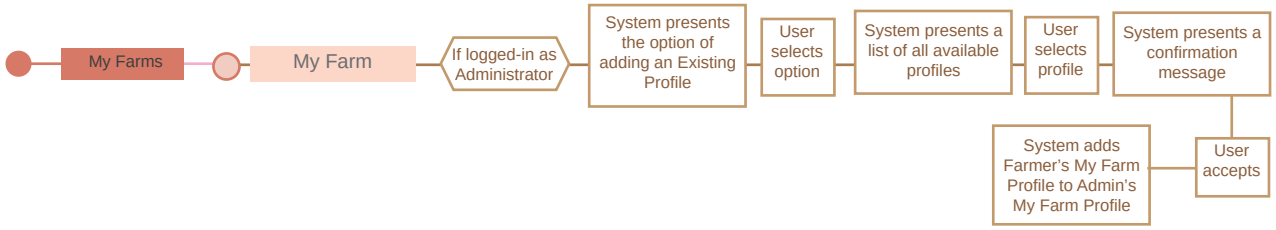
User journey 9: Task- Flow C: Adding a Garden sub- profile to a Profile

This task can be used to create any number of crops.

User journey 10: Task- Flow D: Viewing profiles, sub-profiles and messages

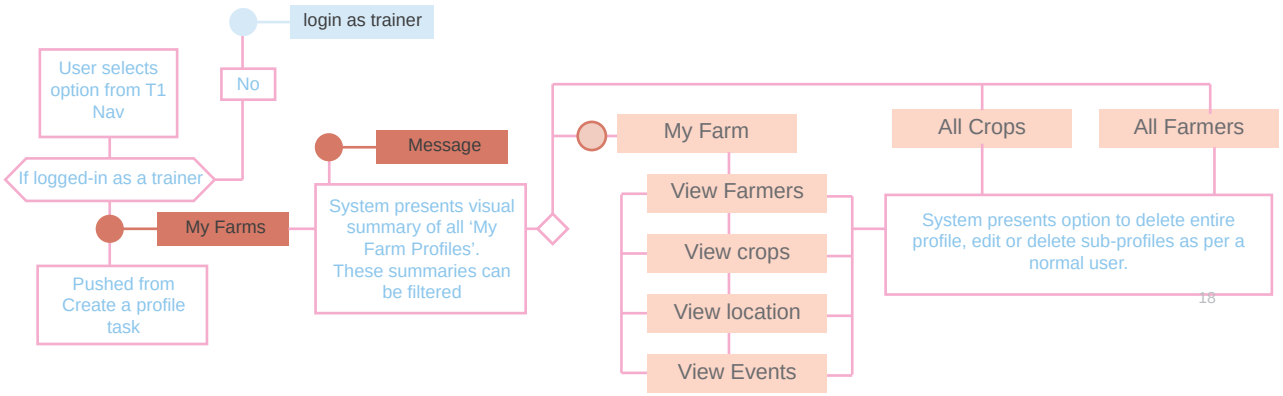


User journey 9: Task- Flow E: Administrator adding farmers profiles to their own Profile

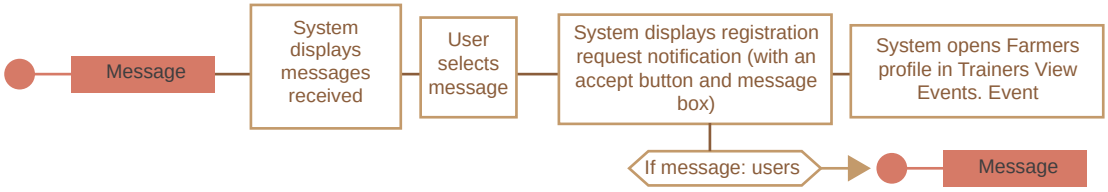


The purpose of this task is allow trainers to consolidate farmers' profiles, who they work with, in their Profile in order to monitor activities. The 'My Farm' heading is incidental and can be changed when an instance is created.

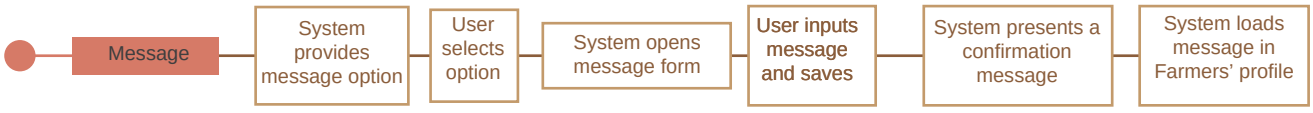
User journey 9: Task- Flow F: Trainers viewing options in the Profile stage.



User journey 9: Task- Flow G: Trainer confirms event registration requests

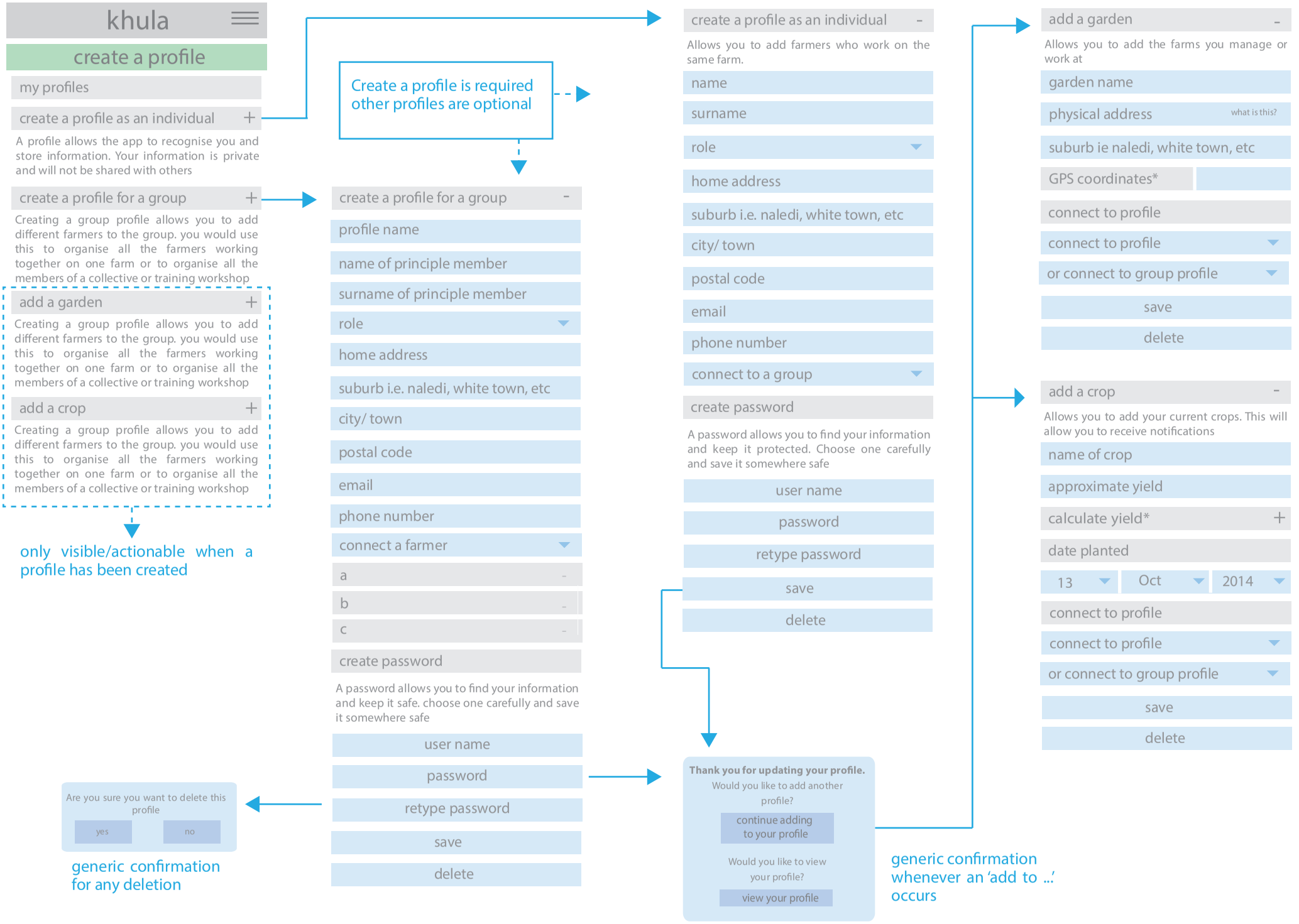


User journey 9: Task- Flow G: Trainer writes and post message for farmers



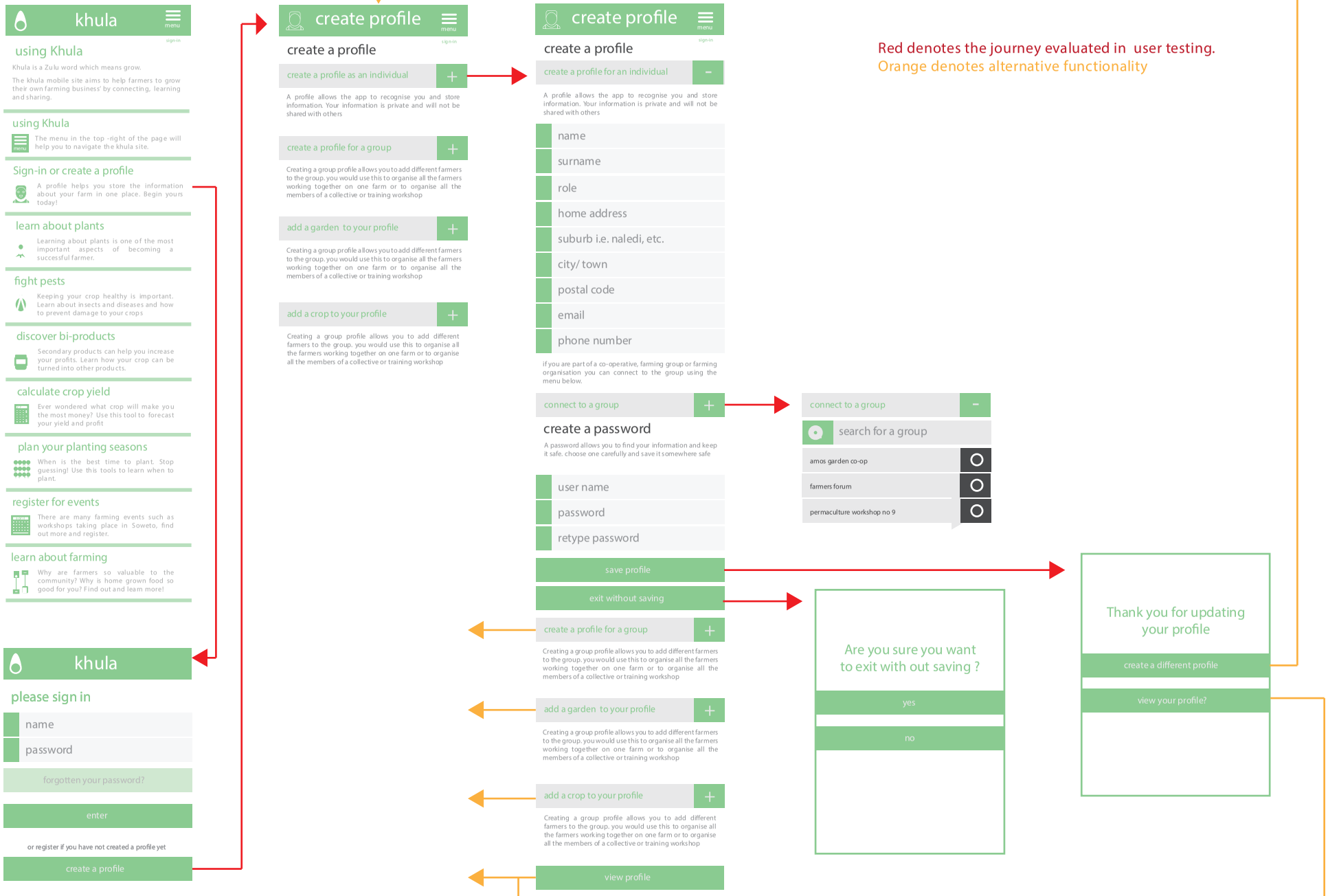
(Current and previous page) The task- flow diagrams describing the various sub-goals included in the various journeys

(Following page) Wireframe diagrams showing the various types of profiles that can be created

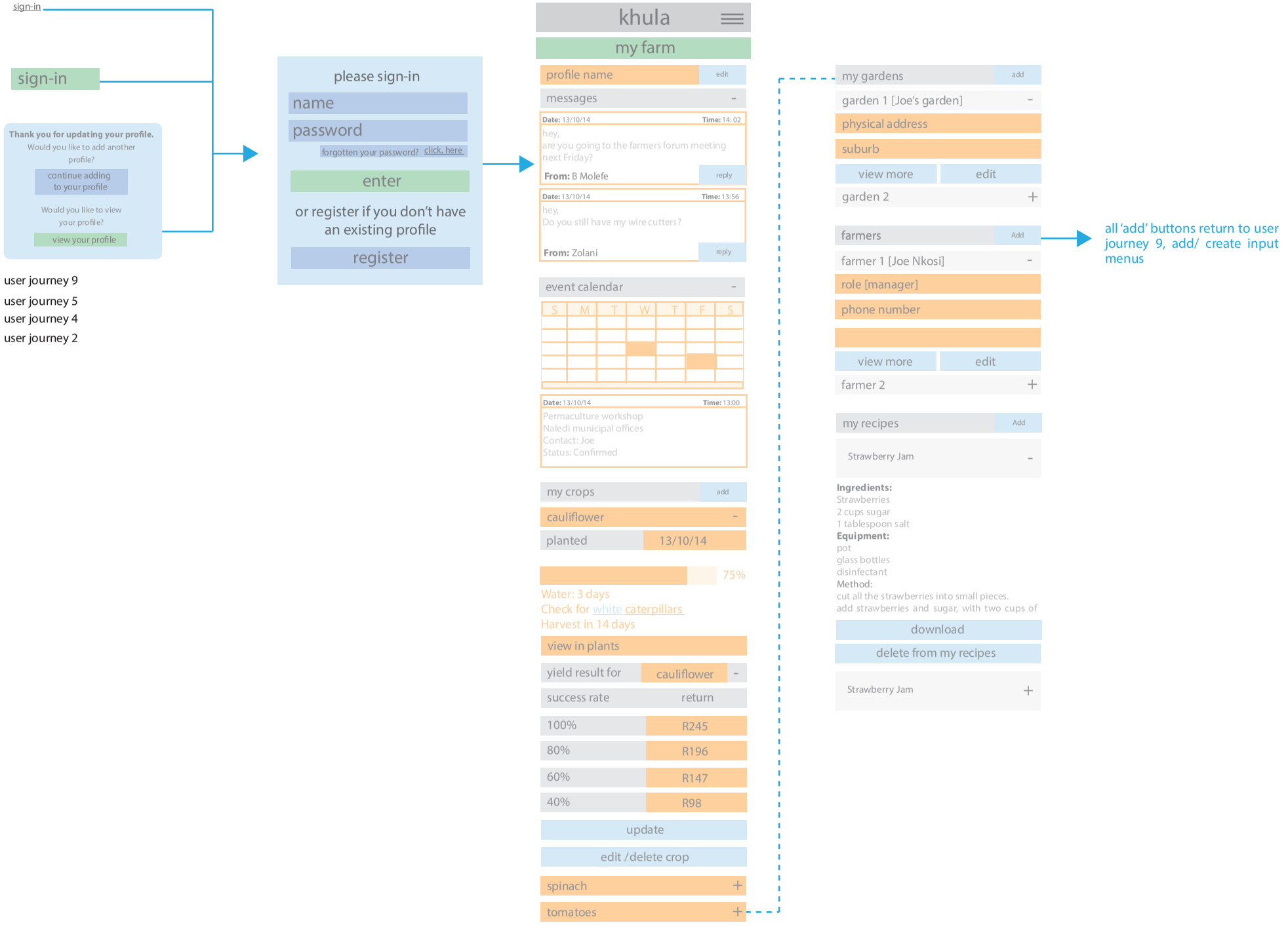

khula
create a profile
my profiles
create a profile as an individual +
A profile allows the app to recognise you and store information. Your information is private and will not be shared with others
create a profile for a group +
Creating a group profile allows you to add different farmers to the group. you would use this to organise all the farmers working together on one farm or to organise all the members of a collective or training workshop
add a garden +
Creating a group profile allows you to add different farmers to the group. you would use this to organise all the farmers working together on one farm or to organise all the members of a collective or training workshop
add a crop +
Creating a group profile allows you to add different farmers to the group. you would use this to organise all the farmers working together on one farm or to organise all the members of a collective or training workshop
only visible/actionable when a profile has been created
Create a profile is required other profiles are optional
create a profile for a group -
profile name
name of principle member
surname of principle member
role
home address
suburb i.e. naledi, white town, etc
city/ town
postal code
email
phone number
connect a farmer
a -
b -
c -
create password
A password allows you to find your information and keep it safe. choose one carefully and save it somewhere safe
user name
password
retype password
save
delete
Are you sure you want to delete this profile
yes
no
generic confirmation for any deletion
create a profile as an individual -
Allows you to add farmers who work on the same farm.
name
surname
role
home address
suburb i.e. naledi, white town, etc
city/ town
postal code
email
phone number
connect to a group
create password
A password allows you to find your information and keep it protected. Choose one carefully and save it somewhere safe
user name
password
retype password
save
delete
Thank you for updating your profile.
Would you like to add another profile?
continue adding to your profile
Would you like to view your profile?
view your profile
generic confirmation whenever an 'add to ...' occurs
add a garden -
Allows you to add the farms you manage or work at
garden name
physical address
what is this?
suburb ie naledi, white town, etc
GPS coordinates*
connect to profile
connect to profile
or connect to group profile
save
delete
add a crop -
Allows you to add your current crops. This will allow you to receive notifications
name of crop
approximate yield
calculate yield* +
date planted
13
Oct
2014
connect to profile
connect to profile
or connect to group profile
save
delete

User-testing scenario: 1- creating an individual profile for yourself and 2- connecting to the farmers forum group

UIs of journey 9, showing the scenario of a user creating an individual profile.

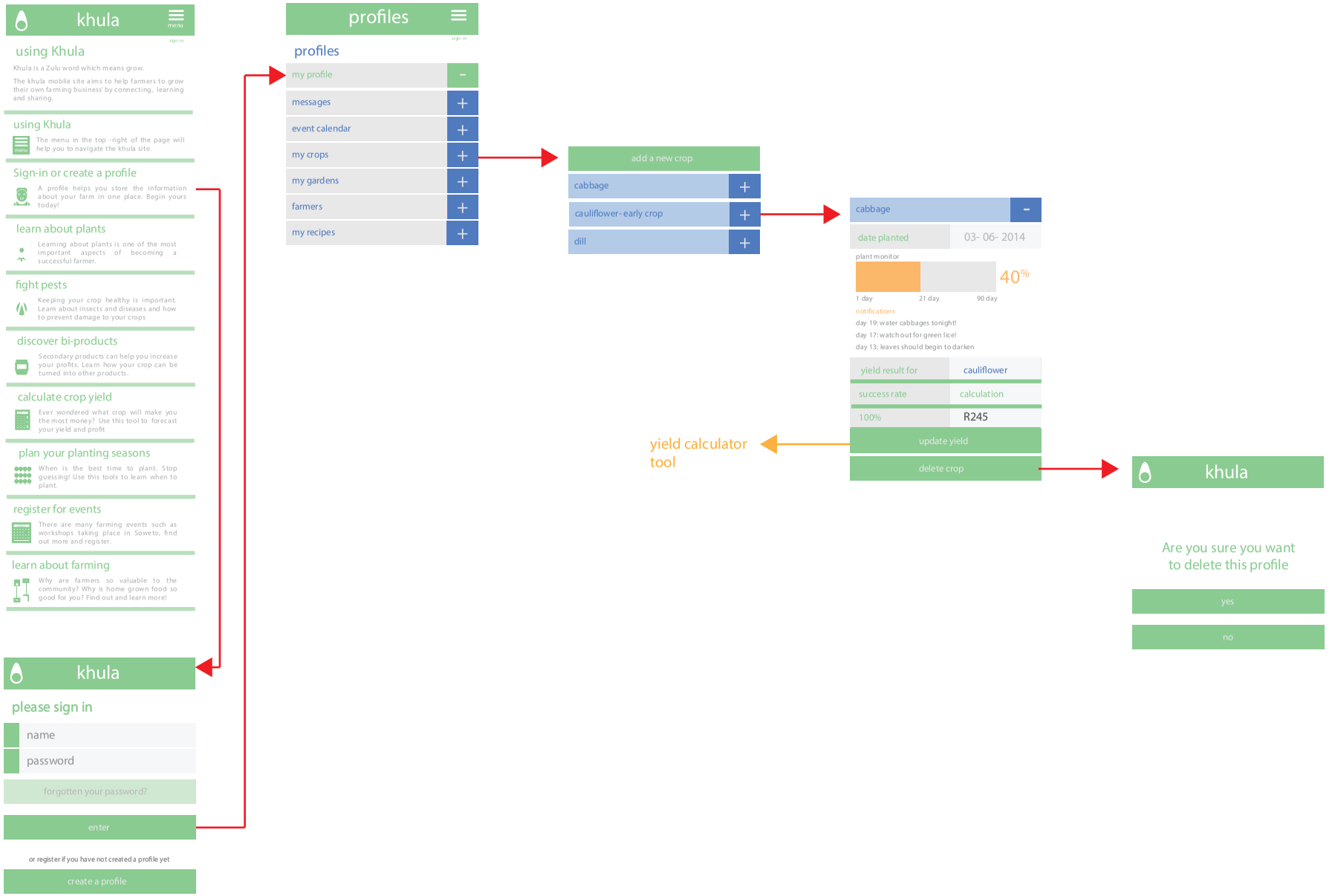


Wireframes describing the viewing of a user's profile, user-journey 10



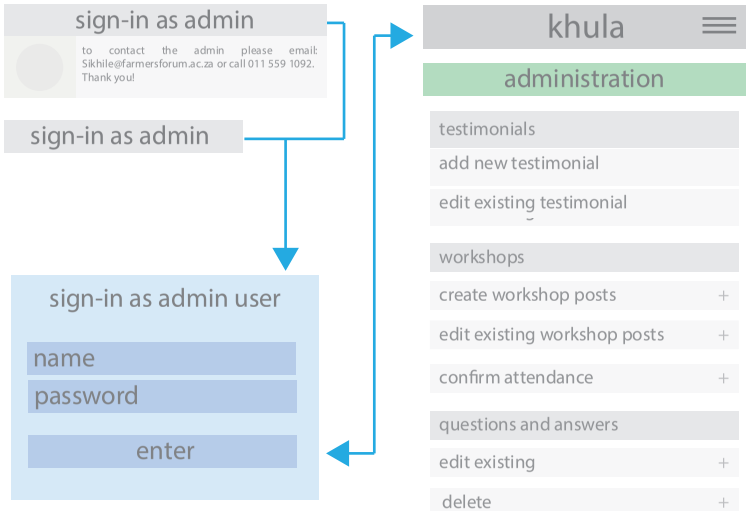
UIs of journey 10, showing the scenario of a user viewing a particular aspect of a crop within a loaded profile content element

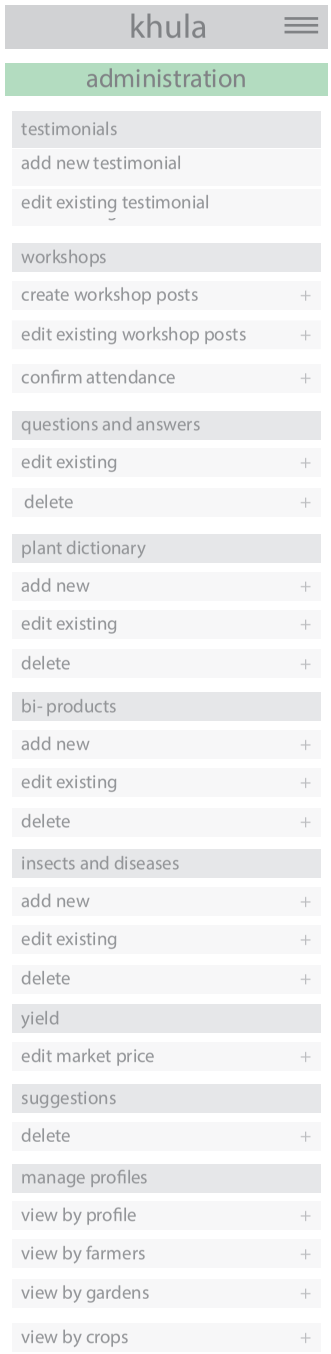
User-testing scenario: 1- finding out how long your cauliflower crop has been growing for and 2- then deleting the cauliflower profile.



Red denotes the journey evaluated in user testing. Orange denotes alternative functionality

user- journey 11

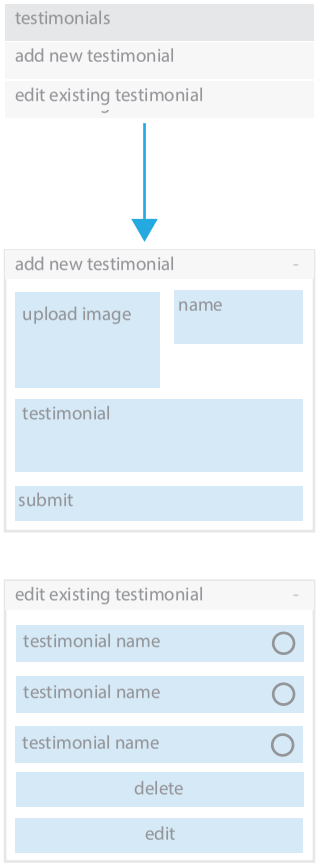




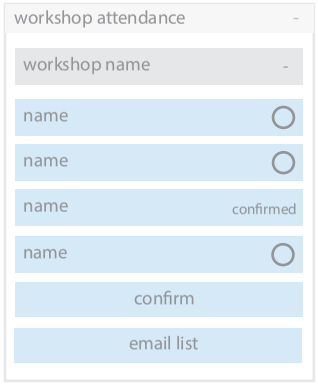
Description:

The wireframes on this page and the following pages describe the administrative functionality of the Khula App. These journeys primarily allow for the creation, updating and editing of content and content elements

user- journey 11a

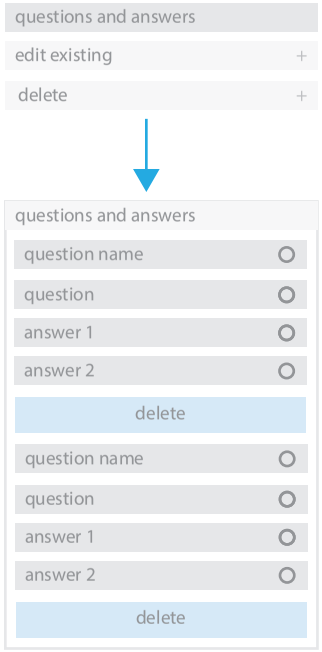


user- journey 11b



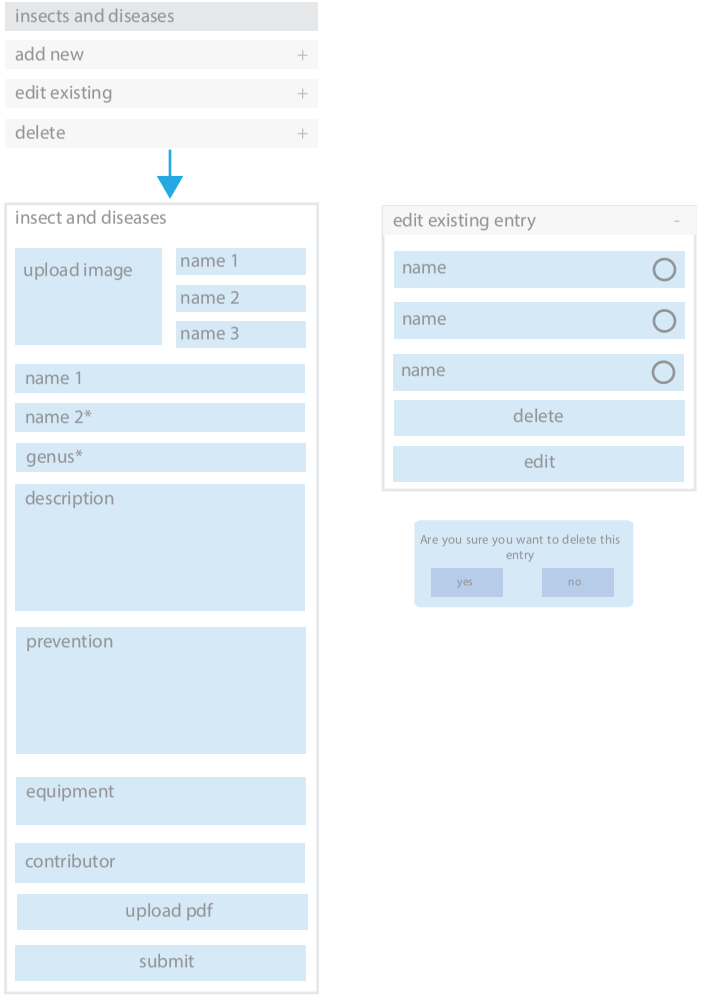
User- journeys 11: Administrator login and control

user- journey 11c

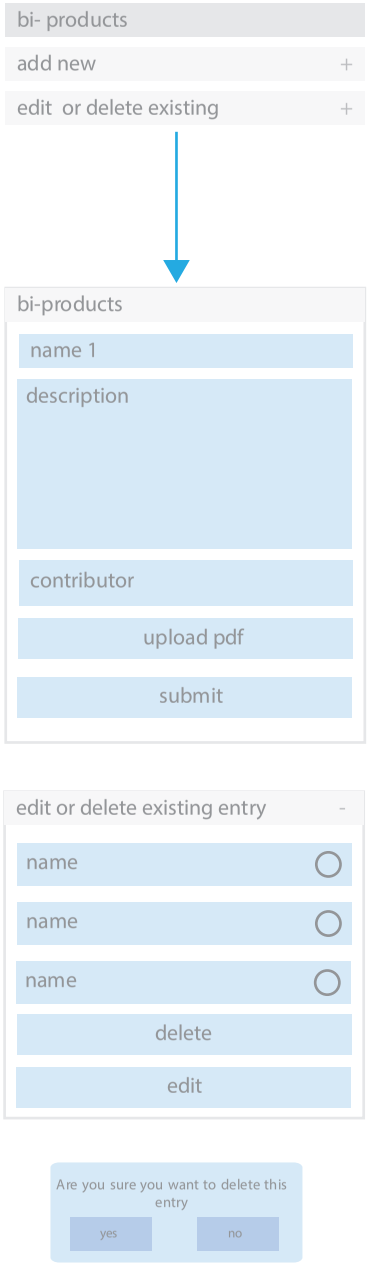


user- journey 11d

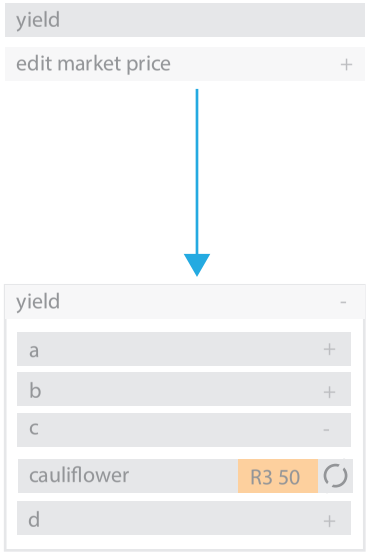
user- journey 11e



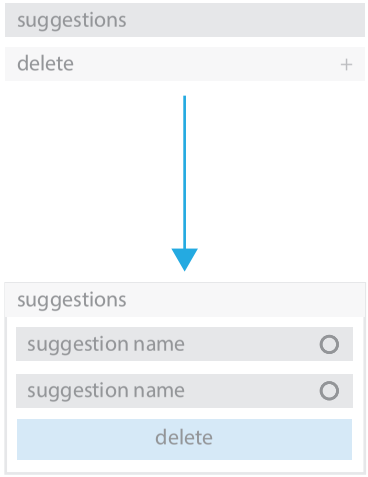
user- journey 11f



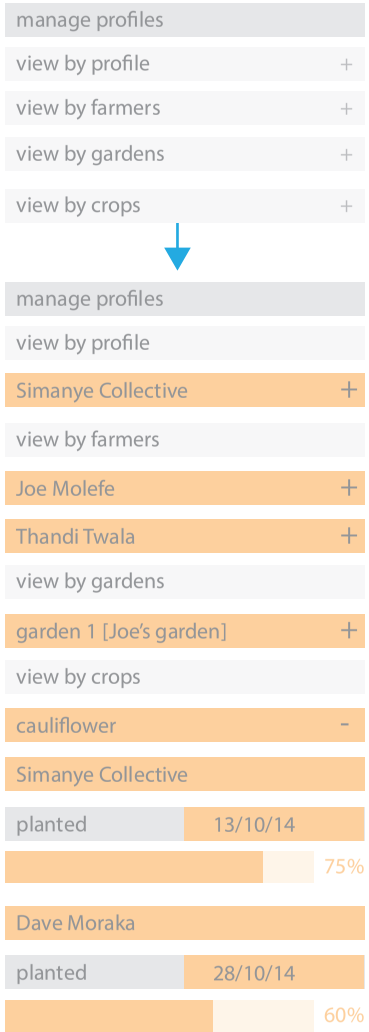
user- journey 11g



user- journey 11h



user- journey 11i

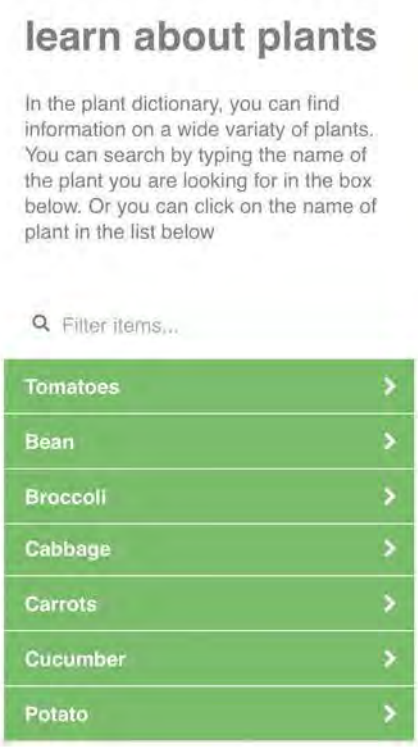


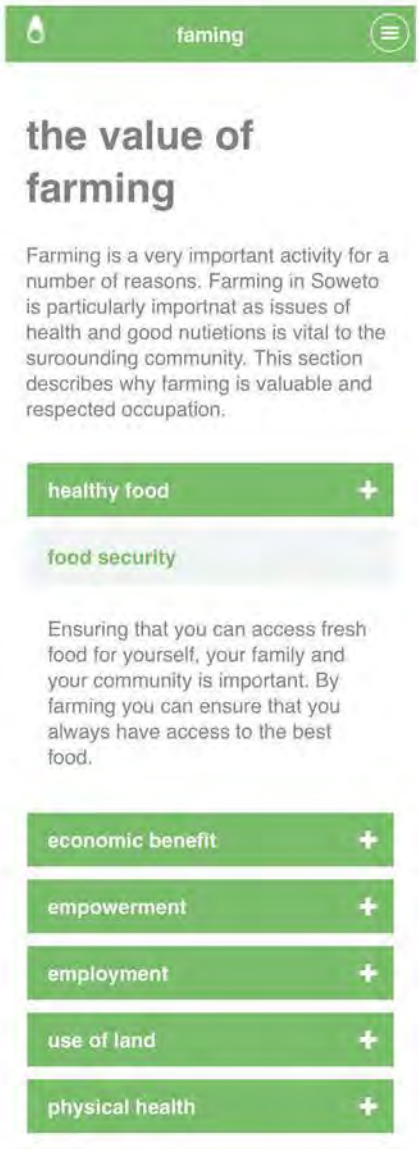
Appendix: Section 3, final interface.

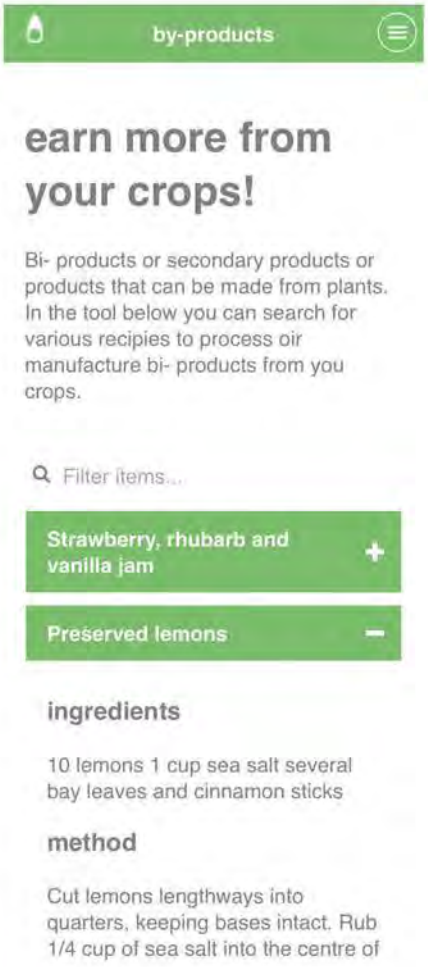
Description:

Page 39-40, show a variety of the interfaces from the digital protoype. Page 39, displays the main navigation of the home page as well as two stages of the 'learn about plants' feature.

The blue concertina navigation/menu of the interface (below, left) denotes the 3rd tier of navigation and is colour coded in terms of the relevant category.







Description:

From left to right: The secondary landing pages for the features of 'the value of farming', 'by-products' and 'pest control'