BCs Creative Technology
Graduation Project

From Field to Yield: A Regenerative Journey

By: Madeleine Lilli Diana Leertouwer

Supervisors: Erik Faber and Kasia Zalewska
Client: Foodvalley

08/07/2025

Faculty of Electrical Engineering,
Mathematics and Computer Science,
University of Twente

UNIVERSITY OF TWENTE.

Abstract

Agriculture in its current form affects the environment to a detrimental degree, contributing to biodiversity loss, greenhouse gas emissions, and soil degradation. Soil can be the key to addressing this issue. Regenerative Agriculture (RA) is an approach to farming that takes soil conservation at its core, utilizing natural processes to restore ecosystems. Its adoption, however, remains challenging due to knowledge barriers, economic concerns, and stakeholder resistance to change. A gap for an RA supply tool was identified.

In collaboration with Foodvalley, an independent organization aimed at bettering the food system, the client for this project, this thesis aimed to develop an interactive communication tool on a RA supply chain in Gelderland that could encourage knowledge-sharing, as well as aid in making better-informed decisions towards RA among supply chain stakeholders. This being the main research question for this paper.

The resulting product was an interactive animation on the journey of a real-world regenerative supply chain, from seed supplier to consumer. It combined hand-drawn visuals, narration, interaction, and educational elements. The tool was designed using the Creative Technology Design Process: ideating, specifying, realizing, and evaluating.

Evaluations showed that the tool was able to successfully educate on RA methods in practice, piquing curiosity and being recognized as a conversation starter for stakeholders. Not all supply chain stakeholder perspectives were able to be implemented, some being prioritized over others, an area that future work could work on. However, the animation still managed to take complex concepts, utilizing interaction together with visuals, and convey them engagingly and understandably, enticing the transition to RA.

Acknowledgment

This project would not have been possible without Foodvalley's call for a project designed to raise awareness of a necessary shift from conventional to regenerative agriculture within a food supply chain. Special thanks go to Foodvalley's contact person, Ileen Wilke, for your open communication and willingness to aid along every step of the way. I am extremely grateful for the guidance received from my supervisors, Erik Faber and Kasia Zalewska-Kurek; your encouragement and dedicated involvement made the entire process manageable, building up my confidence. I also wish to thank my graduation project partner, Jakub Stachurski, for always being open to help in whichever way you could. A heartfelt thank you goes out to my friends, the girlfriends, for your unwavering support, infectious humor, and overall presence. A special mention goes out to my uncle for being the only supply chain stakeholder who was willing to provide their contact information, for not even doubting a successful outcome to this project. Lastly, I would like to thank the rest of my family for continuously believing in me and my abilities; your support was able to bring this project to its final phase. I could not have done it without you all.

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Chapter 1 - Introduction

1.1 Problem Statement

Agriculture has a significant impact on the planet [1]. It affects the world's well-being through numerous variables, including deforestation, biodiversity loss, water and air pollution, soil degradation, disease emergence, and global warming [2]. Agriculture accounts for an estimated 10.8% of the total CO_2 equivalent emissions in 2022 within Europe [3]. Agriculture is a large contributor to the emissions that, when tackled, can improve the planet's state in many aspects. This can be seen with the United Nations Sustainable Development Goals (SDGs), which are a call to action to positively transform our world which all countries within the United Nations should strive for [4]. Diogo et al. [5] state that by improving the sustainability of agriculture, 12 out of 17 SDGs will be met, positively impacting the environment. Europe is trying to take initiatives in this direction. The European Commission composed a plan of action with regard to agriculture, called the European Green Deal. Within this document, a strategy for sustainable farming has been specified, the Farm to Fork strategy. All countries within the European Union must abide by this. This specific strategy focuses on shifting toward a sustainable food industry through the means of pesticide, antimicrobial, and fertilizer reduction, improved animal welfare, reverse biodiversity loss, and organic farming. [6] These practices are known as regenerative agriculture.[1]

There has been an up-and-coming interest in the shift to sustainable farming, however, there has not been a consensus on how to define regenerative farming. According to Newton's [7] findings, there are still various internal variations between definitions, specifically whether a definition is outcome- or process-based. In this project, the definition of the client, Foodvalley, will be utilized, stating that regenerative agriculture is an approach to making farming more sustainable through the use of natural processes, improving agricultural land, in this case, primarily focusing on enhancing biodiversity, soil health, and ecosystem resilience. [8][2]

The client for this project, Foodvalley [8], is an independent organization, whose mission is that "In 2050 the food system needs to offer food security to 10 billion people worldwide. Tasty, affordable, healthy, and sustainable food, produced with respect for animals and our planet." They have taken various steps towards this objective, such as their Regenerative Innovation Portfolio, a project that, at its core, encourages and motivates the adoption of regenerative agriculture within supply chain stakeholders. Additionally, it drives stakeholders to work together within the field of regenerative agriculture. According to the client, partnership across the cross-value chain is crucial in effectively shifting to sustainable farming methods. [8] In collaboration with Foodvalley, this project will delve deeper into guiding stakeholders to adopt a regenerative food supply chain cooperatively.[3]

Due to the novelty of regenerative agriculture, projects regarding the adoption of this approach have not yet been thoroughly investigated, this has to become more accessible [2]. The goal of this research is to create a communication tool for the entire regenerative agriculture food supply chain that can steer and educate the stakeholders within their decision-making process, encouraging collaboration between parties on sustainable farming. From start to finish, from seed supplier to consumers, the full journey of the

[1] GP description
[2] GP description
[3] GP description

products will be conveyed. The chain will involve a multitude of stakeholders, each with different priorities, and coordinating these will be complex. A platform such as this can gather insights and possible improvements that can bring up the gaps in awareness within the chain, identify hidden issues, provide transparency to all stakeholders, and ultimately, with this additional information, encourage them to collaborate.[4]

1.2 Research Question

To be able to accomplish the goal of this project, a main research question had to be formulated and, in turn, various relevant subquestions. The main research question (RQ) is formulated as follows:

How can an interactive communication tool concerning the food supply chain on regenerative agriculture in Gelderland be created to encourage knowledge-sharing and better-informed decision-making on regenerative agricultural practices between stakeholders?

In order to be able to answer the main research question, several aspects must be investigated firsthand. First of all, it must be clear which stakeholders and their internal connections are involved in this supply chain, as it will lead to a more holistic view of the chain. Secondly, the acquisition of data will be investigated to be able to use effective data for the tool. Lastly, it is essential that the tool successfully nudges parties into adopting regenerative agriculture. Therefore, its accompanying sub-questions are formulated as follows:

1. *What key parties and underlying relationships are involved in a sustainable food supply chain?* (Section 2.2)

2. *How to effectively use a visualization to support the transition to regenerative agriculture?* (Section 2.3 and Section 2.4)

When conducting background research, these questions will be answered.

1.3 Outline

Chapter 2 will conduct the background research, where all sub-questions will be answered. This chapter will first gain an understanding of RA as well as the food supply chain, before moving on to the need for a project within this context, proceeding towards the state-of-the-art. The first sub-question will be addressed in Section 2.2, while the second one will be answered in two separate sections, 2.3 and 2.4. The following chapter, Chapter 3 will outline the design process, its iterative process as well as the methods and techniques used within these stages. Chapter 4, describes the ideation process, followed by Chapter 5: Specification, where the concept is translated into concrete steps to be taken in order to develop the tool. Chapter 6, the realization will detail how the project was designed and implemented. Chapter 7 will focus on evaluating the realized project. The last three chapters, 8 conclusion, 9 discussion, and 10 future work, will wrap up the project, answering the main research question, discussing the process and results, as well as elaborating on alterations and additions for future work.

[4] GP description

Chapter 2 - Background research

Research must first be conducted before creating a communication tool that is designed for the regenerative agriculture supply chain stakeholders to encourage them to take up regenerative agriculture (RA). Additional research will lead to a strong foundation and holistic view regarding regenerative agriculture and European supply chains. Based on this supplementary information, the communication tool can be effectively created. This background research will first thoroughly examine the concept of regenerative agriculture, what it is, its necessity, challenges, and adoption. Next, the client-provided supply chain will be investigated. Followed by an examination of the need for a tool on the supply chain. After that, state-of-the-art knowledge-sharing tools, preferably within the novel field of agriculture [2], will be explored. Finally, all will be discussed in hopes of having this newfound knowledge applied to the project at a later stage.

2.1 Regenerative Agriculture: Understanding, Implementation, and Obstacles

Before developing a tool for the food supply chain, it is crucial to first understand the overarching concept. To achieve this, the concept and context surrounding RA will be defined. Followed by the adaptation of RA, its corresponding techniques, and lastly, presenting an analysis of the barriers.

2.1.1 Regenerative agriculture defined

Regenerative agriculture is a broad term in itself, varying widely across definitions. What all authors seem to agree on, according to [7], [9], [10], [11], [12], [13], [14] and [15] is that the main aspect of RA is the restoration and conservation of soil achieved through natural processes. All seem to be aware of the fact that RA includes many practices and approaches within soil conservation that, in the end, improve the health of the farming system. Despite this consensus, RA's interpretations begin to diverge. White [9] states that RA additionally enhances ecological and economic resilience, conserves watersheds, and promotes biodiversity. While Rhodes [11] agrees on these improvements, they state that the enhancement of water quality, vegetation, and land productivity are effects of its main goal of improved soil health, and neither discusses the possible economic improvements. Khangura et al. [13], however, mention the potential economic, social, and environmental improvements that come with rejuvenating the land. LaCanne and Lundgren [14] further build upon its economics, stating that while the goal of RA systems is being reached, its farm products will be produced profitably. Giller et al. [12] argue that another effect of RA is the capture of carbon, which tries to tackle climate change. Lal [15] further implies that soil health is managed through the sequestration of carbon, yet [7], [9], [11], and [12] see it as an effect of the methods of regenerative agriculture. Furthermore, Giller et al. [12] and LaCanne and Lundgren [14] state that the second most important aspect of RA is its aid in the reversal of biodiversity loss, contrasting White [9] and Khangura [13], as they see it as one of many benefits.[5]

Researchers have attempted to establish a definition for regenerative agriculture. Schreefsel et al. [10] are among those researchers who tried to figure out a scientific definition for the term RA. During the research, it was noted that opinions are divided, and there is no distinct measure for the term. Their findings are based on sifting through numerous articles that involved RA; from this, dealing with environmental issues was common in every article, which comes as no surprise, seeing as that is RA's end

[5] Academic writing

goal. Furthermore, improving soil health received a generous amount of attention in all articles. Interestingly, the second most mentioned aspect was optimizing resource management, which, based on the findings of this research, was not prevalent. Improving carbon soil was just as common as resource management in about half of the researched articles. Carbon soil represents the carbon stored within the organic matter in the soil, this capture in the soil can help mitigate climate change, as well as enhance soil fertility. [16] Other than that, numerous topics, including climate change, water quality, and availability, were observed. Schreefsel et al. [10] concluded that the understanding of RA is not uniform, yet methods and objectives are brought together to define regenerative agriculture, which is similar to the research above; there seems to be no overarching definition. Newton et al. [7] conducted similar research on the lack of a regulatory definition of the term, yet their findings were that there was a distinct difference between outcome and process-based definitions of regenerative agriculture. They advocate for defining the term clearly before delving any deeper. On the other hand, Schreefsel et al. provide a provisional definition "an approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting ecosystem services, with the objective that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production." [6, p. 5]. This definition seems quite adept at illustrating the complexity of RA and will, therefore, be the reference point of this project regarding RA, as it seems to support the client's definition which claims that RA is a method that improves agricultural land by utilizing natural processes that focus on improving biodiversity, soil health, and ecosystem resilience. [7][6]

To sum up, there are many principles within regenerative agriculture. The authors seem to be divided on the approach and its effect. However, what all seem to agree upon is that regenerative agriculture is a method that improves sustainability in farming through the use of soil conservation with natural processes. RA's other effects vary from paper to paper since it seems to benefit numerous aspects, to name the most prevalent ones: the capture of carbon, the reversal of biodiversity loss, economic resilience, and improved water quality. Within this project, a revised definition of RA will be held true; RA is an agricultural method that, at its core, utilizes soil conservation to sustain and regulate ecosystem services, mainly enhancing environmental dimensions, with additional economic and social proportions of sustainable food production.[7]

2.1.2 Regenerative Agriculture Adoption

Various practices fall under the regenerative agriculture category, ranging from conventional to uncommon [12]. According to Rhodes [11], RA techniques typically link to organic agriculture. This is another farming method that has varying definitions, yet its main stance contains farming without chemicals involved, instead using natural substances [17]. Rhodes [11] states that the most successful practices would be to avoid artificial pesticides, herbicides, and fertilizers completely. Giller et al. [12], on the other hand, do not even mention the avoidance of artificial chemicals as an RA technique, instead, they consider minimized tillage, the retention of crop residue, and the constant covering of the soil with plants such as grasses, enhancing soil health [18].[8]

[6] Academic writing
[7] Academic writing
[8] Academic writing

Several researchers outline step-by-step approaches that will lead to regenerative farming. Brown (as cited in [9]) mentions several steps to the RA transition. They start by stating that the first step is to quit using synthetic chemicals altogether, as these chemicals simultaneously kill all beneficial organisms, fungi, soil microbes, and insects. The second step would be to stop using the plow since tilling harms the life present within the soil due to this disturbance each spring. The following step is to make sure that all soil is never bare, meaning the use of, for example, cover crops for instance broadleaves [18]. This will mimic nature as intended, keeping the biology underground boosted. The next step follows, along with impersonating nature, keeping a variety of crops, essentially creating a polyculture, the process of diversifying crops within the field [19]. The next step White [9] mentions is the avoidance of artificial fertilizer, and then lastly, a very drastic step, yet again in line with impersonating nature, is to integrate livestock within a field. This additionally solves the problem of no artificial fertilizer, as now natural fertilizer is present within the soil, and limits the number of overrun plants due to livestock grazing. Another paper that suggests a plan of action is LaCanne and Lundgren [14]; they, however, only have 4 actions, in no particular order: the abandonment of tillage, the avoidance of bare soil, crop diversity, and combining livestock on the land. This lines up fully with the practices White [9] notes, though lacking any mention of synthetic chemicals and artificial fertilizer. That being said, those were the main practices Rhodes [11] indicated to be primarily considered RA.[9]

To clarify RA's ambiguous nature, an overview of RA practices with their corresponding agronomic principles is discussed. Giller et al. [12], fortunately, have taken it upon themselves to create a list of RA practices that coincide with agronomic principles, displayed in Table 1. Its effectiveness was ranked on a scale from 1-3 stars, with three being very successful and one being mildly effective, based on two concepts: the restoration of soil health and the reversal of biodiversity loss.[10]

Principles	Practices	Restoration of soil health	Reversal of biodiversity loss
Minimize tillage	Zero-till, reduced tillage, conservation agriculture, controlled traffic	***	–
Maintain soil cover	Mulch, cover crops, permaculture	***	*
Build soil C	Biochar, compost, green manures, animal manures	***	–
Sequester carbon	Agroforestry, silvopasture, tree crops	***	**
Relying more on biological nutrient cycles	Animal manures, compost, compost tea, green manures and cover crops, maintain living roots in soil, inoculation of soils and composts, reduce reliance on mineral fertilizers, organic agriculture, permaculture	***	–
Foster plant diversity	Diverse crop rotations, multi-species cover crops, agroforestry	**	***
Integrate livestock	Rotational grazing, holistic [Savory] grazing, pasture cropping, silvopasture	**	?
Avoid pesticides	Diverse crop rotations, multi-species cover crops, agroforestry	*	***
Encouraging water percolation	Biochar, compost, green manures, animal manures, holistic [Savory] grazing	***	–

Based on McGuire (2018), Burgess et al. (2019) and Merfield (2019).

Table 1: *Agronomic principles and practices considered to be part of Regenerative Agriculture and their potential impacts on restoration of soil health and reversal of biodiversity loss [12]*

Comparing this table to the other papers, it can be said that the adoptions mentioned by [9], [11], and [14] are not considered practices of RA but, instead, the overarching principles. Giller et al. [12] delve further

[9] Academic writing
[10] Academic writing

into what can be done to the mentioned principles; however, some speak for themselves, such as minimizing tillage and avoiding pesticides. All of the previously discussed techniques in [9], [11], and [14] are listed in Table 1, which states additional unaddressed methods, those would be: encourage water percolation, rely more on biological nutrient cycles, build soil C, and sequester carbon. To clarify exactly what the differences between the highly comparable last two practices are; building soil C, refers to increasing only the carbon component of the soil, while sequester carbon means the act of removing CO_2 from the atmosphere and storing it within the soil [12].[11]

In conclusion, RA contains a wide range of methods that, in some cases, are too broad to be even be considered as practices and have to be further defined. However, there seem to be fundamental practices that are more frequently stated, these being minimizing tillage, avoiding synthetic chemicals, diversifying crops, maintaining soil coverage, and integrating livestock.[12]

2.1.3 Regenerative Agriculture Barriers

A range of general barriers hinders the seamless adoption of regenerative agricultural practices. Khangura et al. [13] state that the implementation of RA carries a lot of complications; these include cultural, social, economic, institutional, biophysical, and a lack of knowledge, evidence, and models. Chinseu et al. (as cited in [20]) support this claim, stating that social, economic, institutional, and technological complications are typical in adopting new agricultural practices. According to interviews conducted in Gosnell et al. [21], farmers themselves suffer from similar hurdles as social and economic concerns, with additional personal, ecological, and political standpoints. One of the biggest roadblocks, as said by Pannell et al. (as cited in [21]), is defying convention and going along with ‘unpopular’ agricultural practices that no doubt bear a certain controversy. However, according to Khangura et al. [13], an absence of knowledge relevant to locations, a lack of science-based evidence, and models regarding the transition to RA seem to be the leading concerns. Giller et al. [12] add to the absence of region-based knowledge, stating that agricultural challenges will vary over regions and, therefore, not all farming techniques will be equally effective. This project would be able to contribute positively to these challenges by specifically addressing these gaps.[13]

The transition to RA practices encounters several hindrances that, in most cases, surround social, institutional, and economic aspects. However, several challenges diverge from these areas. One worth noting, as it seems to be widespread, is the ignorance concerning agricultural regions, which this project can aim to actively reduce. Despite that, many sources are lacking to make it a full-fledged examination.[14]

2.2 The Food Supply Chain: Understanding and Sustainability

In order to make a tool regarding the supply chain, the concept of a supply chain as a whole must first be understood, including the inner workings and stages. From there on out, the link between sustainable practices and supply chains will be made, seeing what steps the chain can take in order to reach the same objective as RA: sustainable farming. As well as exploring the importance of this entire

[11] Academic writing
[12] Academic writing
[13] Academic writing
[14] Academic writing

project, uncovering the need for such a tool and its potential benefits with regard to promoting collaboration and visualizing a food supply chain.

2.2.1 The food supply chain

As a whole, the food supply chain consists of the entire roadmap the food takes to get to the consumer, all stages including production, storage, delivery, and retail. Bringing the food supply chain into perspective, it starts off with the production stage, which begins with farms, the production of crops, and livestock. This is followed by the selling off of their items to handlers, these handlers take care of processing and storing products. From here onwards, they ship the products to manufacturers and wholesalers, who then distribute them to supermarkets and the food service sector. Below, a conceptual model of a nonspecific food supply chain has been visualized (see Figure 1). [22]

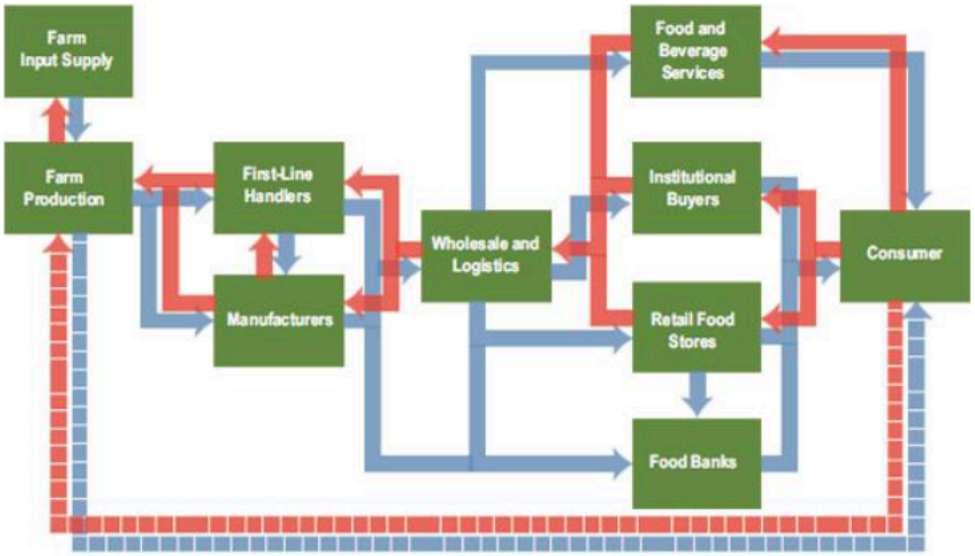


Figure 1: *A Conceptual Model of a Nonspecific Food Supply Chain [22]*

Within this figure, the first stage starts off to the left with the concerned agriculture and ends to the right with the consumers. The model even includes an often forgotten aspect, the food banks, which sit in between several stages, collecting surplus food. The blue arrows visualize the push for food and the red the pull. [22]

Goor et al. [23] have deviated opinions on the matter of defining a supply chain. The paper settles on the fact that the chain includes decision-sharing and communication between at least 2 parties. Goor et al. [23] additionally looked into a classical supply chain, this chain is even further simplified than Figure 1, as it only includes 4 stages, those being: the supplier, manufacturer, retailer, and consumer. When comparing it to Haessner et al. [22], it seems it lacks the wholesale and logistics component, immediately jumping from manufacturer to retailer, which, according to Figure 1, is possible, just not always applicable. Since it has become increasingly obvious that strong collaboration within a supply chain is needed. [23] Food Management Institute (as cited in [23]) even claims that the supply chains of 2005 were so dysfunctional that they could not possibly effectively serve the consumer. Therefore, good supply

chain management is needed to sustain a successful chain, wherein its primary goal is to integrate decisions among actors in a chain. A manager's role changes with the application of effective supply chain management, to be active in not only a single division but also present in all stages. Actively maintaining connections with stakeholders. [23] The Center for Supply Chain Management of Nyenrode University (as cited in [23]) provides a term and definition for this situation: demand and supply chain management, which includes the coordination of a network that ideally connects all parties as one, reducing waste and crafting value. This will be the food supply chain that this project wants to represent, as it focuses on the connections in a chain.

2.2.2 Sustainability within the food supply chain

The demand for sustainable food supply chains has increased [24]. Present supply chains are generally based on industrialized production processes, which are considerably longer and less transparent [25]. The complexity of such chains is mainly due to the many actors involved in the whole process, which no doubt requires good management. Inefficient management is linked to the food waste that occurs substantially in the supply chain, for about two-thirds of the food waste is present here. Davis et al. (as cited in [22]), unfortunately, note that this means that merely one dysfunctional actor and one (unaccounted-for) problem could bring the whole chain to chaos. [22]

A possibly more sustainable alternative could be the shortening of food supply chains; short food supply chains. The term itself remains rather ambiguous; it can contain a direct link between consumers and producers, yet there can be a small number of parties working in between. Augère-Garnier (as cited in [25]) gives a formal definition regarding the European short supply chain, defining it as a supply chain that is comprised of a small number of intermediaries. These intermediaries consist of both geographical and social proximity, and keeping this to a minimum. In implementing these chains, one has to keep in mind that there must be an in-depth understanding of the context and the location of the chain for it to become as efficient as possible. The paper conducted a multitude of research methods, from fieldwork data collection to interviews, surveys, and literature findings in the European-based food supply chain. Results showed that both consumers and actors perceive an improved collaboration and, therefore, an experienced increase in the community’s strength. [25]

2.2.3 The Need for Knowledge-Sharing Tools

According to Eichler Inwood and Dale [26], a lack of knowledge sharing tools has been observed; while there are applications that deliver information, these only educate farmers about sustainable farming practices. Within agriculture, numerous stakeholders are involved. Eichler Inwood and Dale [26] state that merely the delivery of information will not be effective as parties can vary drastically from each other; therefore, a system such as this cannot support the multitude of varieties. To make this more applicable, knowledge-sharing tools between all stakeholders, not only the farmers, can be brought to life. From here on, peers can be linked to one another and trustworthy scientific information, providing a structured platform that takes a personal approach in supporting their decision-making. Vollebregt and Berghout [27] from Wageningen University and Research, which additionally specializes in agriculture, state that all stakeholders must be involved in bringing change to the food production system, since such chains are very interconnected and consist of diverse phases.

2.2.4 The Need for Visualization Tools

Vollebregt and Berghout [27] argue that bringing about a sustainable change requires insights into the development of approaches based on the food supply chain in reaching this goal. There are numerous aspects within a supply that require attention in terms of a fuller comprehension, those being investment and operation costs, product quality, capacity, food supply chain alternatives, and environmental footprint. Tools can help stakeholders in uncovering the sustainability and efficiency of a chain, whilst offering actors various steps in improving these aspects of their food supply chains.

The National Center for Supercomputing Applications of the University of Illinois [28] claims that food supply chains will benefit from being visualized. Such a complex concept should be translated into visuals instead of words, using an inviting approach, in hopes of making it actually be seen and understood by stakeholders and even policymakers. Visual tools are more accessible to the general public than academic articles when reaching such actors. Through research of their own, it was discovered that by showing users the visualization, which will be discussed in 2.4.2, their understanding of the foreign concept reached within only 10 seconds of viewing, the entire three and a half minutes of the visualization was not even necessary in comprehending the subject.

2.3 Existing Knowledge-Sharing Tools (within Agriculture)

Before creating a knowledge-sharing tool for RA, existing tools will be examined and learned from to potentially come up with a more tailored and comprehensive approach.

2.3.1 Farmer-Driven Insights and Tools

Bliss et al. [29] evaluated various tools for farming; there are numerous ways of going about it, from websites to videos. A thorough evaluation revealed a preference for videos, technical guides, and decision support tools (DST) over websites. In general, fertility and soil health were the most prevalent topics within these tools. Valuable information is gathered from inquiring farmers on various agricultural tools, a common aspect being the need for information from experienced farmers who have implemented the queried techniques. This information can be quite detailed, such as what functioned and what did not.
In fact, Bliss et al. [29] created an overview of themes that farmers who were interviewed on these tools liked and disliked (see Table 2); this list can be used as a basis for making this project's end product, seeing as it takes into account one of the most prominent stakeholders within the process, the farmers.

☺ Well-liked	☹ Less well-liked
Visual information—pictures, tables, diagrams, videos of machinery in action	Long streams of unbroken text. Lack of images that farmers can relate to
Contextual information—tailored to different regions/farm types	Generalisation of a practice without a sense of 'place'. Unreliable data
Farmer experience—case studies, tips, dos and don'ts	Theoretical concepts with lack of application in the real world
Honest account of what works and, importantly, what does not work	'Promoting' an idea and giving a one-sided account. Omitting negative results
Easy to use and to find relevant information	Time consuming and difficult to navigate
Clear, plain language/glossary for technical terms	Overly complex, technical language
Makes relevant practical observations/-recommendations	Lack of recommendations that take into consideration other elements of the farming system
Includes numbers—economics, yields, seed rates	No consideration of the impact on factors critical to farm decision making
User friendly way to interact with other farmers, researchers and advisors	Underutilised forums and difficult log in

Table 2: *Common themes in farmer feedback on knowledge exchange tools [29]*

To dive deeper into agricultural applications, Eichler Inwood and Dale [26] essentially found that a considerable number of apps are connected to specific products. Eichler Inwood et al. (as cited in [26]) claim that their impact, however, is limited to solving a single problem, most of the time, the transition to sustainability. This, however, lacks a comprehensive way of addressing the problem.

Another known knowledge-sharing tool is the Short Messaging System (SMS). Although limited to interacting only through text, it is widely accessible, cheap, and practical [8]-[11] (as cited in [30]). This specific study utilizes this technology, combining it with the practice of knowledge sharing for farmers. Galeon et al. [30] developed an SMS prototype through an interactive text platform that contained a great deal of features. This prototype included five of the six levels of SMS based services, namely communication, listen, notification, pull-based, and transaction Susanto et al. (as cited in [30]), missing the integration level, as it is a prototype. The platform would allow users to send formatted and unformatted messages with inquiries or comments to the model, who would receive an answer. Further along the line, a whole conversation was possible. The model would be able to send notifications and allow payment transactions. This prototype was evaluated by knowledge experts, a representation of the intended user, through researchers and scientists. The most notable findings were the nearly perfect agreement of the model's efficiency and ease of use, while on the other hand, risk to money, trust of the government, and compatibility weighed heavily, with around half of the users being in disagreement with the presence of these concerns. A system such as this has its ups and downs, and each side's worth must be carefully considered. However, Galeon et al. [30] additionally looked into knowledge sharing models, providing a comparison of these models listed with their advantages and disadvantages (see Table 3).
When moving to the ideation phase, these already existent models can be considered, at least as a stepping stone, to be able to gain insight from their shortcomings and benefits and grow past them.

KS Models	Advantages	Limitations
Web Portal	Stores a collection of relevant websites with easily accessible, compressive and detailed agricultural knowledge	No customization of information
Voice-Based (Phone) Service	Disseminates knowledge in a direct two-way verbal communication	Tedious and requires human involvement
Voice-Based (Radio) Service	Disseminates knowledge far more quickly to rural farmers	Inflexible, one-way commutation, and requires human involvement and radio programming
TV Broadcasting Service	Disseminates knowledge to an extensive local and global audience and allows for the active demonstration of spectacular knowledge	Messages have short life plus time shifting and cannot provide detail information
Text (SMS)-Based Service	Disseminates knowledge in short and timely messages effectively and efficiently	Cannot provide comprehensive and in-depth information
Online Community	Disseminates knowledge and allows end user's participation to an interactive communication	Requires active user participation, efforts and good management and service is only available to members
Interactive Video Conferencing Service	Disseminates easy to understand knowledge interactively to end users in real time	Requires human experts involvement and can be time consuming and less efficient
Mobile Internet-Based Service	Ubiquitous, easy access, and can incorporate GPS technology to provide location-related service	Requires adequate infrastructure, the use of the smart device and higher IT skills to use new technologies

Table 3: *Comparison of Knowledge System Models and their Advantages and Limitations [30]*

2.3.2 Visualization-Based Projects

The highly probable visualization aspect of this project can be based on educational visualizations, podcast episodes, and a playful application created by the company Fork Ranger [31], a digital platform that seeks to aid in the transition to a more sustainable consumption of food. By combining visualizations, real-time data, and storytelling, they seem to be able to communicate effectively the importance of adopting sustainability and, in this case, sustainable food consumption. To illustrate with an example, Figure 2, this is a calendar that combines visuals and text, to convey what produce grows when, encouraging the purchase of these items within their correct timeframe.

It can undoubtedly be used for inspiration when looking at effective ways to target behaviour change with visual storytelling and representation of data of a rather complex topic, narrowing it down into a more widespread and understood language: visuals.

Figure 2: *Calendar Visualization Fork Ranger [31]*

A noteworthy example of a visualization developed by the National Center for Supercomputing Applications of the University of Illinois [28] is the depiction of flows on a 3D globe with regard to agriculture. The same premise was used for 2 different visualizations, the trajectories of water within agriculture and the agricultural export flows. The main driving factors for these visuals were the demand for making complex data understandable for all, which was achieved through these projects, since showing the end result of the visuals through a video format to people outside of this field of expertise, they only needed about 10 seconds to comprehend it. The video itself starts off with a few introductory sentences, explaining the urgency of the visualization and how to interpret the given information. The rest of the video consists of the globe spinning, which coincidentally contains moving arrows that represent the flow of agricultural exports, its size displaying how high the value of the export is, as captured in Figure 3. This all aids in capturing the data from an internationally oriented perspective, since it manages to show the big picture on top of a globe, all the while being able to highlight a recent problem, with terms related to water usage. The flows are able to uncover new data, providing an overview with a sense of transparency, making people more aware of the connections involved.

This example also demonstrates why visualizing is a very effective approach by using visuals to be able to reach actors and improve data comprehension, which is impressive in terms of the bulk of data that was the driving force behind this globe. This approach can be beneficial with regards to this project's aim, since supply chain data is very intricate and ambiguous.

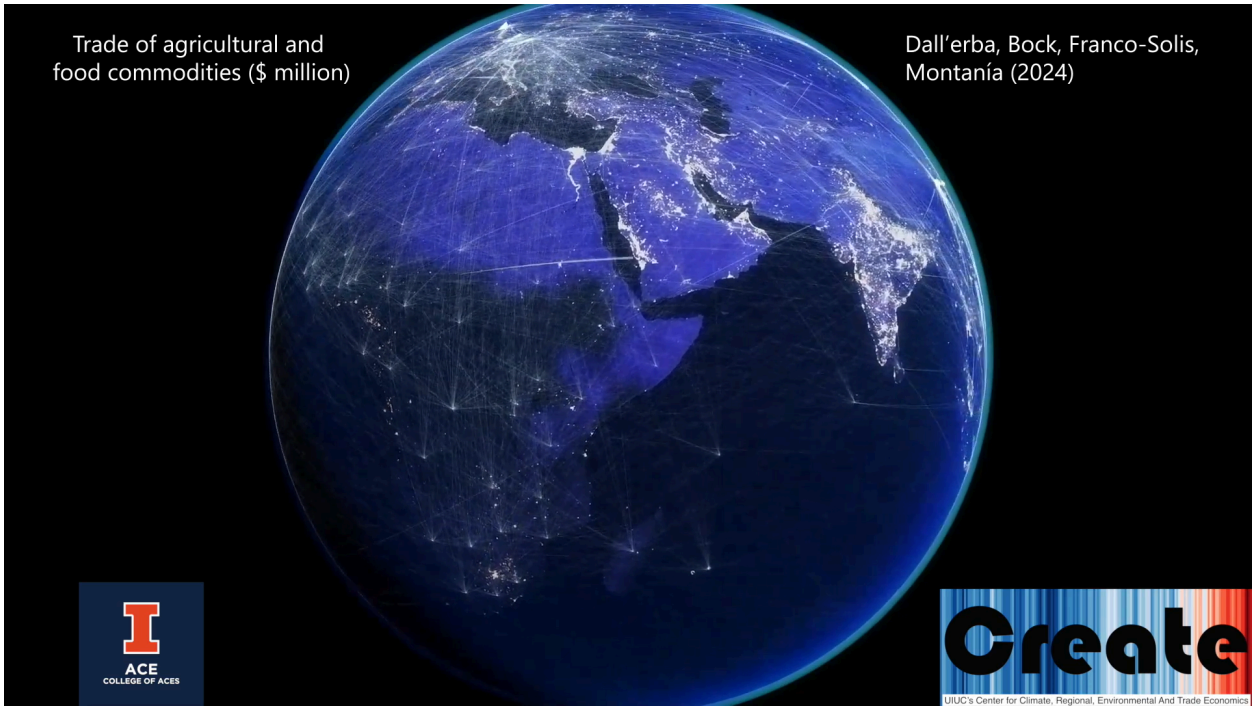


Figure 3: *Trade of Agricultural and Food Commodities [28]*

2.3.3 Food Supply Chain Tools

Going back to tools, the University of Wageningen [27] has created two tools that can help with regards to making the food supply chain more sustainable. The first tool aims to aid in the issues that companies are facing, concerning whether the entire chain is fully sustainable, what measures are actually impactful, and how one communicates this to the outside world. This requires a considerable amount of data, something companies will not all have access to or even be aware of. That is where this tool comes in, the AgroChain Greenhouse gas Emission calculator (ACE calculator) [32], which allows the user to measure the environmental footprint and impact of the taken interventions. The tool functions with a large amount of embedded data on, for example, numerous packaging, storage, processing steps, energy sources, materials, and transport, as well as information on specific crops like their CO_2 footprint and energy and water consumption. The users can supplement the tool with further data. The calculator is even able to work with products that consist of multiple origins as well as data on the volume of specific materials, which can be useful information, on its usage, and the actual data, for the eventual tool of this entire project. On unknown data, the tool will, if the users wish so, make its own estimate and use that throughout. To be able to understand the extent of interventions, the calculator uses data on alternative chains that have already used such measures and experienced the results firsthand. The results of this tool identify the most detrimental factors of the food supply chain, as seen in Figure 4.

This tool is a valuable example of how embedded data on the supply chain can be used to display and uncover the impact of taken interventions and measures. This tool's ability to aid in decision-making can be used as an inspiration for the end product.

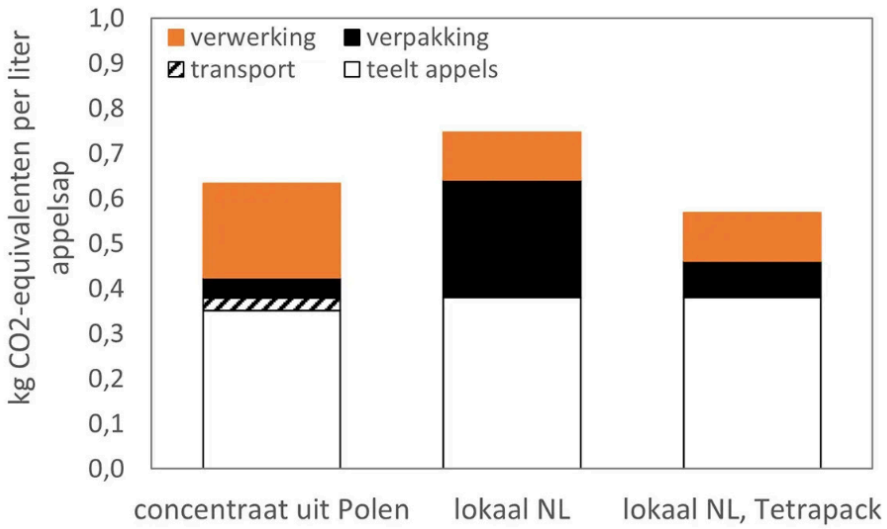


Figure 4: *Results ACE calculator [32]*

The second tool Wageningen University and Research made is called the Procestimator [33], which is a tool that helps in making decisions based on the pre-feasibility of agricultural approaches, in this case, increasing the scale of fruit and vegetable side streams, which is mostly wasted generated biomass. Within this tool, the volume, availability, composition, and resistance to microbial spoilage and enzymatic breakdown of the fruit and vegetables are taken into account. The way this tool works is it starts off with an input stream that contains relevant data, a selection can be made by the user on the side stream, and food databases. The next step involves picking processes that can lead to the desired product, all affecting the end result in a different manner. From these inputs, the tool will provide the user with various insights on the process, an entire layout of possible trajectories, feasibility assessment, alternative process results, and an estimation of the process value, resources, CO_2 footprint, and costs, as depicted in Figure 5. It is a valuable tool in offering stakeholders a way to analyze the economic and sustainable viability by going through the process step by step.
This is yet another tool whose main focus is on decision support, only this time through scenarios, which can be helpful to this project in steering stakeholders into certain actions as well a design ideas in the context of processes, which could easily be linked to a food supply chain instead.

	Cost price per kg product		***GHG-emission per kg product***	
Product	**Min** peso/kg	**Max** peso/kg	**Process** kg $CO_{2\text{-eq}}$/kg	**including savings** kg $CO_{2\text{-eq}}$/kg
flour	12.4	25.2	0.73	0.26
chips	13.7	22.7	0.86	0.51
puree	2.7	6.5	0.07	-0.09

Figure 5: *Results Procestimator Min and Max Cost Prices and Greenhouse Gas Emissions [33]*

2.3.4 Supply Chain Management Tools

A few tools have been explored now, but we have yet to tackle the supply chain management tools, which are designed for practically any supply chain, these do not focus on one sector specifically. Oracle SCM is

a cloud-based software platform that looks at the entire user-provided supply chain [34]. It can manage aspects from inventory to manufacturing and even planning using real-time data. The platform transforms raw data into clear, interactive visualizations. It even contains a built-in AI that aims to predict shifts in the data, detect unusual situations, give out recommendations, automate tasks, identify risks, and simulate scenarios similar to the Procestimator. The tool gives stakeholders the ability to have a monitored overview of the supply chain, whilst even offering advice.

Given that there are numerous interconnected actors along the food supply chain, this will be significantly harder to clearly provide data on the chain. However, this tool provides a helpful example of how it is possible to have one platform that is able to manage complex data, provide feedback, and visuals, as illustrated in Figure 6.

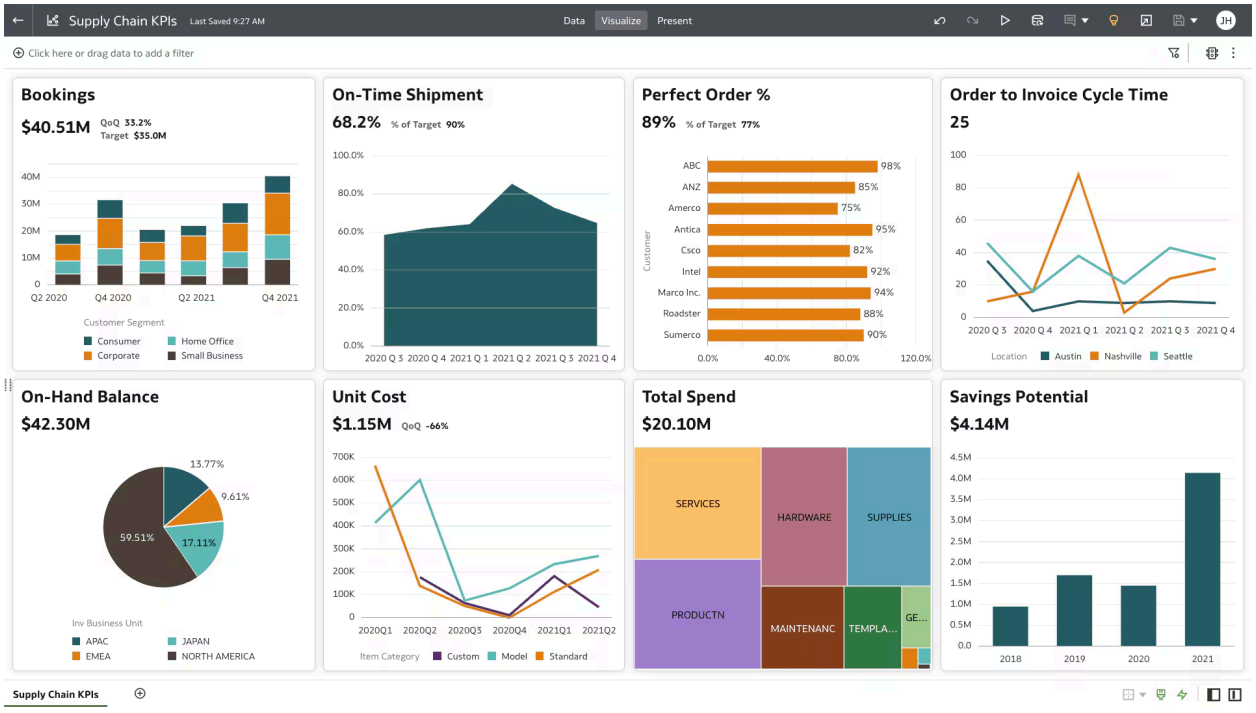


Figure 6: *Supply Chain Analytics [34]*

Another platform on supply chains is Beacon [35], where it differs from Oracle, however, is the ability for communication between supply chain stakeholders. Focusing on enhancing collaboration among stakeholders through communication in just one platform, reducing miscommunication risk and administrative tasks. Similarly to Oracle it utilizes real-time data, provides visibility through customizable dashboards and allows for management. These dashboards set up a collaborative environment for all actors, creating a sense of togetherness and transparency. Figure 7 is an example of a page on the tracking of products.

As one of the few tools on stakeholder collaboration, the means of interactiveness can be used as inspiration in terms of getting actors to actually work together. Not only that but provide them with a transparent overview of the actions within the chain.

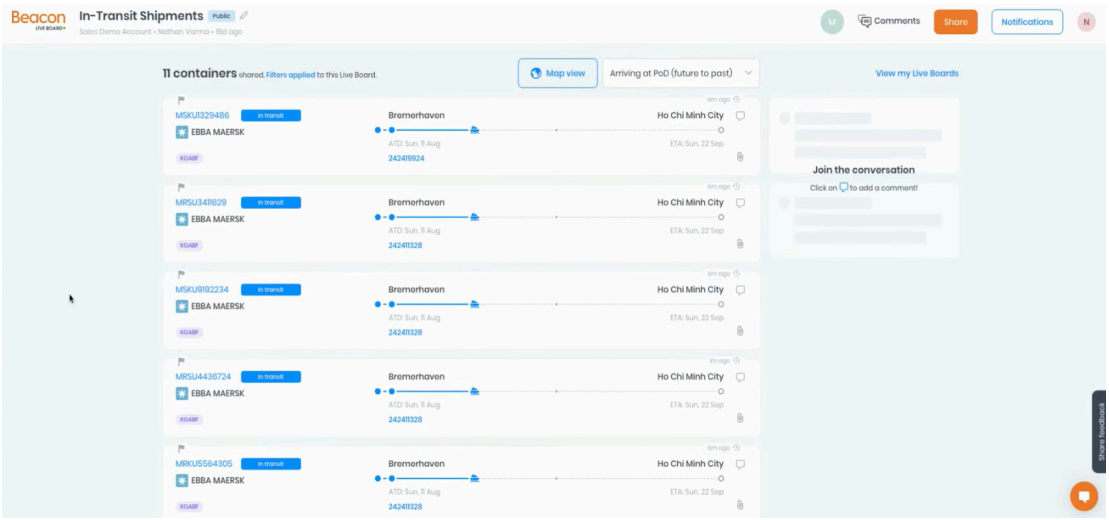


Figure 7: *Tracking Frame [35]*

2.4 Discussion

There seems to be a good amount of literature research on the theory related to RA for such an innovative field [2], yet in practice is where this subject seems to be lacking. With regards to theory, it can be stated that RA techniques are, according to all papers, based around soil health and managed through natural practices, however, the definition will vary substantially from paper to paper. Though RA practices are promising methods in leading up to sustainable farming, implementing these can be met with some initial resistance due to the ambiguity of most principles. Moreover, it was discovered that RA was met with mostly economic, social, institutional, and knowledge-related barriers. In terms of an absence of knowledge, this is where this project can step in and help fill those gaps about RA in the supply chain. As found, the supply chain is a complex system of a multitude of parties who all rely on one another; however, it seems that this structure lacks certain communication and transparency within the chain. Literature shows that there is a clear need for collaborative supply chains when shifting toward sustainability.

This is closely related to the identified need for knowledge-sharing and visualization tools. Across the chain, collaboration can foster a decrease in the fragmentedness and an increase in the willingness to a sustainable transition. Visuals can support decision-making by providing the information in an understandable manner.

Finding, however, tools that already implement knowledge-sharing, provide supply chain data, and influence decision-making altogether within agriculture is near impossible; seemingly, most tools addressing agriculture are specified to a certain area, such as applications that work with the Internet of Things. All available tools manage to focus more on one aspect, such as visualization, which is the driving force for Fork Ranger and the National Center for Supercomputing Applications. They are examples of how important visuals are to gaining an understanding of a topic, as well as complex subjects, or even eliciting a specific action from the audience. Further confirming the need for visuals within this project to be able to convey an understanding and push of RA throughout the supply chain stakeholders. All the while, the ACE calculator and Procestimator mainly aim to support stakeholder decisions through gathered data on agricultural processes. These tools demonstrate how intricate processes can be analyzed and suggested in terms of sustainability. They additionally display how a tool is

still able to function with missing data, which will most definitely become a problem later on in this project, considering the food supply chain is very fragmented. Supply chain management platforms can be a good starting point with regard to creating a website on the chain and having a built-in analysis of that chain; whether that is feasible remains to be seen. Beacon, however, brought to light an interesting manner of promoting stakeholder communication within the chain, which could be valuable for the tool.
The eventual end product of this project can benefit from learning from the aforementioned effective elements from these tools, so that it will turn out to be a tool that not only delivers support on real-time data decision-making, like the ACE calculator, but does so in a visual manner such as the approach applied in Fork Ranger. All the while, simultaneously allowing for a cooperative space, such as the collaborative features from Beacon, that can encourage sustainable actions across the food supply chain.

Chapter 3 - Methods and Techniques

Designing an RA communication tool is done through the Creative Technology Design Process by Mader and Eggink [36], as depicted in Figure 8. This is essentially a method for the design process, which consists of a spiral model containing 4 alternative stages: Ideation, Specification, Realization, and Evaluation. Within the process, divergence and convergence coexist to enable iterative refinement of the prototype and final design. Through combining literature research, feedback, and continuous prototyping, this flexible approach aids in producing a product or prototype that fulfills the stakeholder and user requirements.

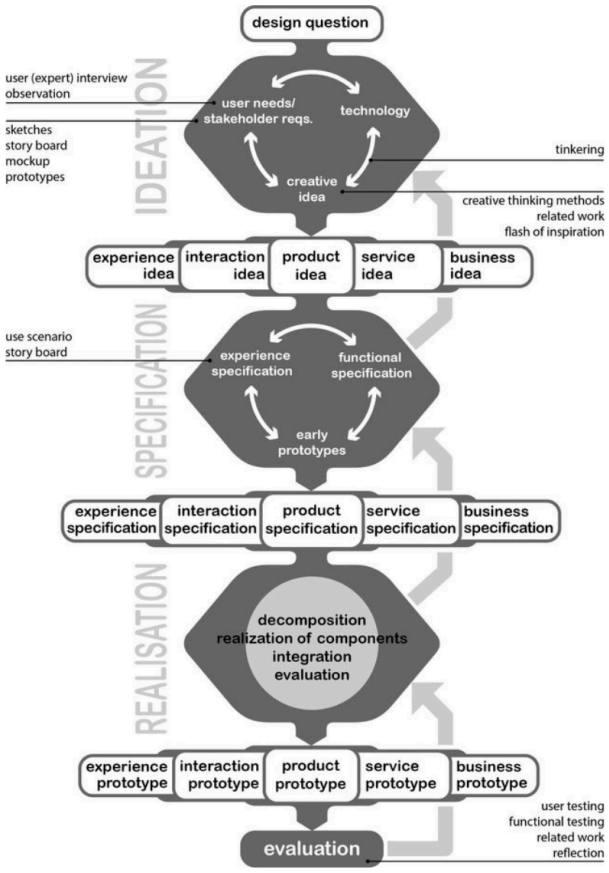


Figure 8: *The Creative Technology Design Process [36]*

The emphasis for this project concerning the design process lies on user-centered design, since within this project it is of utmost importance that the user's perspective is constantly being taken into account at each and every stage, impacting the formation of the final design [36]. Critically important is that the tool is able to hit its mark of steering the users to make better-informed decisions, therefore, the stakeholders must be thoroughly involved in the process. The prototype will undergo testing with members of the target group and client, the then gathered feedback will be examined and implemented according to the areas that need improvement. Going through this iterative process with the stakeholders enables adjustments, which will result in a product more in line with the requirements and preferences of the target users.

3.1 Ideation

The first phase to come across in this design process is the ideation phase, which will help identify an elaborate project idea and problem requirements. As a starting point, there was a client involved who had a certain concept they wanted to have realized; from there, a design question was formulated, in this case, the main research question. That would be the premise for the ideation. The design stage, as seen in Figure 8, has 3 alternative starting points. Considering the client's eventual goal of bringing parties together, the user needs/stakeholder requirements can be assumed as the first step. When wanting to reach this goal, one first has to understand who the stakeholders are. The client will provide this information through an expert interview. Following the determination of the various stakeholders, their requirements and needs for such a tool had to be investigated.

The stakeholder salience model (SSM) [37] was used as a strategy to evaluate the stakeholders based on three aspects: power, legitimacy, and urgency. To elaborate, power as in the ability to enforce one's own will, legitimacy as in suitable involvement, and urgency as in the desire for immediate action. Stakeholders would then be classified within Figure 9 on the possession of these attributes, which inexplicably leads to an overview and prioritization of a number of stakeholders. Three stakeholders only hold 1 characteristic, either power, legitimacy, or urgency; these can be classified as latent stakeholders and are numbers 1 to 3 in Figure 9. The next layer of stakeholders contains two of the three aspects; these stakeholders are numbers 4 to 6 in the figure below. And lastly, there is one stakeholder that encompasses all characteristics, stakeholder 7, the most important stakeholder.

Background research will aid in categorizing these stakeholders in their corresponding classifications. This is part of the divergent aspect, where potential stakeholders across the regenerative food chain are identified and classified accordingly, and their needs and motivations reviewed.

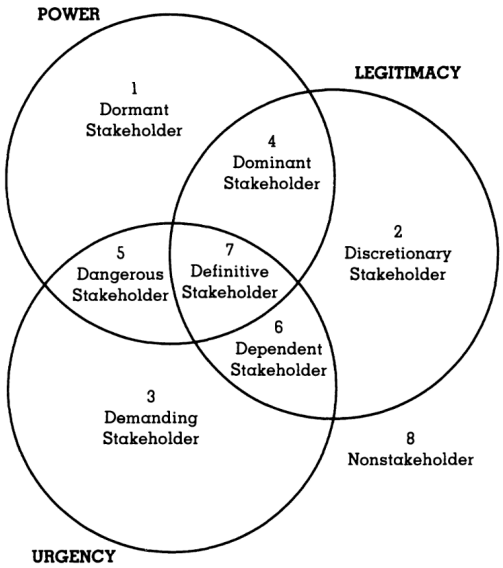


Figure 9: *The Stakeholder Salience Model [37]*

This phase will create a list of preliminary requirements for the tool. Including both functional (the products' features and functions) and nonfunctional requirements (the products' outlined properties). To acquire a clear understanding of the need for functions, features, and properties, the MoSCoW method [38] will be used. This is how it works: M stands for Must-haves, a name that speaks for itself, referring to the crucial essentials in achieving the tool's core purpose. Following up is the S, which translates to Should-haves; its compromised aspects are less essential yet still extremely encouraged to implement. Next is the C, Could-haves, which are requirements that would be desirable but aren't as impactful as the other two. And then lastly is the W, the Won't-haves, elements that are out of scope, fully unrealizable, or even counterproductive. This method will help put the priorities of the tools' requirements in order, which will no doubt be helpful in defining the order of what will be done first during the next phase.

In terms of concept generation, two methods will be utilized. The first being the creation of a mind map [39], a well-known technique, for creating a structured interlinked view on topics. Starting from the centre, where the main idea is placed, it branches out into subsections that surround the main topic. These are all linked to the main idea through lines, occasionally, subsections are interconnected with one another, displaying a sense of relationship between the few. This will be a useful technique concerning constructing a concise overview of the topic and its underlying connections.
The second method is brainwriting [40], which involves participants silently writing down ideas in a face-to-face setting, placing the ideas on a visible spot for all participants to see, which encourages further ideation. All are free to add as many ideas as the session lasts, until there are none left to be discovered. The generated ideas will be inspired by the discovered state-of-the-art.

Following this, a SWOT analysis [41] will be conducted to further aid in uncovering the Strengths, Weaknesses, Opportunities, and Threats of the generated ideas. Allowing for a more holistic view of the concepts, examining both internal and external factors. The following steps will become clearer once this has been brought to light, essentially aiding in deciding on the final concept idea.

3.2 Specification

The purpose of the specification phase is to translate early concepts and ideas from the ideation phase into concrete design requirements and relatively barren first prototypes, establishing a foundation to further build upon in reaching the main objective of this project, facilitating cooperation between food supply chain stakeholders.
Semi-structured interviews will be conducted with regenerative supply chain stakeholders, figuring out the ins and outs of their supply chain to be visualized for the tool itself. This method allows for a lot of freedom and flexibility when it comes to asking questions; one can go off script and inquire further where needed.
To illustrate a stakeholder journey within the platform, a storyboard will be used in accordance with various personas that represent the supply chain, with the intention to accommodate most potential users. Making it possible to almost guarantee suitable interactions for most involved stakeholders. A flow diagram will be created in response to the storyboard, showcasing the specific interactions between frames. This will give a more structured perspective on the inner workings of the tool.
Next, core decisions regarding the visuals and narration will be made, allowing for a quicker creation of the product in the following stage, as well as ensuring the tool will be cohesive all around.

Following this, personas based on the identified stakeholders will be created to hypothetically evaluate the effectiveness of the tool from the perspective of potential involved actors.
And lastly, both functional and non-functional requirements of the tool will be identified, together with the MoSCoW method, essentially establishing what the goal should be able to accomplish in terms of the design, goals, and function.

3.3 Realisation

Within the realisation phase, the focus is on creating a physical prototype, actually bringing the communication tool to life based on the acquired insights from previous phases. Translating the storyboard into a high-fidelity interactive prototype that is even closer to the envisioned RA communication tool. The iterated MoSCoW requirements are the base for this phase, as these discovered functional requirements will steer the priority regarding the eventual prototype. From there on, the tool will be divided into subsystems, which will make it easier to understand the inner functions separately, ensuring it is working properly, and bringing them together as a whole. Each individual component will be developed independently and then knit together once all components work as expected. The system will first have to become a unified tool before conducting a functionality test. Its working components will be evaluated with the functional requirements in mind, obtaining and implementing the feedback continuously until it garners a successful prototype according to the stated requirements. The eventual outcome of this phase will be a prototype that is ready to be evaluated.

3.4 Evaluation

After the creation of the prototype, it is crucial to assess how well it meets the non-functional requirements and answers the design question, the main research question of this project, whether the interactive communication tool has influenced stakeholders to knowledge-share, and if it managed to enhance their decision making with the given information on RA. Prior to taking evaluations, the UT Ethics Committee [42] has to approve both the information letter and consent form, located in Appendix B.
User tests will be conducted, where possible, with members of the target group. They will be asked to interact with the tool, acquiring full freedom over the system. Afterward, the experience will be evaluated using a qualitative research method, specifically a semi-structured interview, to determine whether the design requirements have been met. Utilizing the predetermined questions as a guide, whilst having the flexibility of asking further questions.
Since the Creative Technology Design Process is iterative, the prototype will be altered between evaluations in response to testing and feedback until the requirements have been substantially validated. Allowing for the prototype to grow into a high-fidelity prototype.

Completion of the entire Creative Technology Design Process will lead to an evaluation of all results from the phases, pinpointing areas of improvement, so that a following prototype can be developed using the gathered knowledge.

Chapter 4 - Ideation

This phase marks the beginning of the creative process, where earlier insights will affect the process of generating ideas and concepts, all culminating in a final concept. To start off, stakeholders have to be identified, from there on their desires and requirements will be determined and analyzed. Taking the acquired information, a list of preliminary requirements for the tool will be decided on, with the help of an interview with the client, showcasing their perspective. Subsequently, a brainstorming session for generating preliminary ideas was held. Ending with a thorough analysis of the initial ideas, so that a final concept will be uncovered.

4.1 Stakeholders

Before starting the generation of concepts, it is vital to understand what parties are present within this tool and to what extent. As mentioned in 3.1, the Stakeholder Salience Model will be used to identify what stakeholders are present, whilst subsequently being put into various categories of stakeholders, based on their involvement within this project. Illustrated in Figure 10 are the relevant stakeholders.

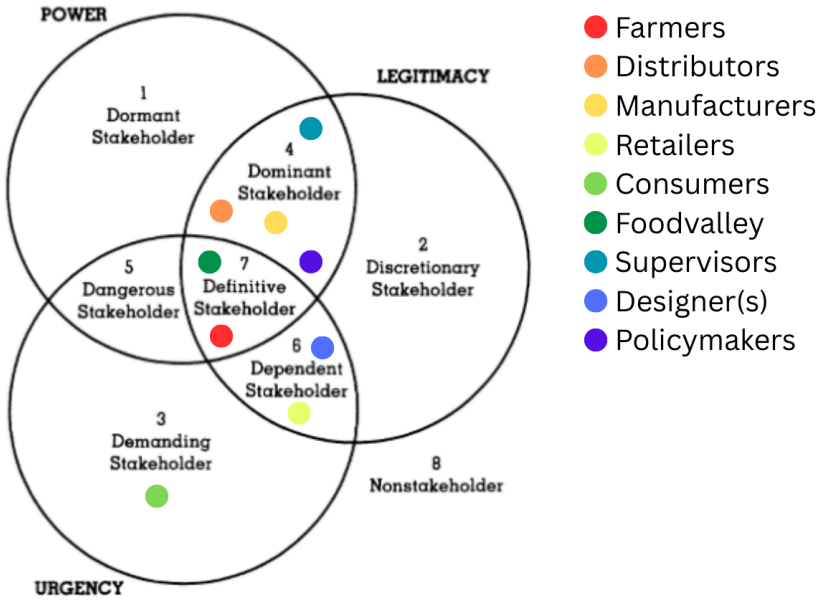


Figure 10: *The Stakeholder Salience Model Applied [37]*

4.1.1 The supply chain

The supply chain consists of a number of actors, each with a different area of expertise, as discovered in 2.2. All stakeholders across this chain have a legitimate involvement, considering all have specific, invaluable roles that keep the chain running and are the users of this tool.

The chain starts off with farmers, who are quite literally at the core of working with RA, as they will be the ones who will directly implement the practices. Not only that, but they are the most important actors, in terms of knowledge-sharing and decision-making, and they would benefit the most from insider support. Possessing thus power as well as urgency, due to the sustainable transition pressure from outside sources that has been growing. Making them a Definitive Stakeholder.

Throughout the entire chain are the distributors, whose fundamental function is the accurate transportation of products. Urgency for change within this area is not as present as for farmers, making them less involved in the tool. On the other hand, they could directly make a change in the supply chain, by being tackled accordingly and positioned most efficiently, thus having power. They could be considered a Dominant Stakeholder.
Following the farmers are the manufacturers, the ones that will handle products after the farmers. Just like the distributors, they are not fully interested in the process of turning farming regenerative, yet they may immediately be able to make an impact by adopting steps towards sustainability, such as better stakeholder communication. Turning them into another Dominant Stakeholder.
Next up are the retailers, who actually bring the products to the outside world, portraying RA when applicable. Their interest in RA is considerable, since a sustainable reputation for products is ideal for selling to certain customers. Retailers, however, have little to no influence on the making of regenerative products and are thus lacking in power. Turning them into Dependent Stakeholders.
Last up are the consumers, who, depending on the person, could be interested in purchasing sustainably farmed products, containing a sense of urgency. However, they contradict all other supply chain stakeholders, as they are not the main actors within this tool; they do not have influence on the chain, but are merely the last stop. Therefore, there is no legitimacy or power for consumers within this tool. Making them Demanding Stakeholders.

4.1.2 Foodvalley

Foodvalley is the client of this project, therefore automatically an important stakeholder, based on their need for the development of such a tool. They hold a high degree of power, being the initiator of this project; it therefore comes as no surprise that the legitimacy can be considered as present. Seemingly, according to 2.4 and the client, a tool that consists of an entire supply chain, with a focus on knowledge-sharing and decision-making, has not yet been created. Such a tool, however, is critically needed, as is the client's wish. Therefore, Foodvalley is a Definitive Stakeholder at the core of the project.

4.1.3 The supervisors

The supervisors hold significant weight over the project; however, they do not have a big sense of urgency. Instead, they hold a considerable amount of power and legitimacy in terms of the academic context of the project. Providing guidance and support throughout the entire project, making sure everything is up to par. They are then classified as Dominant Stakeholders.

4.1.4 The designer(s)

While there is one designer of this project specifically, me, there is another student, Jakub, working within the same topic of RA, but on a different aspect, namely the mapping of agricultural land, portraying the RA and non-RA plots to gain specific insights. If the time constraints allow it and the platforms of the projects are similar, they could become intertwined. The designers could be considered definitive stakeholders, as they possess a certain urgency in delivering a successful finished tool; not only that, but legitimacy due to the designers' role of actually developing the tool. However, it could be argued that their power is considerably less; while the designers' perspective is important and heard, they are, in the end, working for someone else's aim. In this case, power gets overshadowed by urgency and legitimacy, and therefore is considered a Dependent Stakeholder.

4.1.5 Policymakers

There are many institutions who are part of the policymakers that have a vast influence over this project. These can range from individuals to organizations. At its highest level would be the institutions of the European Union, which hold the most amount of power among these policymakers. Next would be the Dutch Ministries, which are concerned with agricultural regulations. And lastly, the government body of Gelderland, who oversee practices within their area. These stakeholders are all in charge of the regulatory frameworks that the food supply chain operates in. Although they are not directly involved in the project, they have authority over agricultural regulations, thus possessing both power and legitimacy. Making them another Dominant Stakeholder.

This analysis uncovered the fact that there are numerous stakeholders involved, nine to be exact, all of whom have to be taken into account, but with a varying level of importance. It was revealed that there are two actors of utmost importance, the definitive stakeholders. They should essentially become the focal point of the tool, having the dominant and dependent stakeholders be slightly on the back burner, however, still present to an adequate extent. The sole demanding stakeholder will be the least significant in the design of this tool

4.2 Preliminary Requirements

When designing a tool, it is crucial that the needs and aims set by the stakeholders are identified and met. To achieve this, an interview with the client was conducted to discover the tools' requirements and form an understanding of the tools' supposed workings. By applying the findings of the stakeholder analysis, it was able to guide the prioritization of the requirements. The user requirements and their level of importance, with regard to the MoSCoW method [38] are displayed in Table 4.

Number	Requirement
1	MUST display the supply chain
2	MUST follow at least one crop
3	MUST distinguish between regenerative and non-regenerative products
4	MUST focus on a specific area
5	MUST provide insight into the supply chain
6	SHOULD encourage stakeholder communication across the supply chain
7	SHOULD aid in decision-making
8	SHOULD reflect real-world data (dummy data)
9	SHOULD focus on the same area as the other RA thesis student
10	COULD utilize real-world data
11	COULD make the product traceable to a specific farmer

12	COULD focus on a regenerative product that comes from multiple sources
13	COULD focus on regenerative products purchased under a mass balance
14	COULD include regeneratively grown products that are sold as conventional

Table 4: *Preliminary requirements*

The MoSCoW method was able to help in ensuring the specifics of the tool, linked to their significance. Providing an overview of what should be involved in supporting the goal of this tool and which ones should have the main focus. The must-have requirements will have to be involved, no matter what, since they verify the realization of the tool's effectiveness. The should-haves emphasize the enhancement of functionalities, while the could-haves are stepping stones for further implementations. Fundamentally, it becomes a guideline for the project. These requirements will be refined in Chapter 5.

4.3 Concept Generation

The identification of stakeholders and preliminary requirements was a necessary foundation for stepping into this next phase of designing concepts in an effective manner. Since it was able to highlight the features and stakeholders that are essential in this tool. Leading up to the first brainstorm, from there a generation of exploratory ideas, a detailed examination of the concepts, and concluding with a final idea of the end-tool.

4.3.1 Brainstorming Process

To set a clear foundation for the generation of concepts, a joint brainstorming, with the other thesis student was conducted. Since working on essentially the same topic, it proved to be a helpful space to bounce off each other with a clear understanding of the sense of RA. During this session, two mindmaps were created to visualize the context of RA and its data in a manner that provided an overview of the otherwise complex concept and could inspire further ideas. Following the creation of the mindmaps, the brainwriting method was implemented to narrow all the gathered information down to actual ideas, based on certain aspects of the tool.

4.3.1.1 Mindmaps

The first mindmap focused on the various types of data that RA is linked to and contains, as seen in Appendix C. It helped establish an understanding of the numerous aspects that are connected with RA, together with allowing for a visual representation of the various options of what data could be used for such a tool and what is currently available. Where the current discovered data could be used as either a stepping stone or inspiration for the brainstorm.

However, in acquiring a relevant idea with regard to RA, a mindmap was created on the entire concept of RA, see Figure 11, providing an overview of its definition and interconnectedness. Enabling a more whole understanding of the key factors and their associations with one another.

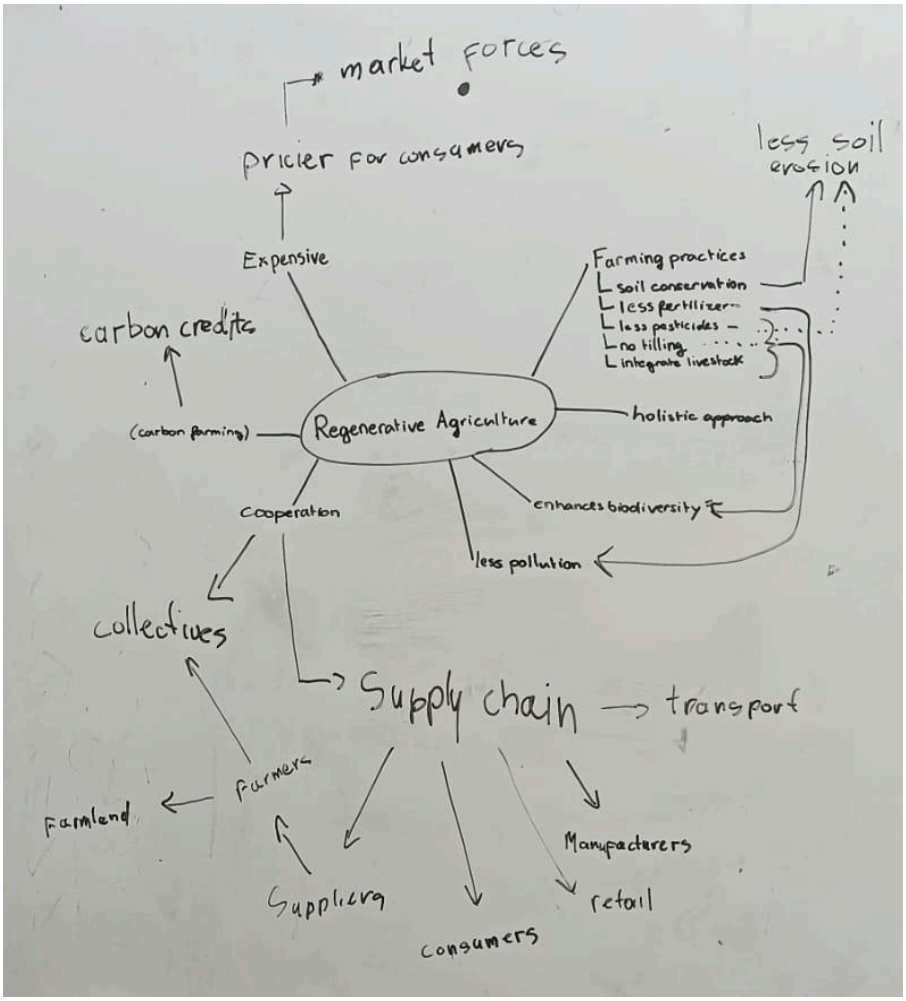


Figure 11: *Mindmap on the Concept of RA*

4.3.1.2 Brainwriting

Now that a fuller understanding has been established, it was up to the brainwriting to spark some ideas. Together with the other student, two brainwriting sessions were conducted, each for their own project. The brainwriting was divided into several categories, those being: the supply chain, farmers/offtakers, cooperation, visualization, user interface, and kind of visualization. These categories were specifically chosen because they each represent a different vital aspect of the tool. This led to a structured, yet rapid generation of concepts only linked directly to their category, as can be seen in Figure 12.

Figure 12: *Brainwriting*

4.3.2 Preliminary Concepts

In making preliminary concepts, the brainwriting was utilized as a base, the various ideas were put together across the categories, shortly evaluated, and either discarded or kept as a concept. This subchapter will follow through with the ideas and explain them in as much detail as possible, whilst pointing out the active barriers to the concepts.

4.3.2.1 Website

The first idea lines up the best with what the client would want in an ideal setting, together with what works the best for the direction of the project. Namely, a website that visualizes a supply chain on a crop that is either regenerative or could easily be turned into RA, all its stages, stakeholders, and data, such as volume across the chain, see Figure 13. When creating a website, it provides the option of linking it to the project of the other student, since they will most likely be developing a website, as they need to visualize RA data onto a map. This could then lead to additional insights on the supply chain, by connecting these two aspects, which can only be done if the same area has been picked by both.

In terms of applicable features, to make the entire website a bit more interesting, one could add filters that allow for specific selection, on perhaps certain stakeholders within the supply chain. Another idea could be implementing ratings, for example, on sustainability and its level of effectiveness. Yet, the most useful of features could be having an option to contact the stakeholders, fostering exactly that interconnectiveness in experience sharing. Lastly, it gives users the opportunity to upload their data, supplying a more relevant view of the chain.

A barrier to this idea is making sure that the data used is similar for both students, which is easier said than done, as both of us need different kinds of data for the projects. Having one specific area that contains both will be difficult.

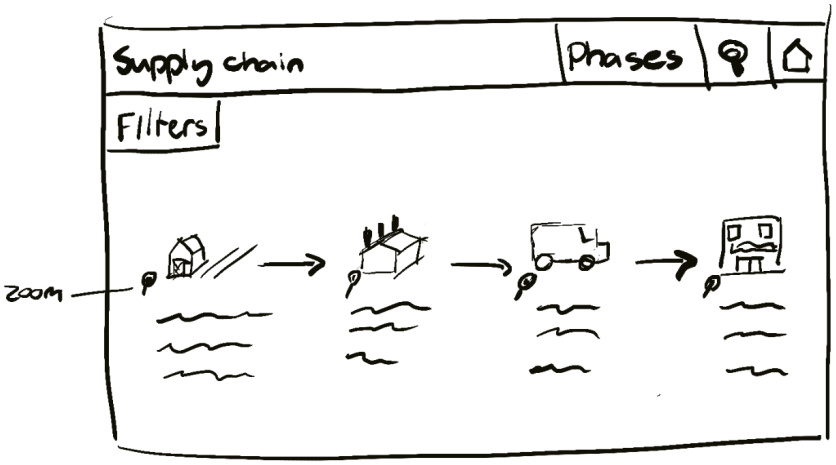


Figure 13: *Sketch of the Website*

4.3.2.2 Animation

A totally different outlook is this concept, an animation that shows the journey of a regenerative product, start to finish, showing all the steps, available data, and stakeholders involved, whilst explaining what RA is through displaying how this project is indeed regenerative, as seen in Figure 14. This project would utilize storytelling as one of its main selling points, narrating through visuals, data, and audio, the process. Additionally, the non-RA side of a supply chain could be shown and compared, and contrasted with the RA product.

The already present downsides to this are that one is not able to alter the data of an animation, since it is fixed after its creation, and would have to be updated, if it wanted to stay as relevant as possible. However, this limitation inspired another idea, of implementing a simplified version of the animation into the website, without any data, that would be controlled by the website, so that it would be able to stay up

to date. Another possible barrier is the fact that it does not incorporate knowledge-sharing and aid in decision-making as its core values, instead, it aims to educate on the journey of the, preferably, regenerative supply chain.

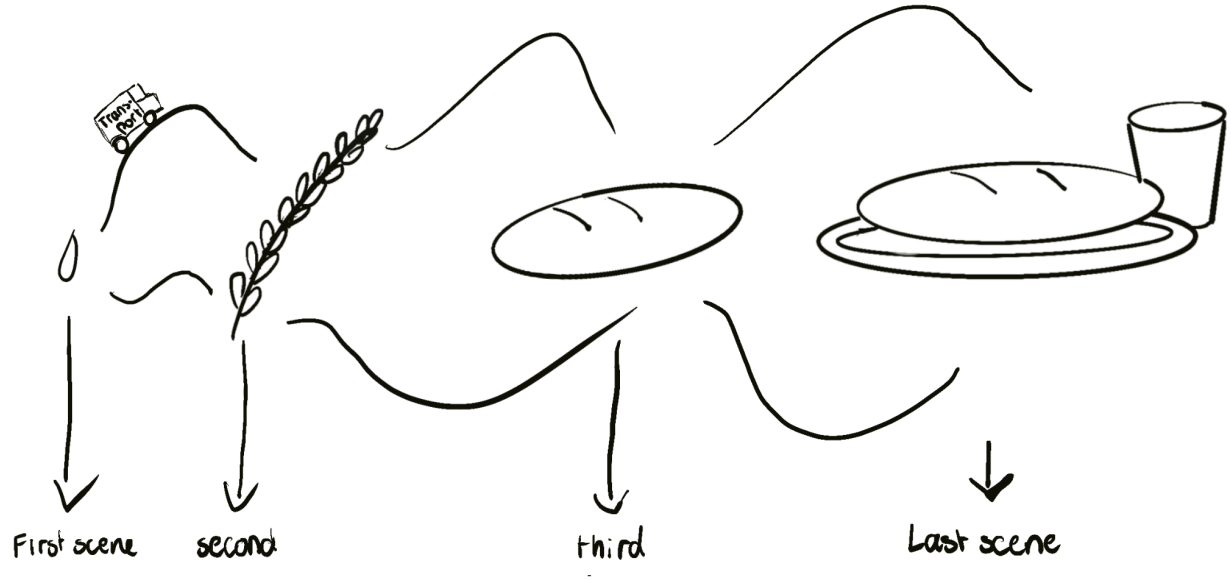


Figure 14: An Overview of the *Scenes in the Animation*

4.3.2.3 Game

The third preliminary concept asks users to follow along with a supply chain, from beginning to end, and have them make certain decisions along the way, changing the outcome accordingly, for better or for worse, see Figure 15. Taking on various roles throughout the process, such as the involved farmers, retailers, etc, and presenting them with fake scenarios and the option to take various actions. In the end, the tool would provide the users with a full analysis of where exactly things went wrong, why, and how they could improve upon this.

While this concept wholly connects to helping in decision making, it fully leaves out the across the chain stakeholder collaboration, which is just as essential. That could be perhaps sidestepped by giving contact information of a few stakeholders on a RA supply chain, which would mean that the users have to reach out on their own initiative.

Figure 15: View of the *Screens of the Game*

4.3.2.4 Movie

The next idea generated was the creation of a movie, where again, the entire journey of a product would be documented, but this time through film. Initially, the idea would then be to actually go to the locations of the various supply chain stakeholders involved and capture the steps that the crop undergoes on camera. Just like the animation, it would heavily use the concept of storytelling, where the road will be narrated either by me on the screen or a voice recording. Essentially becoming a documentary on RA and bringing to light an entire supply chain.

The problems that the animation ran carry over to the movie as well, since data cannot be altered after the fact, even less so than the animation. And it lacks a substantial amount of knowledge-sharing and guidance in better decision-making. Setting everything up to actually be able to film in an adequate manner will not be easy; it brings up a lot of procedures.

Similar to Figure 14 of the animation, the movie will have scenes just like it, only there is a possibility of a person being involved in the screen.

4.3.2.5 Physical Supply Chain Box

The following idea is based on showing the actual products at every stage. It would consist of an actual box that would contain the various product phases and information on the stakeholders and practices in every phase, as illustrated in Figure 16. This information could be on, for example, cards, the box, or a leaflet. The box would then be able to be sent to the stakeholders involved, to actually get them to physically interact with the product that they have a share in, learning about its origins, other stakeholders, and regenerative practices. This experience could be very memorable through the way it is set up, which could evidently educate the stakeholders, solidify that bond they have with the product, and steer them into reaching out to the other actors within the supply chain.

The box could even contain a small QR code to the website of the client of this project, allowing the stakeholders to learn even more on RA on their own accord.

A concern that this concept brings is actually gathering the materials, and being aware that these products have an expiration date, which will most likely not align. These products will then most definitely deteriorate, fundamentally leaving behind nothing except the information tags. This must certainly be

focused on thinking about solutions, perhaps switching out the products for 3D models, which, however, will not have the same effect as the real thing.

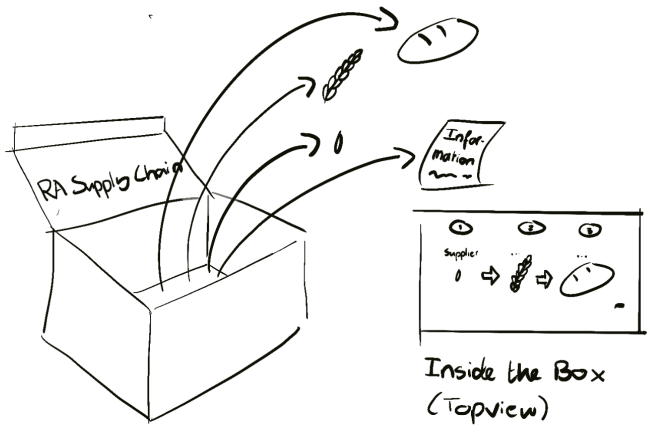


Figure 16: *Sketch of the Physical Box and Its Contents*

4.3.2.6 Technical Physical Supply Chain

The last idea is to have a board where there is a separate crop that snaps onto the various supply chain phases with magnets, selecting that specific step, as displayed in Figure 17. Data would then be displayed on either a separate screen or on the board itself, or in a whole other direction, trigger a voice explanation of what exactly occurs inside the step. LEDs might make the experience even more immersive, by lighting up, for example, 3D printed products/buildings that link to their corresponding phase.

A possible issue with this concept is the limited experience that I personally have with hardware; however, at this specific point in time, the hardware does not seem to be extremely complicated yet. Bringing this project to stakeholders, however, will not be easy, as hardware is prone to breakage and it would have to be replicated when wanting to reach all supply chain actors simultaneously.

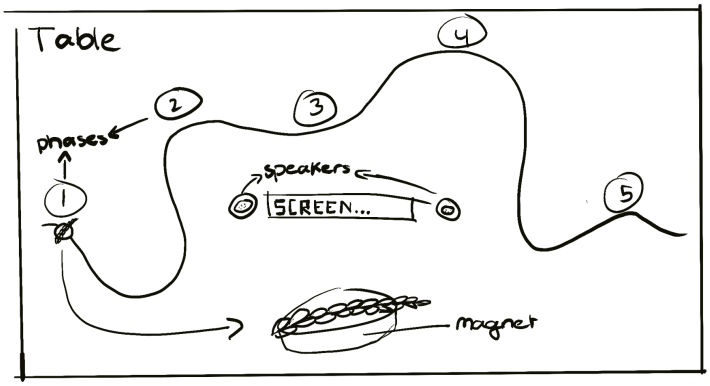


Figure 17: *Sketch of the Physical Supply Chain*

4.3.3 Analysis of Initial Concepts

Two analyses were conducted to take steps towards picking a final concept, garnering a full perspective on the feasibility of the ideas, and whether they were able to reach their aims. To ensure the ideas align

with the client's view and goals, their opinion was asked and used as an analysis. With this obtained information, a few ideas will be chosen for further analysis, through a SWOT analysis, helping in identifying Strengths, Weaknesses of the concepts, allowing for a broader understanding of the ideas and leading to a final concept.

4.3.3.1 Client analysis

The client reviewed the preliminary concepts, giving their opinion on the matter, and seeing if it is still within their scope and perspective. They seemed to be impressed by the range and creativity of the ideas, however, there were a few that clearly caught their attention more than others.

To start off with the first idea, the website, while it originally aligned with what they wanted out of this project, now, after understanding the extent of a bachelor student and their thesis, seems to be out of scope. The client has concerns regarding whether it is too mature for stakeholders at this point in time, since many are not even aware of RA or ready to make the transition and commitment. From this, the tool might be too far ahead of itself. And therefore not the most feasible in reaching the aims of this project.

The second idea of an animation received the most visible enthusiasm from the client. Since they were very excited about the prospect of storytelling and showcasing the holistic approach of RA. Even coming with ideas of approaching this concept from a perspective of a RA retailer, for which an animation could be very beneficial in educating customers as well as themselves, through having the food supply chain displayed. The mentioned possible additions for this concept were, in the eyes of the client, not necessary, as they deem the animation to already be impactful enough. Claiming that it will serve as an example of the possibility of creating an RA chain, sparking interest, and therefore still incorporating knowledge-sharing and helping in decision-making.

The following idea of the game was also well received. Deeming the concept as novel and interactive, however, similarly to the website, the client was wondering whether the users would be ready for a tool such as this. Stemming from whether it is a step too far in the current transition to RA. Despite the obtained enthusiasm, this idea will not be further pursued, due to its usability being unlikely among stakeholders.

The next concept of a movie was generally put into the same box as the animation, considering they did not differ a lot from each other. Therefore, the client asked what the added value of a movie would be Thinking about this, what makes it stand out from the animation is the fact that you see the process in real time, however, it will presumably be more difficult to get stakeholders to agree to on-site filming than only data sharing.

The last few ideas contained the least amount of comments, as they were both still deemed a bit unclear, since at that point they contained no visualization, therefore, the feedback on the box and technical supply chain is considerably less. What the client did remark is that they liked the idea of a QR code that links to their website, which can most definitely be implemented into various concepts. For the physical box, they agreed that the mentioned concern regarding expiration dates will indeed be an issue. In terms of the technical supply chain, they commented that in the end, the most important factors were that I personally liked the idea and considered it to be feasible.

Taking these remarks into account, three concepts can already be let go of, namely the website, game, and movie. The feasibility of the website and game concerning the aim of this project and its realization is more challenging than it needs to be. When it comes to the idea of the movie, that lined up more with personal preferences, as the animation seemed to be more compelling.

4.3.3.2 SWOT analysis

The three ideas that were still left, the animation, the physical box, and the technical supply chain, were analyzed with the SWOT analysis [41], which will uncover the strengths and weaknesses of the projects, making it easier to assess whether concepts align with the goal and their practical feasibility.

Strengths	Weaknesses
- Understanding through visuals and audio - Narration/storytelling - Able to educate the audience on RA - Can spark interest in RA - Could display the difference between RA and non-RA supply chains - Could be simplified for use in other tools, such as websites	- Static data - Not interactive - Less focused on aligning with stakeholder knowledge-sharing and aiding in decision-making - Rapid changes in the supply chain will not be visualized - Limited long-term engagement

Table 5: *SWOT Analysis on the Animation Concept*

Strengths	Weaknesses
- Tangible and memorable experience - Appeals to many senses - Visual representation - Portable - Able to educate the audience on RA - Promotion of stakeholder collaboration - Containing a QR code to the client's website - Switching to 3D models of the product in the product stages - Return mechanism with stakeholder feedback	- Perishable products - The contents of the box moved around during transport - Cost and time - Sustainable packaging concerns - Reception differences between stakeholders - Evolving with the supply chain - The box staying unopened - Logistics

Table 6: *SWOT Analysis on the Physical Supply Chain Box Concept*

Strengths	Weaknesses
- Hands-on interactive - Audio-visual feedback - Uses multiple senses - Encourages actors to experience the supply chain - Reflects the interconnectedness of the chain well - Dynamic in data - Useful for events	- Only one product - Transport concerns - Unclear visuals (LEDs) - Costs - Durability - Hardware malfunctions

Table 7: *SWOT Analysis on the Physical Technical Supply Chain Concept*

4.4 Final Concept

The SWOT analysis allowed for clear comparisons between the concepts. Leading up to the final concept, the animation. There are various reasons for this decision, namely that, unlike the other ideas, this one is able to bring a rather complex subject to supply chain stakeholders through visuals and storytelling, essentially using various techniques that are able to aid in conveying the subject. That is extremely helpful for raising awareness on RA and providing an overview, leading towards stronger supply chain communication and, subsequently, better decision-making. Weighing out the cons versus the pros, it can be said that the animation's strengths outweigh its weaknesses. Where its Weaknesses were not as significant as the others, in fact, its weaknesses could technically be applied to any of these concepts.
Both the physical box and the technical model would be able to provide a more tangible and multisensory experience, but it does not outweigh the logistical challenges they would come face to face with. The box would not be able to provide the products' experience, as it is perishable, and the model would not be able to reach any stakeholders, in terms of not being easily accessible, whilst one of the main aims for this product is engaging with actors. To which it all inevitably comes down to the animation to capture the interest of actors and display an entire chain.

The final animation will initially take the form of a video, narrating the journey of one specific product, whilst explaining regenerative agriculture and the principles used. The video would start off with the suppliers of the product, an explanation on what happens in the phase, and throughout explain the regenerative principles used, whilst simultaneously introducing the term and its impact. Afterwards, the video would continue on with the following stakeholders and their functions and actions: the transport companies, the manufacturers, and eventually, the retailers. Essentially, conceptualizing an entire chain. If time allows for more alterations, the concept will be expanded into an interactive animation, therefore allowing the users a more controlled environment in gathering information on this supply chain. It would still go through all the same steps the product goes through, in a manner that tells a story, however, additional details that could not make it into the original video could be put into this interactive video.

4.4.1 Requirements check

In order to make sure the concept will indeed manage to fulfill all that it needs to achieve, it is compared to the preliminary requirements (see Table 8).

Number	Requirement	
1	MUST display the supply chain	
2	MUST follow at least one crop	
3	MUST distinguish between regenerative and non-regenerative products	
4	MUST focus on a specific area	
5	MUST provide insight into the supply chain	
6	SHOULD encourage stakeholder communication across the supply chain	
7	SHOULD aid in decision-making	
8	SHOULD reflect real-world data (dummy data)	
9	SHOULD focus on the same area as the other RA thesis student	
10	COULD utilize real-world data	
11	COULD make the product traceable to a specific farmer	
12	COULD focus on a regenerative product that comes from multiple sources	
13	COULD focus on regenerative products purchased under a mass balance	
14	COULD include regeneratively grown products that are sold as conventional	

Table 8: *Checking of preliminary requirements*

The green in this table (Table 8) means it most definitely has achieved that requirement, which is thankfully most of them; the yellow, however, means that it it has been partially met and could in fact easily be implemented, which all depends on the data that will be gathered from the stakeholders. To elaborate on the third requirement, the animation will show a product that is already regenerative and explicitly mention this; however, it does not include a counter food supply chain that is not regenerative. So in a way, this requirement has been met, however, it is constricted due to the work and effort that would have to be done in terms of gathering information on another supply chain. As for requirement number 9, it was coloured red, meaning it was not achieved. Since it will be highly unlikely that the farmer(s) of this animation appear in the other RA thesis student's work, as there has not been a concrete chain yet that farmers will allow to be visualized, options have to remain open. With regards to the last three requirements, they are all additions that could be made to the project if the data allows it, which is why they are represented with the colour yelow.
All in all, as the concept currently stands, it aligns well with its intended goals, leaving room for future adaptations.

Chapter 5 - Specification

This chapter aims to translate the exploratory research from the previous chapters into concrete design criteria. Outlining non-functional and functional requirements through the use of stakeholder interviews, storyboards, visual and narrative decisions, a flow diagram and personas with their corresponding scenarios. This process is essentially able to uncover specifications that the design should adhere to, so that it will remain user-centered, goal-oriented, and feasible.

5.1 The Supply Chain

In this section, either the final 'real' supply chain will have been mapped out, or a dummy version of a RA supply chain will have become the example chain of the project. The goal here is to uncover a regenerative chain in Gelderland, which will be achieved by reaching out to potential stakeholders and conducting semi-structured interviews. If it is deemed that none are willing to participate, a switch towards dummy data will have to be made. If so, it will become extremely important that the visualization still resembles reality to the best of its abilities.

5.1.1 Stakeholder Interviews

5.1.1.1 Interview Regenerative Farmer

In the target area of Gelderland, it was quite difficult to find a regenerative farmer by scouring the internet. These few individuals were reached out to over email, together with an information letter on RA and conducting a semi-structured interview, as seen in Appendix B together with a consent form (Appendix B). There was a regenerative grain farmer, located in the target area, that was interested in helping out with the project, however anonymously. Over the phone a semi-structured interview was conducted, containing questions about their practices, produce and supply chain. Appendix D contains both the script for the interview as well as the questions, all in Dutch. The interview was forgotten to be recorded; fortunately however, there were many notes made during the questions in Dutch (Appendix E).

The farmer was more than open to sharing how exactly the chain worked; they were much more in control over their supply chain than most farmers. Called it "from the field to the bakery", being very aware of all that happens to the product they supply. They suggested a few interesting grains with regard to what would be interesting in visualizing. Red wheat was picked as the sole focus for this supply chain, as it is a grain type that is used for flour; in any case, the most relatable for the project's users in terms of end products. They proceeded to explain their regenerative practices and reasoning for the transition towards these methods, which was mainly wanting to work better together with nature. These methods were to be visualized in the animation, showcasing examples for RA. This farmer stated that they were inspired by other farmers across the globe, who have implemented regenerative methods successfully, and decided to follow in their footsteps with their own little twist on it. The interviewee even gave their reasoning for why they wanted to remain anonymous, stating that there is a lot of judgment in the farming community, especially where they are located. According to this farmer, their conventional counterparts are likely to laugh at discovering the novel processes utilized in the field. They then went on to elaborate on every step the produce goes through, explaining their role in the chain and their knowledge, which, quite frankly, was a lot, on each and every step in the supply chain. And lastly, they revealed a little bit about their financial situation after and during the transition, stating that the revenue stayed relatively similar to

previous years, but contained minor reductions, which, quite frankly, is positive when it comes to transitioning to RA.
Most answers were to be incorporated into the design, showcasing the specific supply chain for red wheat, its stakeholders, and the methods used.

5.1.1.2 Interview Distribution Company
Within this specific supply chain, most actors were not willing to participate; however, a distribution company, OVT Winterswijk [43] at the edge of the chain, was up for the task. As this actor is at the very end of the chain, it was beneficial to know the extent of their knowledge of the chain they were involved in, as well as RA. They were asked about this specifically, stating that they were knowledgeable about the chain, not the specifics, such as which stakeholders were involved in the previous stages, but knowing about the phases the product goes through. This interviewee even knew about some sustainable practices within agriculture, as this company drives for the mill in this food supply chain. This mill is organic, so it comes as no surprise that the interviewee is relatively in the know about the production of the product they distribute. However, they had not heard of RA before; this was a new concept to them. OVT Winterswijk was willing to participate in this project, where they were more than willing to publicize their name.
Leading to adding this distribution company to the animation, as the only stakeholders willing to share their private information, open to the idea of users reaching out to them, should they have further questions.

5.1.2 Sustainable Farming, Connection Event
Whilst searching for a supply chain to be conveyed through the project, a sustainable farming event was attended, at the suggestion of the client, titled “Klimaatverandering als kans voor landbouw & natuur in de regio”, organized by Netwerk Platteland [44]. The event focused on utilizing climate change as an opportunity for novel farming methods, it introduced various individuals who are taken with this practice. It was quickly realized that the attendees for this event were policymakers instead of farmers in the field, so the chances of finding a regenerative farmer in Gelderland were slim to none. However, established connections with such actors could still prove to be useful in further stages, such as the evaluation phase. There was time in between workshops on various topics to connect with participants; this proved to be successful, and the project was able to garner the interest of all individuals spoken to. Connections were made with various stakeholders, a representative of ReGeNL [45], a company similar to Foodvalley, however, with their focus entirely dedicated to RA, as well as a policymaker on agriculture in the municipality of my target area, Gelderland, and lastly, a regenerative farmer. All seemed to be very receptive to the idea and were open to helping in the evaluations for the prototype. Bringing useful alternate perspectives to the table with such a diverse group of individuals.

5.2 Storyboard
To make the animation and the steps towards the animation clearer, its details and story should be specified, done here through the means of a storyboard, or rather an overview of the storyboard scenes and the storyboard. Since it will visually plan out the content, structure, and flow, aiding in the next step within this project, the realization.

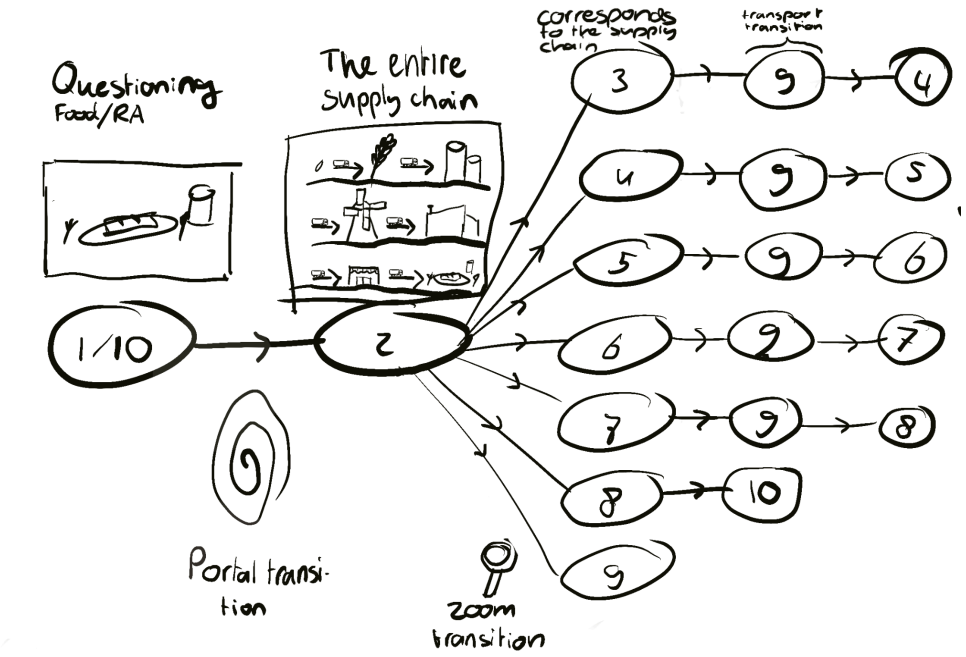


Figure 18: *Storyboard Scene Overview*

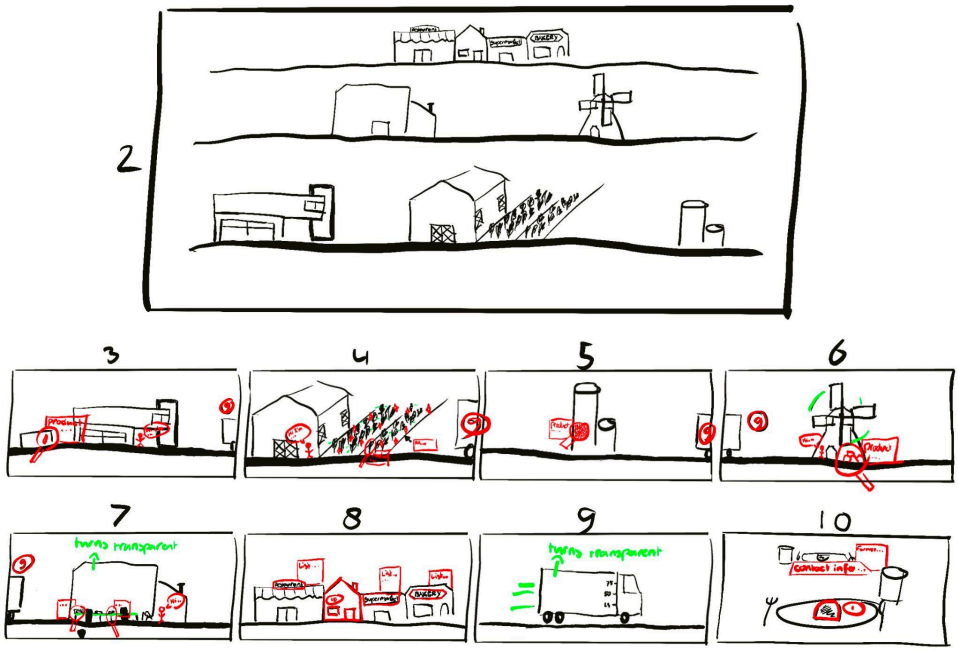


Figure 19: *Storyboard Detailed Scenes*

Figure 18 displays a tree structure of the overview of the scenes that have been elaborated on in Figure 19. Figure 18 starts off with a familiar setting, the dining table from the perspective as if you are the one sitting at this table. Within this scene, you, the user, are suddenly wondering about the origins of the food on your platter and specifically if it is regenerative or not. At the mention of RA, the scene zooms into the food and uses a mystical portal to transition the scene into an overview of the supply chain, number 2

within Figure 19. Here, the various stakeholders are visualized in a village setting, each having either their own buildings or vehicles. The first few stakeholders are at the forefront, containing the most details and interactivity, as these actors are directly linked to RA. In this second scene, the user is allowed to click any of the buildings/vehicles, immediately transporting them to that specific scene. In this example chain the lifecycle of grain is being visualized, however, this animation could be altered to the chain. Each of these scenes contains interactables, as shown by the red lines in Figure 19. The green lines are linked to the simple movements of objects that are already in the scene, such as the turning of the blades from the mill, making the story seem more alive.

In this case, it starts off with a seed supplier. Scene 3 visualizes the supplier with a modern building, where you can click on the person, truck, or the magnifying glass in front of the box that has the product inside it. The magnifying glass, when clicked, can provide the user with a zoomed-in view of the product and a pop-up of the product at this stage. Next is the person, in this case the stick figure, who, when clicked, will introduce themselves and bring up contact information, where applicable. Lastly, the rear of a truck will be visible and, when clicked, will actually transport the user through scene 9 to the next step in the chain.

Scene 9 can be reached directly from scene 2, the overview, as well as be directed to after specific scenes. This scene contains the transport stakeholders within the chain. It starts off with the truck driving from either left-to-right or right-to-left, depending on which level the user is located in the second scene, practically driving off the screen. Whilst the truck is driving, the outside is first visible, which displays the brand of the transport company at this stage, during its drive, the outside will become invisible and give the user a peek of the amount of volume of product that has left the previous stage, and afterwards driving off the frame.

Scene 4 visualizes the farmer with a barn, a field, and a farmer. Here, the interactables are the farmer, the magnifying glass, the truck, and the sparkles on the field. All already known interactables work the same as in the previous scene, however, there will be actual sparkles on the field that are visually linked to the portal, which, when clicked, bring up a small panel that explains RA and the specific method used in this stage.

Scene 5 is the drying and storing of grain in silos, which is casespecific to the example of a grain food supply chain and will possibly not hold true for other food supply chains. In this frame only two aspects are interactive, namely the truck to scene 9, and the magnifying glass, that in this particular case not only zooms in on the product and gives information, but also provides a see through look into the silos.

The sixth scene is also specific to this example chain, namely a mill, where the stored wheat gets transformed into the state it needs to be in for the next phase. In this frame, the windmill blades are turning, and the stick figure, magnifying glass, and truck can be clicked on and work as in previous scenes.

Scene 7 is a tad more complicated, as it depicts the chain's manufacturer. It utilizes the same principle as the transport scene (scene 9), where the outside of the building turns invisible and the user comes face to face with a working conveyor belt that actually moves. The rest of the scene contains the same principles as the stick figure, truck, and magnifying glasses; in this stage, multiple, as the product will most likely go through various changes in this phase.

Scene 8 depicts a little village with all its retail stores, supermarkets, restaurants, and bakeries. Here, one can click on the name sign and a list of all the products retailers will appear.

However, there is also a house present and when clicked will transport the users to a familiar scene, scene 10, but now the user is filled with answers to the questions that were asked at the beginning, bringing the users to a full circle. This scene is a little bit different from the first scene, as now you are sitting with ‘someone’, aka a name card that says ‘contact information’ and when clicked brings up a popup with the contact information of all stakeholders that were involved.

5.3 Flow Diagram

Building on top of Figure 18, Figure 20 was created to offer more clarity into the process behind the scenes. The flow diagram maps the scenes to the interactions between the frames; it leaves out the interactions within the scene, so that the links between the frames can stand central.

The starting scene is outlined in green at the very top, whilst the end scene is allocated in yellow at the very bottom. The purple diamonds are the decisions the user is faced with, specifically only the choices that will lead to another scene. These choices only have two possibilities: “YES” and “NO”. Not surprisingly, “YES” corresponds to actually interacting with the mentioned action, and subsequently leading to the following scene. On the other hand, “NO” means that the user has not undertaken anything and will remain on the scene until they interact with it again. And lastly, the blue rectangles represent the various scenes within the storyline.

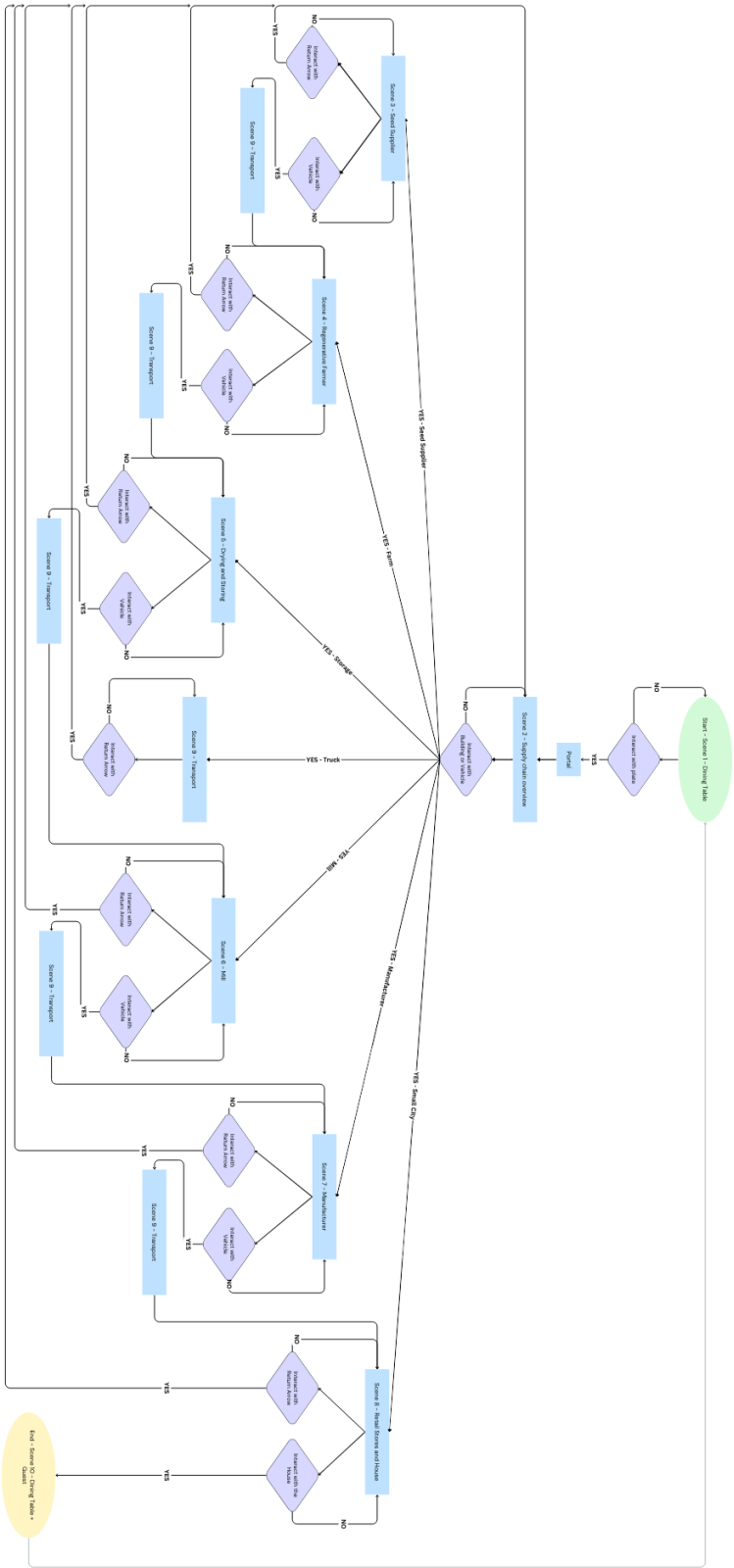


Figure 20: *Flow Diagram*

As can be seen from the form of the flow diagram in Figure 20, it follows a similar structure for the scenes after scene 2 (the supply chain overview). Users will have two interactions that can lead them further or back, the first one being the return arrow, which, to no one's surprise, returns the user to the main screen, the overview. The second one is the opportunity to click on the truck on the screen, which will transport them to the next scene in the list. Only the transport scene (9) and retail scene (8) vary slightly from this structure. Within the transport scene, there is no opportunity to click the truck and be transported to the next frame, as this is that particular transition, however, it does still include the return arrow. In the eighth scene, the penultimate frame, the return arrow is still visible, whilst the truck is also missing, as it has finally arrived at its destination in this scene, however, another interaction is now possible, namely clicking on the house and landing at the end scene, the familiar dining table. Each choice that the user is presented with will lead them deeper along the supply chain. Depending on their decisions, the system will dynamically respond and route the user towards their desired scene. This flexibility gives the user a sense of freedom and allows them to learn through exploring and digesting the information at their speed.

5.4 Visual and Narrative Decisions

This section will outline the visual and narrative choices within this animation, which play an important role in how the tool is received. These decisions should be able to support the aim of the tool, creating an experience that is not only informative but memorable. Keeping users at the center of its design, it supports intuitive navigation and clear and accessible conveyance of the topic of RA.

5.4.1 Visuals

The visuals will be hand-drawn, using various pictures of buildings and objects as inspiration, to give it that sense of authenticity and creativity, as opposed to creating vector art. In an effort to leave a lasting impression on users, through its original and human style. When designing visuals, it is essential that the main users: farmers are taken into consideration. As shown in Table 2 of the document, the “Common themes in farmer feedback on knowledge exchange tools”, quite literally, puts into words what farmers do and do not want in a system. When it comes to visuals, farmers find that they add to the information that is being shared, especially when these are relatable to them. Therefore, the system should primarily utilize visuals, specifically, those that resonate with farmers.

When it comes to the colours of the animation, the feeling they should evoke is one of warmth, yet in a modern way. Modern, as in that it looks fresh, green, and sustainable. What is important when picking colours is the harmony that reigns between them; they must be pleasing to look at when you put them together in situations. Colour theory can help with that [46]. By going through the various options, at least one main colour was chosen; #6fa471, or put into understandable words, a warm, yet light and fresh green (Figure 21). Choosing one colour as the main colour, it allows for the use of multiple colour palettes, such as monochromatic and square (Figure 22), that can be used accordingly, where one can rest assured that the tool will come across as coherent.
For the animation’s elements on nature, colours will be derived directly from real natural environments and subtly made a bit warmer where necessary, ensuring a cohesive look.

Figure 21: *Monochromatic Palette*

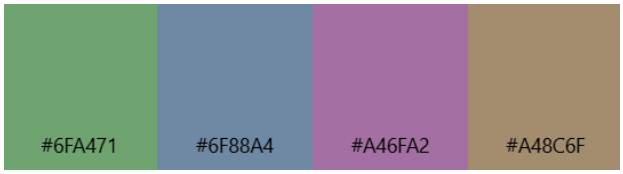


Figure 22: *Square Palette*

5.4.2 Narrative

The only ‘actual’ narration will happen in the first and last scenes. Where a voiceover accompanied by text on the screen, will in the first scene recite questions regarding the origins of the food. The last scene will be characterized by the same voice, but now having left all their questions behind and gained insight, the voice will simply end with a so-that-is-how-it-works moment. The voice itself should initially be curious and perhaps even have a sense of underlying concern and care, whether the food on their table is harmful to the environment. To make the voiceover as relatable as possible, the voice should most definitely be that of an adult and feel and come across as an actual person. It should stay far away from static, robotic voices and speaking manners, neither using very complicated words, as most users will want to understand the storyline, without being taken out of it, due to complicated and irrelevant words. The gender of the voiceover is, in this case, not important, as the given information can be interpreted by both men and women, and the relatability is managed through the tone of the voice and clarity of the message.

The user will have the freedom to interact with all scenes at their own pace and manner, deciding on what to explore, as well as when to explore it. However, there is an overarching storyline, if one wishes to follow it in its order. Where the creation of the product is explained, start to finish, with all the scenes being followed in their retrospective steps. While there is no actual voiceover in these frames, the interaction will bring up pop-ups explaining the process or product at that step. This will essentially guide the users through the making of an end product for a consumer.

In terms of the narrative, farmers have many opinions, as seen, again, in Table 2; it should not be a long stream of unbroken text, but it can be an addition, however, language should be easy to understand. With regard to the contents of the narrative, they value opinions from other farmers with an honest perspective and the option to contact such farmers and other stakeholders. Additionally, the tool should have a navigation that is easy to use and an inclusion of numbers. All except for the numbers will be kept in mind when creating this tool, as gathering the actual economic state requires the stakeholders to agree to share such personal data.

5.5 Personas

Ensuring that the design is appropriately aligned to its users, personas were created. Offering a structured approach to translating the vast diversity of stakeholders within the food supply chain into design observations that can actually be applied. The following personas were made considering the most important stakeholders of this project, based on the stakeholder salience analysis in Section 4.1 [37], those being; the farmers, both regenerative and traditional, the client and a policymaker, whilst they are not a definitive stakeholder, the amount of power they have can change the entire course of farming. Capturing

their specific positions within the chain, with an emphasis on their individual priorities, will serve as a reference point in the design decisions. The images used were generated by an AI model that creates realistic faces of people that do not exist [47].
To hypothetically evaluate the effectiveness of the tool, scenarios with the personas, in real-life settings, were developed. As they will be able to represent the variety of stakeholders, whilst providing their perspective and insights on their interactions with the chain, with the possibility of uncovering aspects that need to be altered to capture the core aims of the project.

5.5.1 Persona 1 - Regenerative Grain Producer

The main users for this project are emulated through this persona: a regenerative farmer, and people who are already engaged surrounding this topic (Figure 23). For these users, the ability to share knowledge between stakeholders and mainly farmers can be valuable in broadening the understanding of these practices, maybe even discovering other methods and implementations. The main goal here is to improve their current agricultural practices.
Sasha started off as a traditional farmer but recently switched to regenerative agriculture. The transition was slow but paid off in terms of sustainability. Whilst she does reap the long-term benefits of this approach, she feels isolated within her field and would love to learn from like-minded individuals how they work with these practices. Another aspect that interests her is what exactly happens to her products along the way; a tangible overview of an example supply chain can help in clearing up these questions, whilst explaining and validating her efforts.

Figure 23: *Persona 1 - Sasha Veerman, Regenerative Grain Producer*

5.5.1.1 Persona 1 - Scenario

1. It is a regular late Tuesday afternoon, and Sasha has finished her tasks on her small farm in Groenlo for the day. She settles down at her dining table with a cup of tea, the clock striking 5 PM. She opens up her laptop and checks her email when one in particular catches her eye: “An example of a regenerative supply chain.”
2. Curious, she clicks the link, landing her on the first scene, the dining table. She tilts her head, inspecting the scene, funnily enough, she is sitting in a similar setting. She lets the scene play out, and the narrator voices their internal thoughts, filled with wonder and curiosity, about where their food comes from. The thought makes her smile, she has been in the same situation.
3. As the scene zooms in on the food, a portal gradually appears, taking her slightly off guard. She watches her computer screen in suspense, wondering what could possibly appear. The frame that appears is the second scene of the storyboard, the entire supply chain visualized by buildings. Sasha takes in the screen, waiting patiently for something to happen. When nothing happens, she decides to click on a building she recognizes, a farm.
4. That transports her to a farm setting, the same building as before, but, now with more objects surrounding it. Her attention is immediately drawn by the sparkles on the land. Now expecting some interaction, she clicks on it, and a pop-up introduces the term regenerative agriculture and the methods implemented in this specific setting. Sasha is all too familiar with regenerative agriculture, but her interest has been piqued by the specific practice applied; this method is new to her.
5. She explores the scene further, clicking on the person, and bringing up their contact information. This sparked an idea within her. She wrote down their personal information for later use.
6. Finally, she interacts with the magnifying glass, providing her with a well-known, detailed view of the product on its stage. As Sasha is a grain farmer herself, this specific information interests her the least, so she clicks on the truck, which, through scene 9, transports her to the following scene, 5.
7. Sasha diligently follows along with the rest of the scenes, whilst curiously exploring the frames. The entire course of the product gives her a better sense of what exactly happens to a product and how it gets to the end stage.
8. As she interacts with the house, she is met with the same scene as she started with. She is at first taken by surprise, but not in a negative manner, as she notices the sign that says “contact information”. She clicks on it and is met with all the actors involved within the supply chain. She smiles to herself and realizes she should contact the regenerative farmer for more information on their implementation of RA, she might learn valuable lessons.

5.5.1.2 Persona 1 - Scenario Takeaways

The tool seems to have met its goals, as this particular persona used this animation as an opportunity to write down contact information on those she could, in fact, learn from. Some minor issues, however, occurred, as it is not fully clear yet whether the users are given control over the visualization after the portal appears. That specific aspect, at first confused the user as well, since it is beyond realistic, but perhaps more an action that users will have to get used to, as the ‘magical’ element will reappear in raising attention to RA, the same goes for the interaction that takes users to the last scene.

5.5.2 Persona 2 - Traditional Lettuce Farmer

Arguably, a more hard-headed user, this traditional farmer, is equally important, if not more so (Figure 24). They are the users who should be convinced by the animation to adopt such regenerative practices; however, their aversion to change stands in the way of actually applying new methods. These users need convincing and encouragement to implement RA practices. This persona will highlight the need for an easily comprehensible visual introduction to the world of regenerative agriculture and its supply chain.

Hans is a traditional farmer in every sense of the word; he has a strong aversion towards change and personally is not aware of the impact that agriculture has on the environment. Unlike Sasha (Persona 1), this farmer can benefit from being educated on this topic, without turning the blame towards them, as that might result in the opposite effect. What motivates him is having a financially lucrative farm within a close-knit community. In this particular sense, the tool should continue to incorporate other farmers, in order to lower the threshold for transitioning to RA, allowing for connections to form and perspectives to switch. Additionally, it might be of value to the tool to incorporate financials as an aspect, since the economy is what makes the world go round, and many farmers, such as Hans, deem that as an important factor.

Figure 24: *Persona 2 - Hans Siemens, Lettuce farmer*

5.5.2.1 Persona 2 - Scenario

1. Hans is sitting at his favorite cafe, having lunch, together with his farming buddies. One of them perks up, “Have you guys seen the farming tool?” Hans’s brow furrows at the mention of the tool, but he answers his friend nonetheless, “No, I have not seen it yet.”. The friend pulls out their laptop, takes a seat next to them, and boots up the visualization.

2. Skeptical, but curious, Hans watches the screen as it plays out. He listens to the narrator voicing their concerns over the origin of the food on their table. A gruff chuckle escapes his mouth as he says, “How could they not know the origins?”
3. As the scene transforms into the supply chain, he narrows his eyes as he takes in the various buildings. He visibly lightens up at the sight of there being so many buildings, not fully in the know about this.
4. Hans is confused as to why nothing is playing on the screen anymore. His friend nudges him to click on any of the buildings. He reluctantly does so, clicking on the one thing he knows, the farm. His expression softens at the sight. The sparkles catch his attention, albeit not necessarily in a good way, and he can only think that it strays too far from reality. Still, he clicks on the soil, and the pop-up appears, explaining the practices.
5. As the text explains the positive aspects of regenerative farming, without blaming traditional farming. Hans appreciates that the focus is on regenerative agriculture and not the downsides to traditional farming, so he starts to gradually mull it over, as far as someone as hardheaded as him can. When he clicks on the person and the contact information of an actual farmer, he starts to warm up slightly to the idea, realizing that there are people practicing regenerative agriculture.
6. He goes through a few other scenes, already familiar with the drying and storing of grain, and he starts turning disinterested. So he goes back to the overview, clicking on a building that he does not recognize, the manufacturer. He explores the setting, finding surprising comfort in learning about this aspect of the supply chain.
7. After this scene, he decides he has been interacting with the tool for long enough and closes the program. His mind is filled with additional questions, mainly regarding the financial situation of this specific method, and he might contact the aforementioned farmer. Leaves with a fuller sense of the supply chain, a slightly more open-minded look at regenerative farming, and decides to himself that he might return to this tool, if and when he has further questions. But for now, he needs to let the information sink in.

5.5.2.2 Persona 2 - Scenario Takeaways

The tool tried its hardest to convince this traditional farmer, but unfortunately did not seem to work entirely. However, it seems that due to this animation, this persona has become more open concerning regenerative approaches to farming, particularly after learning there are actual farmers utilizing these practices and an innocuous way of explaining RA. Just like Sasha, however, Hans was struggling with how to use the program and adjusting to the otherworldly aspects.

5.5.3 Persona 3 - Client Innovation Manager

Not all users of the tool will be farmers. Cillian here represents the client, Foodvalley (Figure 25). His involvement within this project mainly focuses on the design being able to reach its set goals, those being offering a broader sense of RA awareness, creating transparency around the food supply chain, allowing for peer-to-peer information exchange on this particular topic, and be able to guide these stakeholders towards the path of RA.

Cillian is an innovation manager at Foodvalley, working at the forefront of ingenious ideas. His mind is constantly running with novel concepts he has come across, concepts that would innovate the food system, on its sustainability. He is in need of new ideas that can be implemented in ways that leave a sustainable footprint behind. For this user, the animation should not only tell the story of a project, but it

should be able to act as a bridge between stakeholders and hesitant farmers alike, connecting the narrative with real-life people and organizations. Allowing the tool to show what RA can do and how it precisely moves through such a complicated chain.

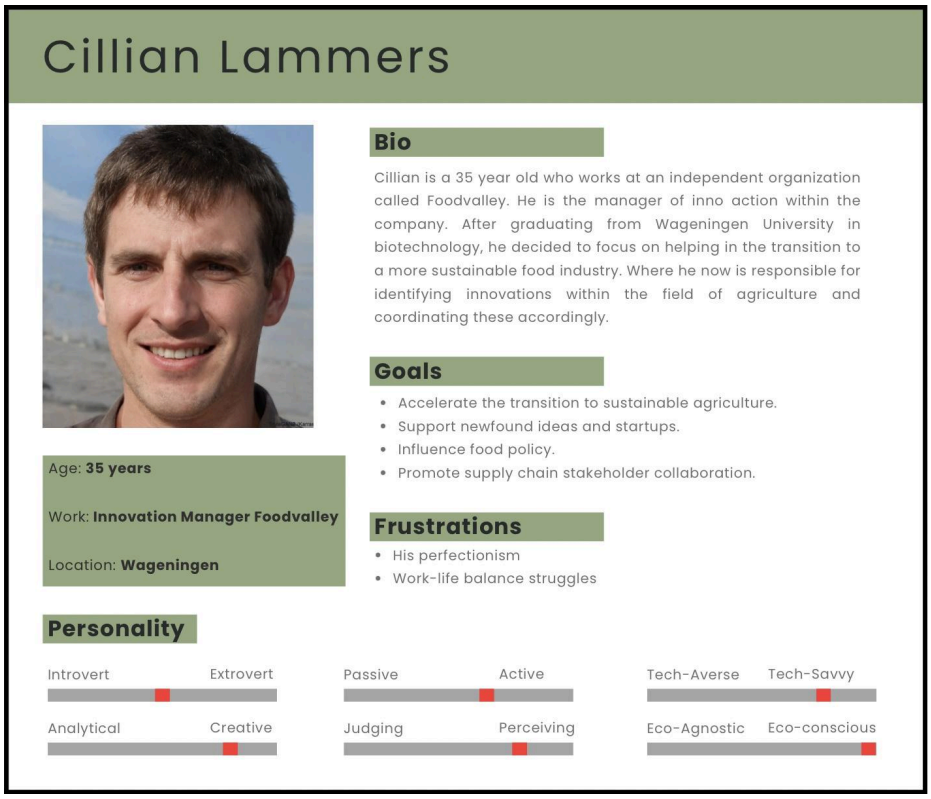


Figure 25: *Persona 3 -Cillian Lammers, Innovation Manager Foodvalley*

5.5.3.1 Persona 3 - Scenario

1. It is morning, and Cillian is sitting in his office going through his email when he comes across an email that claims to have a product that visualizes the RA food supply chain. Curious, he clicks on it.
2. The animation starts off with its relatable setting, one he has been in many times as well, wondering about the sustainability of the products on his plate. The scene quite literally transports him to the next one, the portal leaving him wondering what the next frame will be.
3. The screen shifts to an overview of the supply chain through buildings. He clicks on the first building he sees, a research facility. As the building comes into the frame, he starts exploring it by clicking on the magnifying glass, providing him with information on the product at that stage. He finds the next interactions mainly by exploring by accident, but is grateful for the information nonetheless.
4. As Cillian interacts with the truck, it directs him to the transport frame. He is surprised when the outside of the truck disappears and provides the user with a side view of what is actually inside the truck, together with a ruler that visually shows the amount of product going from one stage to the other. He is impressed by the visual integration of the amount of product.

5. The following scene is that of the farm, where Cillian's interest is piqued by the sparkles on the field since the other frame does not include any. He interacts with them, and it brings up information on the specific regenerative agriculture practices used. He smiles to himself, finding it a very standout and positive visual in terms of RA.
6. He goes back to the overview, wondering where he is at this point. Cillian scans the buildings, slightly confused about how exactly the chain moves. Left to right? Right to left? Or maybe even both? So instead, he goes back to his previous scene and clicks on the truck, knowing for sure that it will get him to the correct scene.
7. Cillian follows along with every scene, trying to find all interactables possible, which was quite easy after the first few scenes, since they are the same throughout, appreciating the clarity.
8. When arriving at the penultimate frame, he goes through the various retail names, clicking on the house, not expecting anything to happen, but gets to the final scene. He chuckles at the setting, turning it into a full circle. But this time, there is a place for another person, any of the contact persons involved in the chain. Cillian can already imagine that in practice, this can be the starting point for real supply chain collaboration.

5.5.3.2 Persona 3 - Scenario Takeaways

This scenario is able to demonstrate that the tool could be used strategically by an organization such as Foodvalley, by having the supply chain actors be visually connected with each other. Nevertheless, the interactivity, while appreciated, especially the knowledge it provided, was not as straightforward to this user. A main roadblock for Cillian, however, was that he was unsure of the journey of the product when looking at the overview scene.

5.5.4 Persona 4 - Policymaker Sustainable Agriculture Gelderland

The most influential actor, who is able to either bring things to an abrupt halt or a speedy start. Though not directly involved in the food chain, the actions of this stakeholder are directly connected to the implementation of RA. The job of this specific policymaker includes coordinating and advising on policies toward sustainable agriculture (Figure 26). The tool needs to convince this specific actor of the importance and benefits of RA so that this concept can be picked up by the ministry.

Karina works within the Ministry of Gelderland as a policymaker on sustainable agriculture. As someone who is not directly in the field, it is important that the information is delivered in a manner that is understandable to all. The animation should give her the tools to communicate this topic to the rest of the municipality, demonstrating its value. Framing RA as a method that justifies funding due to its positive impact on the environment.

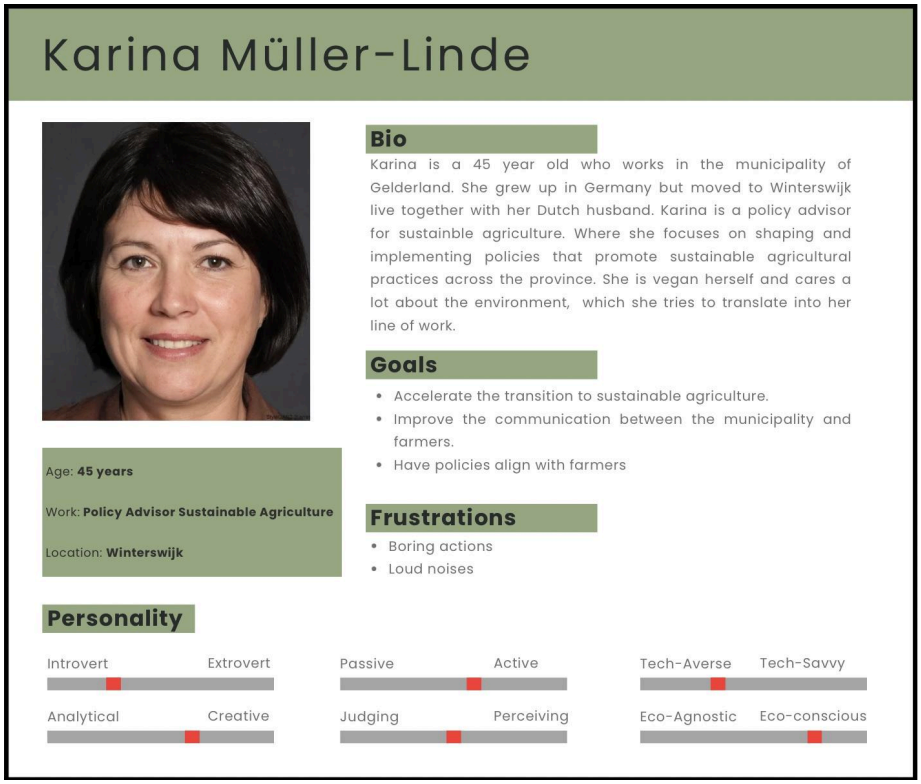


Figure 26: *Persona 4 - Karina Müller-Linde, Policy Advisor Sustainable Agriculture*

5.5.4.1 Persona 4 - Scenario

1. Like most personas, Karina received an email with the corresponding tool. She was sitting at her desk inside the municipality of Gelderland when she got a notification regarding the email. Lately, she has been hearing frequent things about this new method of farming called RA. It is safe to say that she is intrigued by the email's content.
2. She opens the tool and is met with the first scene, the dining table, showcasing a scenario that she has recently been in herself. Immediately formed some sort of emotional attachment to the project, since it literally hits close to home.
3. Through the portal, a stylized village appears. Karina notes that these buildings must be the supply chain. She immediately starts exploring, at complete random, she clicks a building. The scene turns into that of a manufacturing building. The outside of it is slowly disappearing to reveal the process on the inside; this movement captures Karina's attention.
4. She very quickly grasps an understanding of the interactivity of the system, through 'exploring' the scene with her mouse. As she learns about the product in this stage, she wonders where the aspect of RA comes into play, so she maneuvers back to the overview scene and clicks on the one she expects to include regenerative farming, the farm.
5. Her intuition is deemed to be correct, as this scene explains the RA methods utilized by the farmer. She is content with the information she's received through clicking the glitter. Whilst she does not understand every single aspect of what is explained to her, she gets the gist of it.
6. The rest of the scenes she follows chronologically, but she starts to lose interest quickly, as most interactions are the same. However, she does diligently follow along with the rest of the frames. Eventually, due to her exploration, she found the end scene. Karina is very content with the

contact overview, so she is able to directly reach them as the municipality of Gelderland. She is also pleasantly surprised at the full circle and now realizes all the questions from before have been answered.

5.5.4.2 Persona 4 - Scenario Takeaways

It could be argued that the tool was able to garner attention from even a non-expert in the field of agriculture. It was able, like most personas, to develop a personal attachment to the users, as they found it relatable, which helped in conveying the animation's message. While not all was understood by Karina, she found the information accessible enough. Yet, her attention wavered at the end, due to the interactions being mainly the same as in the other scenes. The final scene, however, was able to regain her attention by tugging on that personal attachment.

5.6 Functional and Non-Functional Requirements

After the identification of the key users and their interactions with the system, the functional and non-functional requirements for this tool can be made with their takeaways in mind. They will be able to steer the project in the direction of a successful supply chain on the RA tool.

5.6.1 Functional requirements

The functional requirements describe the specific tasks the system must be able to perform, as seen below in Table 9.

Number	Functional Requirement
1	MUST at least display scenes 1, 2, 4, and 10 of the supply chain
2	MUST be interactable
3	MUST provide the user with pop-ups of information
4	MUST be cohesively hand-drawn throughout scenes
5	SHOULD include a voiceover or text for the first scene
6	SHOULD include contact information, or the option to add it
7	SHOULD be able to run on most devices
8	COULD include text for the voiceover in the first scene

Table 9: *Functional Requirements*

5.6.2 Non-functional requirements

The non-functional requirements should outline how the system achieves its functions, focusing on usability, visuals, accessibility, and user engagement as seen in Table 10.

Number	Non-Functional Requirement
1	MUST use real data, or as close to real data as possible
2	MUST have self-explanatory interactions
3	MUST have the information written in an accessible manner
4	SHOULD be easy to use
5	SHOULD contain clear language
6	SHOULD have the RA visuals stand out
7	SHOULD appeal to all supply chain stakeholders
8	SHOULD have a curious human-sounding narrator in Dutch

Table 10: *Non-Functional Requirements*

Chapter 6 - Realization

The realization phase describes the process of turning the concept into a tangible project, based on the design choices and requirements found in the previous chapter. Before the animation could be created, it was divided into clear sub-systems, making sure that all functional aspects of the tool were integrated. After their identification, these sub-systems will be realized and evaluated based on the functional requirements as discovered in Chapter 5, leaving room for remarks and changes for the project.

6.1 Defining Sub-Systems

It is useful to create a so-called ‘separation’ within the design. Deconstructing it into sub–systems that together make up the entire design. This will make it easier to evaluate the effectiveness of the design, as the focus is entirely on a specific direction, a sub-system. Four sub-systems were discovered for this animation: the narration, visuals, educational elements, and interactivity.

The visuals are supposed to accurately represent the real-world supply chain. The visuals on their own should be able to tell the storyline that the grain follows. It will collaborate closely with the narration, as the narration will be there to remind the user of elements that must not be overlooked. This data can refer to background information, providing an experience, essentially making the tool feel more alive, or as an aid to the other systems. Another significant factor in this design is the educational elements since that sub-system will focus on conveying information to the user. These three systems should be able to work hand-in-hand, whilst individually being able to reach their goals. They should emphasize each other when put together. This is done by the fourth system, the interactivity. It is quite literally the glue that connects the narrative, the visuals, and the educational elements. The user has been notified of the instructions on handling the system through the voice-over, and they will then interact with certain visuals, generally bringing up another visual with educational text explaining the step seen on the screen.

6.2 Realization of Sub-Systems

Having the sub-systems identified, they can now be realized in terms of the project. Each sub-system is discussed concerning the project, with what tools it was designed with, and finally, how it was realized. The final version of the prototype did come to be after going through the evaluations and bringing changes and alterations into play. The evaluation was divided into cycles, following two or three evaluations, the prototype underwent changes accordingly. The final prototype as depicted within this chapter was realized after the second cycle of evaluations in Chapter 7.

6.2.1 Visuals

The biggest part of the project, the visuals, will set the tone throughout the entire design. Its cruciality to the project should not need to be explained, it being the base and quite literally all that a user sees. Figure 19 served as the basis for all of the final visuals as elaborated on in section 6.3. The visuals were hand-drawn in Procreate [48] on an iPad, together with the use of reference pictures (Appendix F). These drawings were then imported into Figma [49], so they could be used for the tool. The style tried to emulate more of a classic hand-drawn feel instead of tight vector images. Most of the colours utilized were straight from the colour palette specified in Chapter 5; other colours were mostly earthy tones that resemble real life and do not cry for attention, as the rest of the colour palette is more than able to fulfill

that role. The font used is a dyslexia-friendly font called Verdana. Special attention was put to making sure the font always stood out in its colouring, by making it the opposite colour to the background.
The storyboard made in Chapter 5 was the basis for these frames. The final product did, however, deviate slightly from the storyboard. The total number of different settings for the scenes turned out to be 11, one more than the specification, as some scenes were altered according to the input received from the farmer regarding the supply chain. The opening scene stayed the same, a set dining table with food on one's platter, from 'your' perspective. Next, instead of already having the overview of the full supply chain, the portal played a bigger role, where it appeared and introduced the topic RA, using Van den Hoorn et al.'s definition [50] and afterward introducing the chain as an example food supply chain, instead of presenting it as the only model or even correct model, Figure 32 and 33. The follow-up scene was where the entire supply chain was visible to the user, as displayed in Figure 34. Technically, after this scene, the order of the frames does not matter anymore, given the freedom the users were given in exploring the system; however, for consistency, it is better if one follows along with each step as it appears in the supply chain.
There is an evident contrast between the first and last versions of the prototype. Figures 27 and 28 display this difference the best. Here is an overview of all used frames can be seen. All these scenes represent a change/interaction within the system. Section 6.3 describes each scene, as depicted in the overview from Figure 28, in detail.

Figure 27: *Overview Frames in Figma First Prototype*
Figure 28: *Overview Frames in Figma Last Prototype*

6.2.2 Narration

While the narration was not part of the first prototype, it is still discussed due to its presence in the final version of the system. The system was first tested without the narration to figure out how far the tool

would be able to get in terms of storyline and navigation. In Chapter 7, evaluation, this addition was implemented after the second stage of evaluations. It became apparent that users were missing some sort of sound feedback and additional guidance. Following this, the narration was promptly realized using the inbuilt AI text-to-speech system from Microsoft Clipchamp [51]. A wide range of voices was evaluated in order to find the one that fits the narrative of the animation the best. The final voice came to be what was called “Remy”. Within Microsoft Clipchamp, this voice was referred to as bright and cheerful, which fit the project well in terms of piquing interest among the users. This voice in particular came across as less static than most, especially the ones that were classified as ‘only-Dutch’ voices. Unfortunately, it is still apparent that the voice is not human, despite trying to limit this. When it actually voiced the script, he sounded curious, but not to an extent that could be considered overdone. The script can be found in Appendix G.

As mentioned in Chapter 5, this voice was only added to a few scenes. In this chapter, it was stated that the narrator would voice only the beginning and end scenes; however, when evaluating the prototype, it was noted that certain actions needed more introduction, thus the voice was used in two other frames. If this interaction were to be missing, the usability of the tool would decrease drastically. The other additional scene where the voice would make its appearance would be the farm where any of the regenerative pop-ups are triggered; this only happens once. The voiceover would bring attention to a specific interaction within this text that would be able to transport the user to a frame that consists of more information on RA. As this interaction could easily be overlooked, the voice helped bring acknowledgment. The indicated scenes, as mentioned in Chapter 5, were incorporated as such. In the first scene, the voice is filled with wonder, citing questions that appear on the screen as well. The last scene ends with making clear that this is indeed the end, the visuals needed a bit of help in that department, and referencing the webpage of the client for further advice and information on applying RA.

6.2.3 Educational Elements

There are many educational elements within this animation, as every single interaction allows for a pop-up with information to be shown. Not only do the popups allow the users to learn, but there is an entire extra frame that delves deeper into the concept of RA.

6.2.4 Interactivity

All scenes possess some sort of interaction, and the entire system is structured in such a way that these actions are cohesive. Figma, the program where the animation was made, allows the user to animate through various interactions that people might have with the objects located in the scene. This interaction is then linked to a following scene that contains the results of this action. Examples of interactions could be clicking, hovering, or dragging. This link between frames can also be transitioned in many different ways, like fading, instant, or smart animating, a useful feature of Figma where it fills in the gaps that it assumes the interaction would have.

There are several interactions that make up this whole system. First of all, there are the clickable objects, which are what the tool mainly consists of; these interactions are indicated differently depending on the scene. The first possible option is the arrow, where an additional arrow shows the user where to click on an object. Depending on the frame, it could either transition the user to another frame or bring up a pop-up. Next, there is the hover, which is integrated only with the magnifying glasses, where when a user hovers over the object, it will ‘zoom in’, aka reveal an object that is located within the frame. Figure 29 is an example of the many interactions a frame can have.

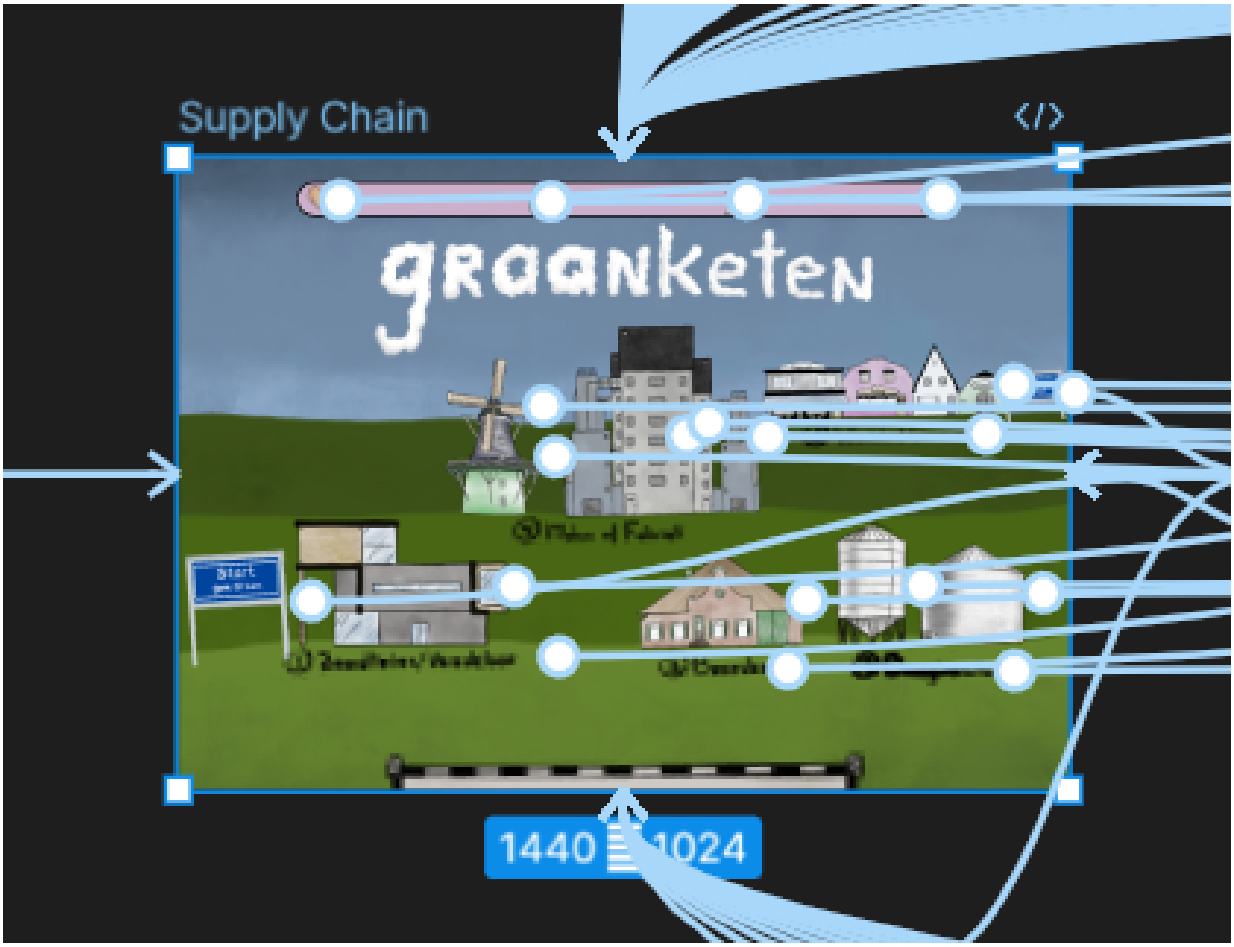


Figure 29: *Interaction Links of the Supply Chain Overview Scene*

The first prototype had considerably fewer features than the finished prototype, as during the evaluations, there was a consensus among participants that the system was lacking in information, as well as having a rather stagnant usability. These issues were resolved, as far as that was possible in the final animation.

6.3 Scenes Divided over Sub-Systems

Each and every scene differs from each other in many ways, therefore they have been explained in greater detail over the discovered sub-systems.

6.3.1 Scene 1 - the Dining Table

When opening the link to the prototype, this is the first scene that will be displayed. The figure on the left (Figure 30) is the starting position of the frame, whilst the one on the right (Figure 31) shows the state of the scene at the end. This scene does not involve any educational elements; it only sets the user up for what is to come.

Figure 30: *Scene 1 Start*
Figure 31: *Scene 1 End*

6.3.1.1 Visuals
A dining table is seen from the perspective of the user. The table is set for one, "you", yet there is an empty chair in front of the user. The plate contains bread, a subtle hint of the specifics of the food supply chain that will be followed.

6.3.1.2 Narration
In the first scene, the narrator is filled with wonder, citing questions that appear on the screen simultaneously. The narrator is meant to represent "you" again, mimicking an experience that many might have had, wondering about the origins of our food and all that it comes along with.

6.3.1.3 Interactivity
The only use-cue within this frame is the white arrow that hovers over the bread. This represents the action of clicking on the bread, essentially guiding the user along. When a cursor hovers over the bread, it turns into a hand, giving even more hints regarding interacting with this frame. By now, it should be clear that the bread has to be clicked; when this occurs, a text will appear on the wall. Click again, and another sentence will appear until there are three; the next click will then transport the user to the next scene.

6.3.2 Scene 2 - the Portal
The following scene is that of the portal, also called the transition scene. This is where an introduction to the actual content of the animation gets made, introducing RA and highlighting the importance of this chain being an example, not a set standard.

Figure 32: *Scene 2 First Stagnant Frame*
Figure 33: *Scene 2 Next and Last Stagnant Frame*

6.3.2.1 Visuals
There is no doubt that this scene contains a portal in the background, inspired by Appendix F, the colours used for the portal was mainly out of the chosen colour palette from Chapter 5, wanting to make these colours subconsciously associated with RA.

6.3.2.2 Educational Elements
This scene is the first of many educational elements. In Figure 32, the user is introduced to RA by displaying a translated version of an academic definition of RA by Van den Hoorn et al. [50] on the screen. In the next figure, the user is informed about the importance of noting that this is merely one example of many food chains, the vastness of RA, and what kind of supply chain will be the example.

6.3.2.3 Interactivity
The interaction is the same as in the last frame; the cursor clicks on the text. However, in this case, more happens on the screen; the portal first twists into a different position before stopping in Figure 33. Clicking on the text in Figure 33 will twist the portal again and let it fade out into the next scene, the supply chain overview.

6.3.3 Scene 3 - the Supply Chain Overview
The next scene is essentially the "home" scene as a starting point to the chain, where an overview of the entire supply chain is made visible through the use of buildings, representing the steps and actors within.

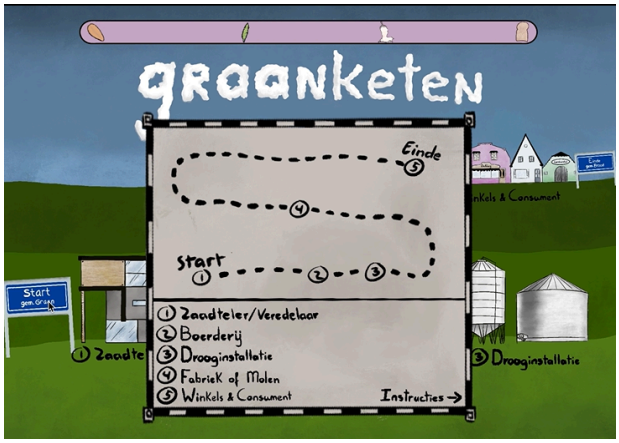


Figure 34: *Scene 3 Supply Chain Overview*
Figure 35: *Scene 3 Map*
Figure 36: *Scene 3 Map Instructions*

6.3.3.1 Visuals

The scene, Figures 34 to 36, is laid out in such a manner that it makes the supply chain feel like a sort of village one can go through. All the various buildings represent steps in the grain supply chain, which will be zoomed in on in later scenes. The top of the frame contains a progress bar with the state of the product included, which will gradually fill up between frames. Additionally, the specifics of the supply chain have

been displayed through the title “grain supply chain”, drawn as clouds in the sky. There are three levels of grass, granting perspective. The start and end of the chain are accompanied by a welcome sign from the municipality, grain, and bread, derived from the reference picture in Appendix F. Figures 35 and 36 are of the map that can be seen in Figure 34 at the very bottom. In Figure 35, the journey in this supply chain is laid out over actors, making it clearer where exactly the user is in the process. The back of the map in Figure 36 includes instructions needed for navigating the system.

6.3.3.2 Narration

This scene involved the addition of a voiceover, where it was essential for the users to follow along with this one action, reading the instructions. Here, the narrator welcomes the user to the supply chain, directs them to click on the start sign, and forwards them to the instructions.

6.3.3.3 Educational Elements

Educational elements in this scene are mostly geared towards providing users with information on how to interact with the system, except for the map in Figure 35, which teaches the user about the stakeholders involved in the road that this grain traverses.

6.3.3.4 Interactivity

As discussed in 6.2.4, this scene contains many interactions. Starting with the start sign, when clicked, it will bring up the map as seen in Figure 35. Within this figure, the instructions with the arrow can be clicked, which will then display the backside of the map, Figure 36. On this page with instructions, the pop-up about RA can be clicked on the white field, which will bring up an additional pop-up showing how the system works (Appendix H). The arrow on this map would allow the user to go back to the previous page. Clicking anywhere within this frame would get rid of the map. In Figure 34, all buildings can be interacted with, transporting the users to the accompanying scene of that particular building. Offering a significantly less structured way of navigating. Lastly, there is the progress bar, where it is possible to click the drawings of the product in its various stages, which will transport the users to the scene that is all about the product in that stage.

6.3.4 Scene 4 - the Seed Supplier

When clicking on the building of the seed supplier, it will bring the user to this scene. Here, the supplier is introduced, and further information on the supplier and seeds is given. This scene does not include any narration with the voiceover.

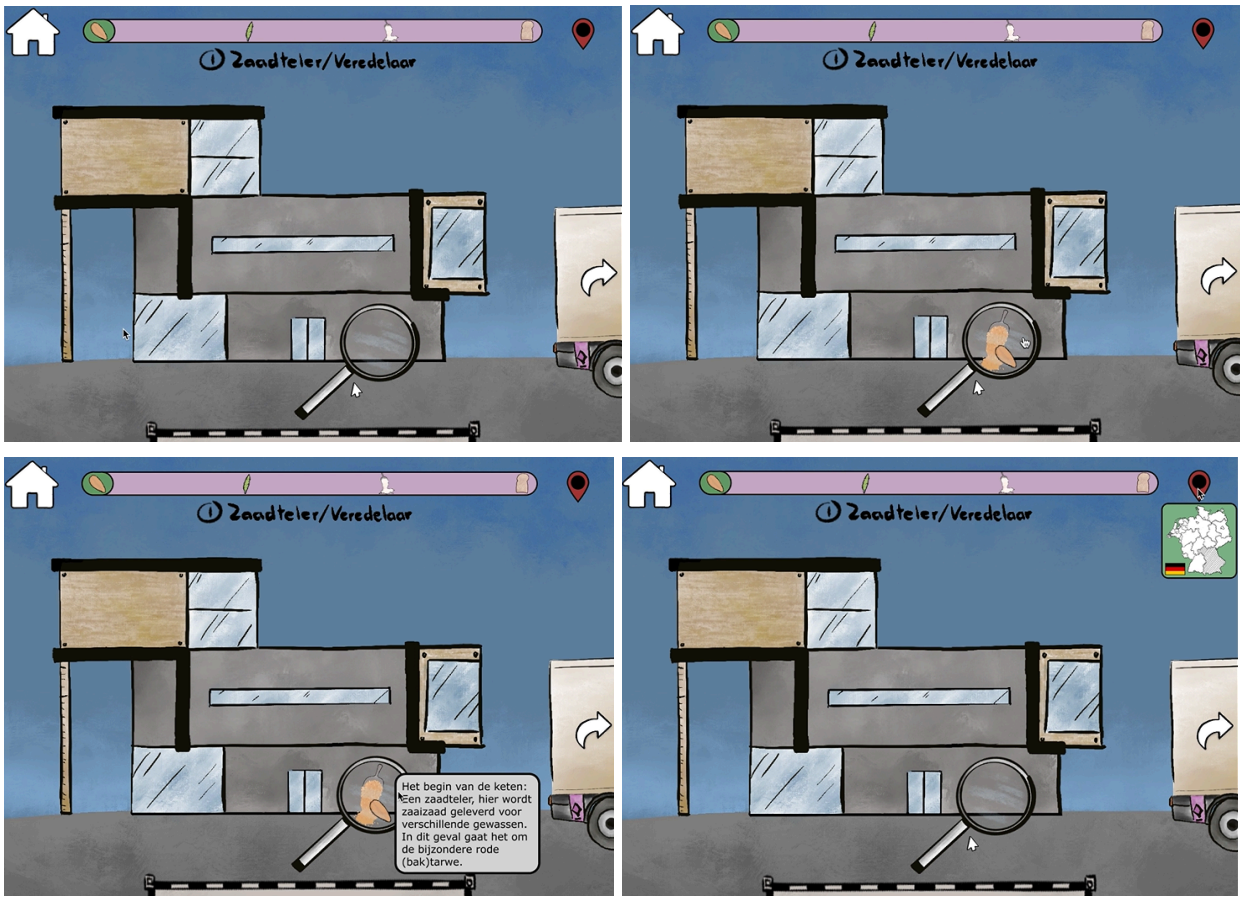


Figure 37: *Scene 4 Seed Supplier*
Figure 38: *Scene 4 Magnifying Glass Hover*
Figure 39: *Scene 4 Pop-up*
Figure 40: *Scene 4 Location*

6.3.4.1 Visuals

The building of the seed supplier is loosely based on both modern structures and a seed supplier in the Netherlands called Syngenta [52]. The structure within this scene will come back in the following ones, where the top of the frame holds the home button, progress bar, and pin for the map, the bottom of the frame the map, all throughout the scene magnifying glass(es), the left side of the frame the 'transition' arrow, within this case the back of a truck, but this can vary on the scene. and. Red wheat seeds are placed under this magnifying glass. The arrow surrounding the magnifying glass will disappear after this scene; it was only to introduce the users to the workings of the tool.

6.3.4.2 Educational Elements

In these frames, both the pop-up and location, Figures 39 and 40, provide the users with information on this stage. The map just displays the location of the seed supplier without any further context. The pop-up explains that this is the start of the chain, what a seed supplier does, and what kind of seed will be focused on (red wheat).

6.3.4.3 Interactivity

Just like in the previous scene, here the progress bar is still interactive. The home button will direct the users to the third scene, the overview of the supply chain, and the pin, when clicked, will bring up the map of its location as seen in Figure 40. These are the first frames that work with a magnifying glass; this will be a recurring object in the animation. It contains multiple functionalities. When hovered over, an object appears (Figure 38), and now the glass can be interacted with, and a pop-up emerges (Figure 39). Click anywhere on the screen, and it will revert to Figure 37. To get to the next scene, the truck with the curved arrow must be clicked.

6.3.5 Scene 5 - the Farm Step 1

The following step in this food supply chain that will be displayed is the farm, specifically the step before growing the grain since that is vital to the regenerative process of producing grain

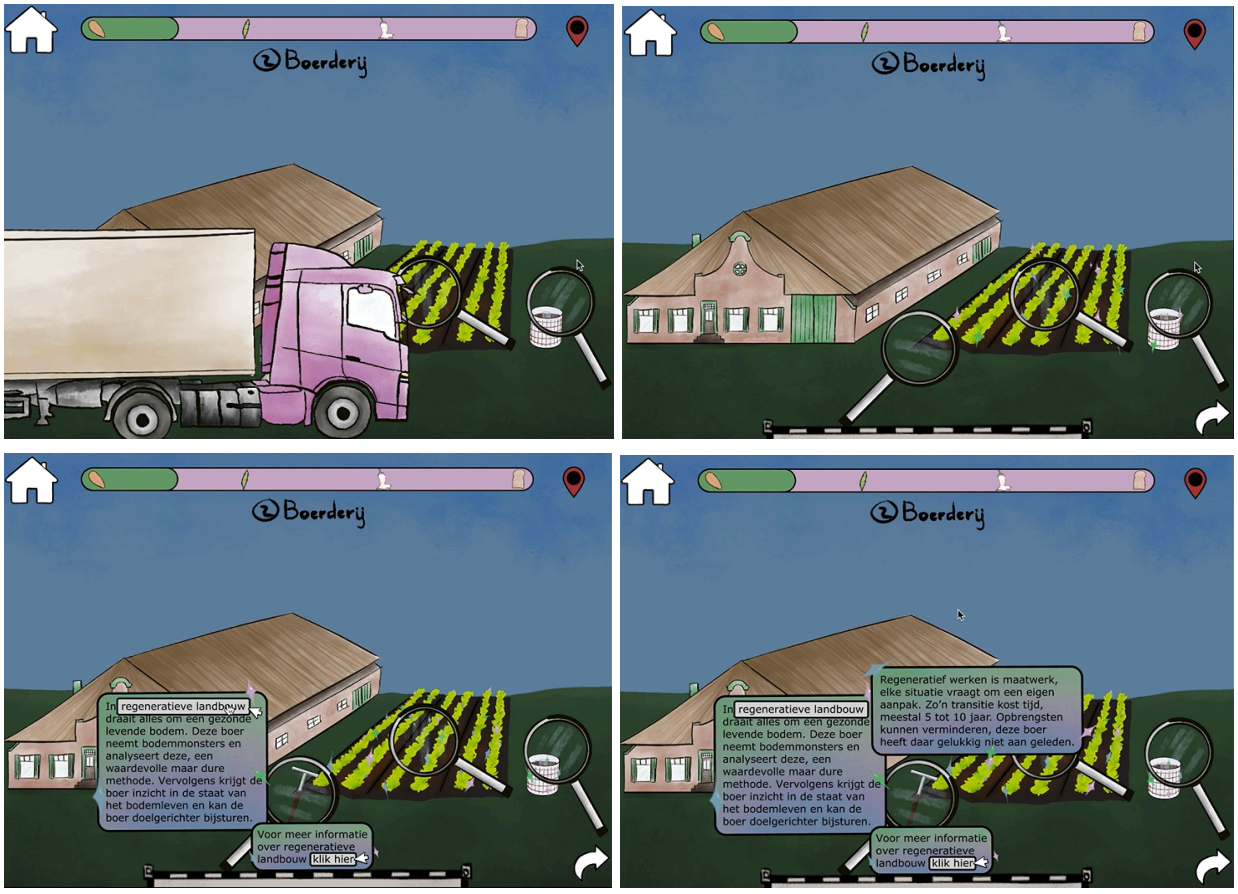


Figure 41: *Scene 5 Truck Transition*

Figure 42: *Scene 5 Base Frame*

Figure 43: *Scene 5 Pop-up*

Figure 44: *Scene 5 Additional Pop-up*

6.3.5.1 Visuals

Before being able to see the entirety of the frame, a truck passes along from left to right, as seen in Figure 41, where it has been captured in motion, which was inspired by Appendix F. After the vehicle has

passed, the scene will look like Figure 42. This scene contains a farm with its crops. The building was based on another farm (Appendix F), incorporating two colours from the chosen colour palette in Chapter 5. The structure of the scenes is similar to Scene 4: a home button, a slightly more filled-up progress bar, a pin, magnifying glasses, a map, and a forwarding arrow. The three magnifying glasses all zoom in on a different aspect, the second and last one can be found in Appendix H, which brings up a bean and an enlarged picture of compost tea. The pop-ups that are brought up by clicking the magnifying glass differ from the usual ones, as seen in the previous scene (scene 4). These RA pop-ups contain three specific colours from the palette from Chapter 5, as well as sparkles, that indicate regenerative methods, as explained in the instructions for the map (Figure 36). This was mainly applied to make it visually more distinct from the regular pop-up so that the user will hopefully automatically relate it to RA.

6.3.5.2 Narration

The narrator is also involved in this scene, however they are only triggered the first time a user interacts with any of the magnifying glasses, where the voiceover explicitly states the complexity of RA, and points them to the option of clicking on a specific button that will transport them to another scene, going more in-depth on this concept.

6.3.5.3 Educational Elements

This scene contains possibly the most information of all of them. The first magnifying glass, located on the left, will elaborate on a regenerative practice that the farmer implements, taking soil samples (Figure 43). A second pop-up within this one can be triggered and will, for clarification, explain the long transition that RA goes through, as well as whether the revenues for this specific farmer suffered under this transition (Figure 44). The middle magnifying glass introduces another regenerative method, this being crop rotation, explaining the specific rotation this farmer goes through (Appendix H). When triggering the follow-up pop-up, it discusses a machine that is utilized for this purpose. Finally, the third magnifying glass elaborates on the practice of using compost tea, how it's used, and that it is in its trial phases (Appendix H). This pop-up allows for the reveal of another one, where what compost tea even is is discussed. Lastly, just like the previous scene, the pin showcases the area where the farm is located (Appendix H).

6.3.5.4 Interactivity

The interactivity within this scene is pretty much the same as in the previous one (Scene 4); however, these interactions will trigger different responses. All magnifying glasses trigger two pop-ups when clicked, one for the seen RA method and another one. Both of these pop-ups contained a hitbox that would either lead the user to Scene 6, where more information on RA was explained, or give further valuable information on the practice. The progress bar, map, pin, and curved arrow can still be interacted with as previously determined in Scene 4. The curved arrow located here will, however, bring one to Scene 7.

6.3.6 Scene 6 - the Additional Regenerative Agriculture Frame

This scene is actually an in-between scene, as it can be referred to through multiple scenes. It contains more information on RA, as displayed in Figure 45.

Figure 45: *Scene 6 Information on Regenerative Agriculture*

6.3.6.1 Visuals

This scene does not contain many hand-drawn elements like the others; however, it does make use of the portal from Scene 2, where RA was introduced, linking these two to each other. The font stayed the same except for the hand-drawn ones, which keep cohesively returning. And is able to make it distinguishable from the rest of the words here. The entire page was tried to be utilized as much as possible.

6.3.6.2 Educational Elements

Basically, this entire scene is an educational element. RA is reintroduced; afterwards, supply chain stakeholders are elaborated on, based on what they could add in regards to RA. Lastly, comparisons between RA and conventional agriculture are made to put it more into perspective.

6.3.6.3 Interactivity

The two interactions within this frame are that of clicking the link of Foodvalley's website at the top left corner, which will direct the user out of the program. The other interaction includes being able to click the backward arrow, which will transport the user back to the previous frame they were on.

6.3.7 Scene 7 - the Farm Step 2

Within the farming stage, a second step is located, that of the actual grain after the beans.

Figure 46: *Scene 7 Base Frame*
Figure 47: *Scene 7 First Pop-up*
Figure 48: *Scene 7 Second Pop-up*

6.3.7.1 Visuals

The visuals within this scene are almost completely similar to Scene 5; however, the crops have changed into grain now, as well as the progress bar is fuller, and the magnifying glasses are completely different (Figure 46). The first one brings up flowers, while the second one shows a more detailed grain (Figures 47 and 48). Two notable additions were made: the tractor with its trailer (based on Appendix F), moving

the arrow that was located in the bottom right corner slightly more to the left, and the addition of the arrow backward.

6.3.7.2 Educational elements
The first pop-up explains the use of another regenerative practice within this stage called herb-rich arable land. The second pop-up finally reverts to the original product, introducing it to grow in the fields now.

6.3.7.3 Interactivity
All previously seen products work as intended, the magnifying glasses bringing up regenerative pop-ups, as well as the additional pop-up that leads to Scene 6. The pin is still showcasing the same picture as (Appendix H). The progress bar and home button are still interactive, and the arrow on the right is still transporting one to the next stage, Scene 8. However, now there was also a backward arrow, which, when clicked, would bring the user back to the first stage of farming, Scene 5.

6.3.8 Scene 8 - the Drying and Storing
The following scene introduces the next step in the supply chain, storing and drying. This phase, however, is not very prevalent in this supply chain as this all happens on the farmer's property, instead of with an additional actor.

Figure 49: *Scene 8 Base Frame*

Figure 50: *Scene 8 First Pop-up*
Figure 51: *Scene 8 Second Pop-up*

6.3.8.1 Visuals
The farming of this scene is similar to the other ones, the content, however, is vastly different. The tractor from the previous scene has returned, driving in from the left side of the screen to stop as seen in Figure 50. Within the scene, there are grain drying cabinets, based on the pictures provided by the farmer (Appendix F) as well as a silo, following the reference picture in Appendix F, placed next to each other to showcase the difference in possible drying and storing methods, as displayed in Figure 49.

6.3.8.2 Educational Elements
The first pop-up explains how this farmer dries and stores its produce, as well as notifying the user where these boxes are located, not in a random field, but in a shed. The following pop-up explains how the storage and drying of grain work in average supply chains.

6.3.8.3 Interactivity
The home button, progress bar, pin, and map work similar to the previous scene. However, one interactive feature has been eliminated, namely, bringing up the pop-ups, which appear automatically. What the users can control, though, is the tractor. In Figure 50, when clicking on the arrow, it will drive towards its position as seen in Figure 51; however, here the user can send the tractor back to the previous frame or forward to the following scene.

6.3.9 Scene 9 - the Processing Phase
The next step within this supply chain is the processing phase.

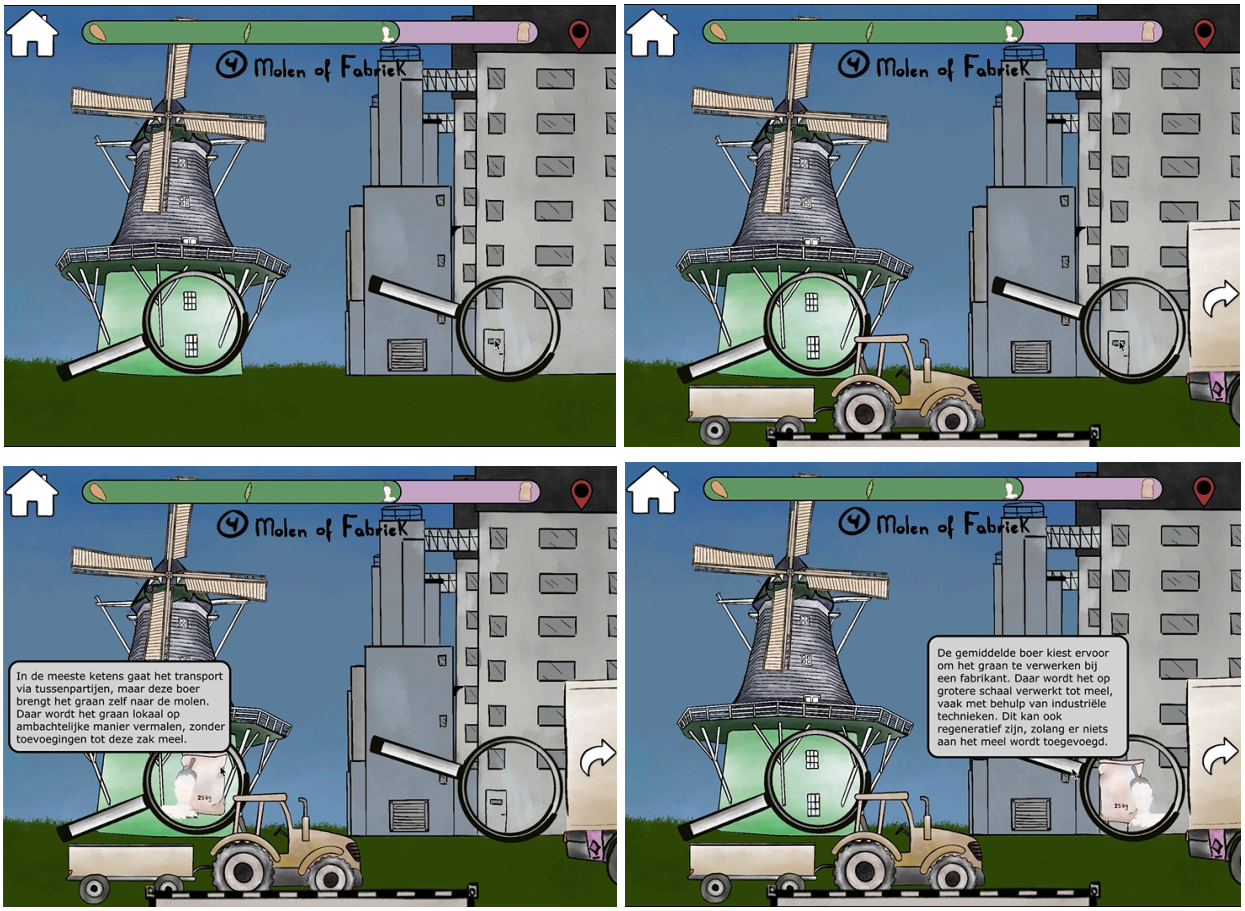


Figure 52: *Scene 9 Base Frame*
Figure 53: *Scene 9 Arrival Vehicles*
Figure 54: *Scene 9 First Pop-up*
Figure 55: *Scene 9 Second Pop-up*

6.3.9.1 Visuals

Here, a few familiar visuals can be seen, of course, the structure of the frame and magnifying glasses, but two vehicles, the tractor, and truck, which drive from the left-hand side of the screen, starting with Figure 52, and driving towards their position in Figure 53. Two visually well-known buildings can be found within this scene: a mill, derived from Appendix F, and a grain factory, inspired by Royal Koopmans [53], as seen in Appendix F, a grain manufacturer. Where the mill incorporates two colours of the square palette in Chapter 5. Within the magnifying glass, a sack of flour as well as flour can be seen.

6.3.9.2 Educational Elements

The first pop-up contains information on how most average supply chains leave the transport to a distribution company, but not this farmer (Figure 54). This pop-up also briefly explains the process of turning it into flour. The second pop-up notifies the user on how, with an average supply chain, farmers usually process grain with a factory, still elaborating on in what cases a factory can be regenerative (Figure 55).

6.3.9.3 Interactivity

Similarly to all other frames, the interactions work as intended (the home button, progress bar, pin (Appendix H), map, forwarding arrow, transporting towards the next scene, 9, and magnifying glasses, bringing up the correct pop-up).

6.3.10 Scene 10 - the Retailers (& Consumer)

The last phase of the supply chain is the retailers and consumers.

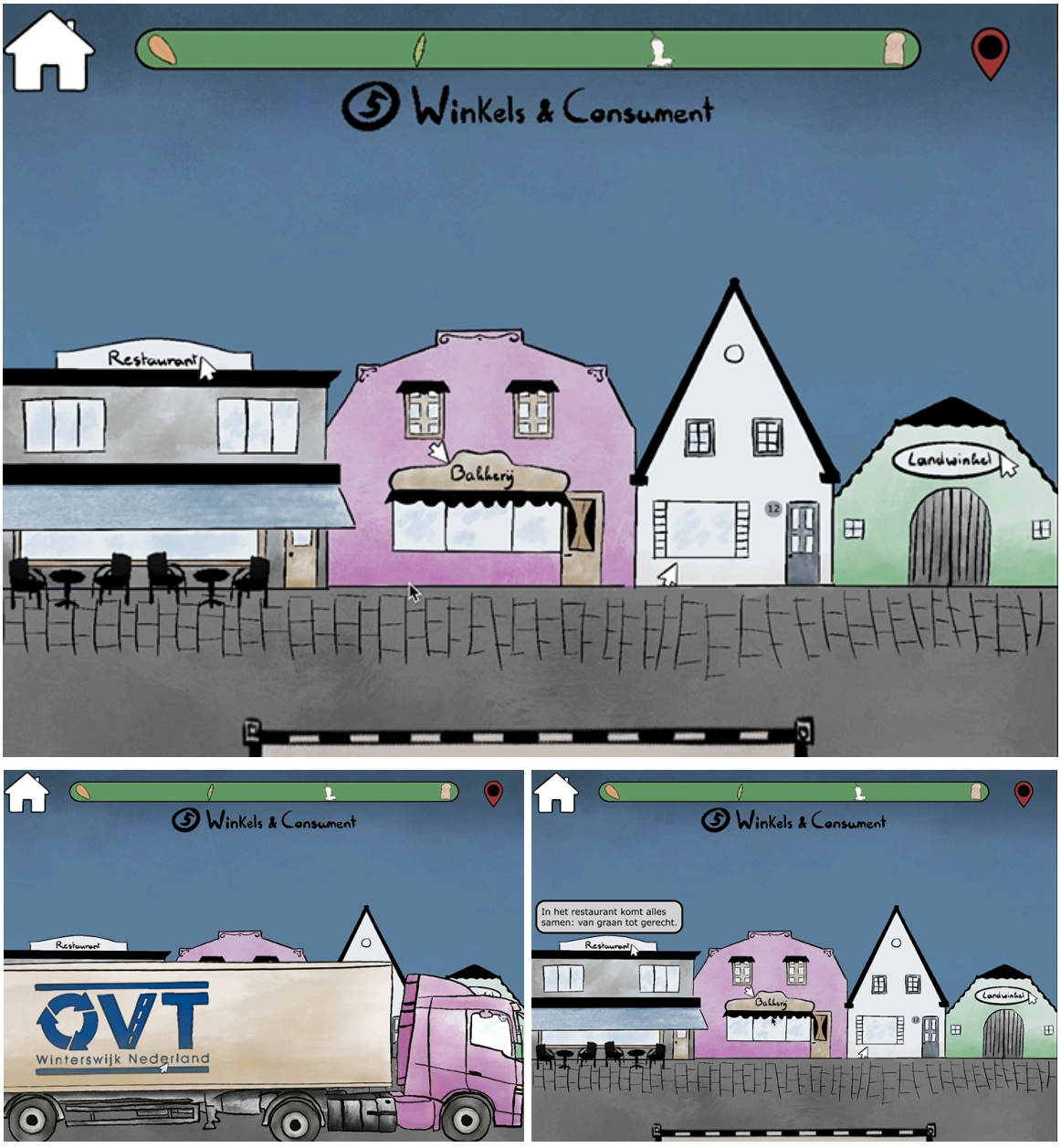


Figure 56: *Scene 10 Base Frame*

Figure 57: *Scene 10 Vehicle Distribution Company*

Figure 58: *Scene 10 Pop-up*

6.3.10.1 Visuals

As per usual, the framing is the same; however, the location as well as the buildings are new. Here, all three types of retailers that utilize this farmer's flour have been visualized: a restaurant, bakery, house (consumer), and farm shop, all drawing upon various pictures in Appendix F. These were all put together in Figure 56. There is, however, a truck that pops up within the frame (Figure 57), which now contains the logo of the distribution company within this supply chain. Additional arrows have been placed all around, helping notify the user of the possible interactions within this scene

6.3.10.2 Educational Elements

The pop-ups within this scene contain relatively self-evident information, as all retail stores have pop-ups, each educating the user on how the grain will be used within their retail store (Figure 58, Appendix H).

6.3.10.3 Interactivity

The interactivity within this scene is the same for the framing (the home button, progress bar, pin (Appendix H), and map). However, in these frames, the signs in front of the retail stores are clickable, indicated with an arrow. Clicking these will bring up various pop-ups. However, clicking on the house will transport the user to the next scene, Scene 11.

6.3.11 Scene 11 - the End

The final scene, where it all comes full circle.

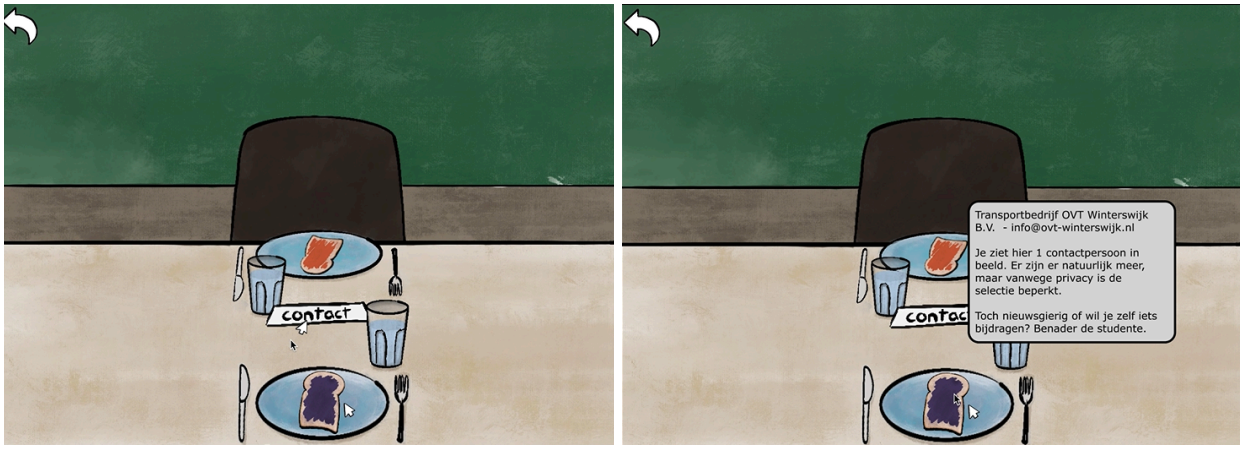
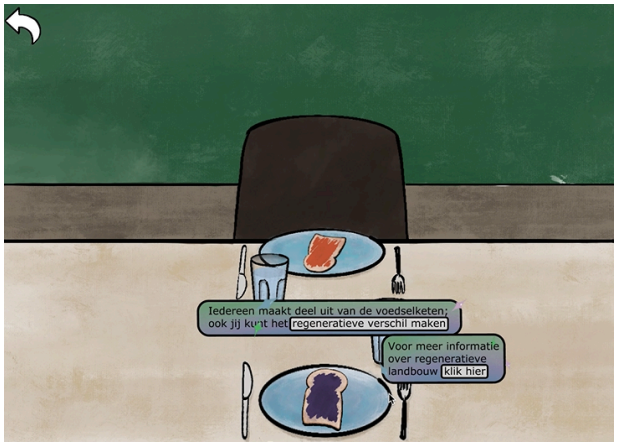


Figure 59: *Scene 11 Base Frame*

Figure 60: *Scene 11 Normal Pop-up*



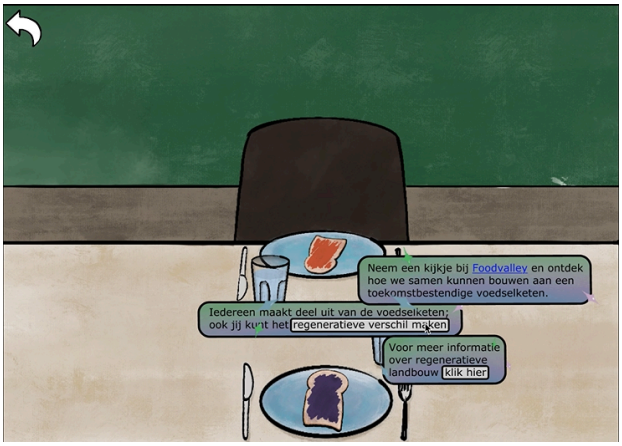


Figure 61: *Scene 11 First RA Pop-up*
Figure 62: *Scene 11 Second RA Pop-up*

6.3.11.1 Visuals
A familiar setting is the dining table from Scene 1, however, here, there is another individual joining the table, as well as a contact card and a curved arrow to the left. Regular arrows were reused to indicate special interactions. The pop-ups were both regenerative and non-regenerative, depending on the context. As can all be seen in Figure 59.

6.3.11.2 Narration
The voice-over is back, another full circle moment, announcing to the user that they have made it to the end of the regenerative food supply chain, declaring that they could browse Foodvalley if they would like to know more about RA, as well as stating that the users are more than free to go through the chain again.

6.3.11.3 Educational Elements
The pop-ups here can be considered slightly educational, as the regular pop-up informs the user about a stakeholder that is involved in this food supply chain, whilst stating the challenges in acquiring contact information. The regenerative pop-up is more of a call-to-action, reminding the user about their position in RA. The second RA pop-up guides the user towards Foodvalley, should they be interested in learning more about RA.

6.3.11.4 Interactivity
All interactions within this scene make use of arrows, either a regular or curved arrow. The regular arrow displays that an object is interactable; this will bring up a pop-up. When clicking on the bread, two regenerative pop-ups come up, one that can lead back to Scene 6 and the other that brings up another pop-up with a link to Foodvalley (Figures 61 and 62). Clicking on the contact card leads to Figure 60. The curved arrow will revert the user to Scene 10.

6.4 Evaluation of Functional Requirements
After having the prototype come to a final version, the functional requirements, as discovered in Chapter 5, were evaluated. Table 11 displays whether these requirements have been met by the current system.

Number	Functional Requirement	
1	MUST at least display scenes 1, 2, 4, and 10 of the supply chain	
2	MUST be interactable	
3	MUST provide the user with pop-ups of information	
4	MUST be cohesively hand-drawn throughout scenes	
5	SHOULD include a voiceover or text for the first scene	
6	SHOULD include contact information, or the option to add it	
7	SHOULD be able to run on most devices	
8	COULD include text for the voiceover in the first scene	

Table 11: *Functional Requirements*

From the table above, it can be concluded that all requirements have indeed been met, even exceeding requirements such as the first one, where the prototype was able to show all the steps in the supply chain instead of a few. The entire animation is based on interactions and utilizing pop-ups as a result of these interactions, so these requirements have been more than met. As for the latter functional requirements, they were both implemented in the first scene, and the narration was even extended to other frames.

Chapter 7 - Evaluation

The evaluation phase is the last phase of the design process, where the realized product was evaluated with real-life identified users who were willing to participate. All evaluations were qualitative, focusing on detailed semi-structured interviews and observations. This phase focuses on both improving the prototype with the received feedback and surveying whether the non-functional requirements, as discovered in Chapter 5 Specification, were accurately met through the use of evaluations with the prototype.

7.1 Evaluation Set-up

7.1.1 Participants

All evaluations were conducted online through Microsoft Teams since users who were willing to evaluate the prototype were spread out over the entirety of the Netherlands. Almost all identified stakeholders in Figure 10, The Stakeholder Salience Model, were reached out to. Varying individuals were interested in guiding the prototype along with an evaluation; 7 individuals participated. The client and a colleague from the client were open to an evaluation, having recommended this colleague specifically due to their knowledge of the chain and RA. Another organization that resembles Foodvalley in its goal is ReGeNL [45], with which contact was already made in the sustainable farming event, another valuable individual when it comes to content correctness of the chain and RA. During this event, another contact was made; a policymaker who specializes in the field of agriculture in the municipality of Gelderland, the target area of this project. The event turned out to be a valuable resource as another participant was reached out to, a farmer who implements regenerative methods. Out of the visualized chain, only one actor was willing to evaluate the product, the distributor between the mill and retailers. Unfortunately, neither the farmer nor the mill was willing to evaluate the prototype, potentially because they lacked access or familiarity with online meetings. Lastly, a consumer of the product made by the farmer in this chain evaluated the animation, providing insight into participants who lack prior knowledge on this type of farming but are in actual contact with the created product.

7.1.2 Evaluation Procedure

There were various steps in conducting these user tests. All of them followed along the lines of:

1. The participant was briefed beforehand on the project. Through email, they first received an introductory message explaining the project and its needs. Stating that if they were interested in helping out, they should reply to the email, indicating their interest and preferred date.
2. Upon receiving an email back from the willing participants, they would in turn obtain an information letter that breaks down the project and its intended purpose for this evaluation, together with a consent form to be filled out and returned by them beforehand (Appendix B). As a last admission, a Microsoft Teams link to the specified date for the participant would be sent.
3. When arriving at the Teams meeting, the participants were already posted due to the sent documents. A short repeat of what had been mentioned in the documents would occur to make sure the user was well kept in the loop. Though not before the meeting started off with a “Hello” and a “Thank you for taking time out of your schedule to participate”.
4. The participants were reminded of the project’s goal and asked to keep it in mind whilst interacting with the system.

5. The link to the prototype was then sent in the chat, where it could be opened by the user on the other end. Before allowing them to start, one technicality had to be checked, the screen size, to make sure it fit correctly with each device.
6. The participants were then instructed on having to use their mouse instead of any keys. They were further informed that they were allowed to ask questions during their time interacting with the prototype, though they were advised to first go along with the prototype. After all this information, they were now free to interact with the prototype.
7. During their usage of the system, the facial expressions of the users were observed, together with all of their interactions with the prototype, which could all be seen through the same link.
8. After completion of the full journey of the animation, semi-structured interviews were conducted with the participants about their experience handling the prototype, the information received, and how goal-oriented it was. For further details, refer to Appendix D, which holds the questions asked.
9. The user was then thanked for their time and insights and questioned whether they would mind doing a second evaluation with the improved system.

Appendix D contains the script for the evaluation, together with the questions asked, all in Dutch, which would vary depending on the participant at hand, as they have alternating goals when it comes to this project.

The evaluations were split into four cycles, allowing for alterations in between. The first stage tested the initial version of the prototype, this was done with the client as well as a colleague of the client. Afterward, various changes to the system were made and this version was in turn tested in the second cycle, with the agricultural policymaker, regenerative farmer, and ReGeNL employee. Following with again, changes to the system, leading to the next stage. The third stage of evaluations were conducted with the distribution company and a consumer, after these evaluations no adjustments were made to the prototype. The system, however, was still tested one last time, in the fourth cycle, with the client again, a follow-up evaluation, as further discussed below.

7.1.3 Follow-up Evaluation Procedure

One follow-up evaluation took place, this was done with the client, but now together with the final prototype. This allowed for direct comparisons between the initial version of the prototype and the final version. It was only conducted with the client due to the time constraints of both the project and previous participants; only one secondary evaluation could take place. Most participants had incredibly busy schedules, especially since the date for the first evaluation was pinned at least two weeks beforehand.
Regarding the procedure, this generally remained the same. It, however, deviated in terms of introduction, since by now the participant was more than familiar with the process, making it reasonably faster to get through. Another variation could be found in the questions asked in the semi-structured interview, where additional questions on the alterations of the prototype were asked, which can also be found in Appendix D.

7.2 Evaluation Results

For the initial evaluations, the focus was spread across several aspects. These were: the usability of the prototype, its content correctness, whether it was goal-oriented, and what takeaways the participants had

gathered. This, all in all, was predominantly answered through the semi-structured interviews; however, usability benefited greatly from observations as well as the questions. The non-functional requirements, as mentioned in Chapter 5, were sporadically spread out over the questions. The evaluations were split up into cycles, which meant that after about 2 to 3 evaluations, intermediate changes to the prototype were made based on the gathered observations. This new system was then evaluated with the following evaluations. All notes on the evaluations can be found in Appendix E.

7.2.1 First Evaluation Cycle - Evaluations 1 and 2

The first two evaluations laid the groundwork for the rest of the evaluations. There was a noticeable difference in the ease with which the second evaluation was conducted. Both users were very knowledgeable when it came to regenerative agriculture as well as actual food chains. Currently, the first participant is working at Foodvalley, as well as at other sustainable food-related companies. The second evaluation was conducted with another employee at Foodvalley, but a familiar face, the contact person of the client, Foodvalley.

When it came to observations, not much could be said in terms of visceral reactions for the first user, as they were very engulfed by the prototype, though they did crack a small smile at the truck passing. In contrast, the client's initial reaction was a lot of excitement; they were enthusiastic to finally see the ideas come together in a concrete, clickable prototype.

When exploring, both participants struggled quite a bit with usability; what seemed clear to the designer did not turn out to be clear to the user, as the interactions for visuals did not go without saying. Both were visibly confused by the lack of a “road” in the overview, making it hard to comprehend the journey. In the first evaluation, the arrows brought one to the next actor, but the overview did little to guide them. Similar to the first participant, the second user felt more explanations were needed, as the overview was confusing, had no text, and was not clickable.

Both identified important gaps in missing information on RA, its forms, and applications and that it is context-specific. The client noted an absence of interactions with the retailers, which were just stationary buildings except for the house leading to the end scene. They also mentioned that the overarching goal of RA was lacking and suggested moving this more to the forefront to help connect the storyline and end with a call to action.

The other participant gave worthwhile input to smooth the usability of the animation, even suggesting possible ideas. Both agreed it was an accurate depiction of a supply chain, with the inclusion of a typical manufacturer helping.

During the interview, the first participant stated that Foodvalley likely had no use for the prototype internally but that it could help when talking to farmers, the second user agreed. As well as ending positively, saying it would be a great conversation starter with interested farmers, mentioning it is 80% there and just needs fine-tuning.

7.2.1.1 Intermediate Changes Evaluation 1 and 2

After these two evaluations, a lot of alterations were made when it came to the usability of the prototype. Arrows were now used in a consistent manner, and interactions were introduced with an arrow. The start sign was now clickable, immediately moving to the first scene. More minor changes were made in the flow of the interactability of the animation. As well as a bug being discovered and fixed. The pop-ups were fine-tuned according to the remarks of the users, together with new pop-ups that further explained the concepts. A progress bar was added on the idea of the first participant, to clearly show where in the

chain the user was. This bar included depictions of the product in each phase as well as the current state. A new road in the overview was introduced, which contained arrows pointing towards the following step in the supply chain.

7.2.2 Second Evaluation Cycle - Evaluations 3, 4, and 5

This second evaluation stage consisted of three participants, each from a different sector connected to regenerative agriculture: a regenerative farmer, a policymaker in Gelderland, and an employee at ReGeNL, an organization similar to Foodvalley. The third evaluation was with someone quite literally in the field, a regenerative farmer. Evaluation four was done with a policymaker in agriculture in Gelderland, who could actually create an impact on regulations. Finally, the fifth evaluation was with an employee of ReGeNL.

A recurring theme with these users was the lack of clarity in what was interactive and what was not. The third evaluation set the tone, showing a prevalence in that many objects were not interactive even though users expected them to be. When the ReGeNL employee navigated the system, confusion akin to the third participant appeared; they clicked on multiple items expecting extra information. Through trial and error, the participant managed to find their way but highlighted the need for a more guided approach. The fourth user expanded on this, while they enjoyed the freedom, they occasionally got lost between what was clickable and what was not. They would have preferred more on-screen cues.

Contrary to assumptions in Chapter 5, the portal did not shock users; it was just seen as a fun way to show RA and transition to the overview. A consensus across evaluations was that the visuals matched the content well, though two participants were confused about the seed supplier building. All agreed that the chain accurately represented a real food supply chain.

The fourth user, coming from a policymaker’s perspective, appreciated the academic RA definition but struggled with the phrasing, worrying that farmers might feel turned off by such a “large” definition. This pointed to the challenge of making sure the tool represents and includes the whole target group.

The third user wanted to see more methods for RA since the depicted farmer only used what worked for them, while there were many options. They felt the farmer's perspective lacked detail. The fifth participant shared this, suggesting side-by-side comparisons of traditional and regenerative farming, even if only mentioned and not shown visually.

Content-wise, the policymaker agreed RA still seemed too vague, emphasizing (just like the ReGeNL employee) the value of comparing it with conventional agriculture. From a policymaker’s view, they noted that while the tool raises awareness, it misses economic incentives, which are crucial to convince people — though this is out of scope for this project. The fifth participant saw potential in reaching farmers and showing RA with further development, despite navigation difficulties. They even expressed interest in the refined version, as did the farmer, who specifically asked to see the end result. Overall, the tool sparked a lot of interest among these participants.

7.2.2.1 Intermediate Changes Evaluation 3, 4, and 5

There was one particular scene (the storing and drying of the grain) that was unclear when it came to interacting with it, so instead, that specific component was taken out and put on a timer, correctly displaying what was supposed to happen when interacting, but without the interaction component. Seeing that the new way of displaying the route did not work, it felt necessary to immediately bring another approach to life, making a full-on map that appears when clicked or when interacting with the “start” sign. Since there were still quite a few hassles with where and when to interact and what everything meant, a

second page to the map was added with instructions, where all interactables were explained together with what certain symbols inside scenes meant. To help with the maps, titles were added to every step; these also recurred within the more detailed scenes on the supply chain steps. To make the interactions even more apparent, a voiceover was implemented in a few main scenes, essentially able to further guide the user. An additional scene on RA was made, as the previous scene would have become considerably overcrowded with pop-ups if all angles to RA were to be captured. This was definitely necessary when looking at the feedback of the users, they wanted more, more details, and more explanations. An actual title to the animation was also implemented to give the users an initial thought about what kind of supply chain they will encounter, as well as an introductory text within the portal to explain how this is just one example of RA, and it can come in many shapes and sizes.

7.2.3 Third Evaluation Cycle - Evaluations 6 and 7

The following evaluations were tested with the current state of the tool as outlined in Chapter 6. These were conducted with an employee at a distribution company and a consumer. The sixth evaluation was with the distribution company in the visualized chain. Surprisingly, they were more in the loop about the links in the supply chain than expected, even having some prior knowledge of RA, despite being at the very end of the chain.

The seventh evaluation was with a participant who had little to no knowledge of RA or food supply chains but was familiar with products from this chain. They knew the product was better for the environment since they got it directly from the mill, but lacked deeper knowledge of why this flour was ahead of others.

The tool was considerably more usable than it started as. However, the employee at the transport company did not initially see the text with “instructions” on the map. After being guided to the instructions, they were able to navigate; otherwise, it would have been much harder, as seen in earlier evaluations. The seventh user luckily reached the instructions on their own. The changes made after previous stages visibly improved usability. This user just needed to “get into it”; after the instructions and the first scene (seed supplier), they understood the system and navigated comfortably. Mistakes in usability were hardly noted and, when present, were minor.

The sixth user confirmed this, as they also got the hang of the controls after small initial mishaps and then found it easy to go through. Both users found the voiceover helpful in guiding them and giving the background, though they were slightly thrown off by the tone. The consumer found it professional but robotic; the other participant liked the pacing but was surprised each time it appeared.

During the semi-structured interview, the distribution employee noted the clarity of the supply chain through the progress bar, map, and ordered scenes. The instructions helped clarify what was RA and what was not, allowing them to learn more concretely about RA. The consumer, who was not familiar with supply chains, mentioned learning how this supply chain works and how this everyday product benefits nature. They specifically highlighted enjoying having the reins in discovering the chain through visuals, feeling they retained the information much better thanks to the combination of visuals and interactivity.

7.2.4 Fourth Evaluation Cycle - Follow-up Evaluation

As the client was one of the first evaluations, the prototype they saw was still in early development. It was therefore worthwhile to have them evaluate it again, as they could recognize the improvements in usability and content and reflect on whether their goal for this assignment was fulfilled.

When starting the system, they immediately voiced their excitement about the portal, finding it amusing. However, the voice frightened them, saying it came across as too robotic and that they would have preferred the designer's voice instead. Still, they mentioned that the voice made it more of an experience rather than just an interactive tool. For future versions, they saw additional sounds as “nice to have” but not necessary.
When asked about usability, they said the prototype had massively improved since the first version, even stating there were few to no additions they could think of. Much more attention was given to steering the user clearly and continuously.
Content-wise, they felt it had substantially improved, saying the text now contained much more information. They saw the updated pop-ups as detailed and imagined this resulted from earlier evaluations, which was true. They also reacted positively to the extra page on RA, finding the explanation thorough, which was initially lacking. They particularly enjoyed the analogies between RA and conventional farming.
Of course, the system could always go deeper on every supply chain actor, but as the client said, “You are not doing a PhD, you have accomplished what we wanted to get out of this project.” It is safe to say that in the client’s eyes, this project successfully brought a regenerative food supply chain to life.

7.3 Evaluation of Non-Functional Requirements

The structure of the evaluations facilitated the assessment of the non-functional requirements established in Chapter 5. Whether these requirements were met can be seen in Table 12.

Number	Non-Functional Requirement	
1	MUST use real data, or as close to real data as possible	
2	MUST have self-explanatory interactions	
3	MUST have the information written in an accessible manner	
4	SHOULD be easy to use	
5	SHOULD contain clear language	
6	SHOULD have the RA visuals stand out	
7	SHOULD appeal to all supply chain stakeholders	
8	SHOULD have a curious human-sounding narrator in Dutch	

Table 12: *Checking of non-functional requirements*

Nearly all non-functional requirements were met when it came to the last created prototype. Number 1 was met due to the visualized supply chain being from an actual farmer in the field, so all information displayed is real-world data. Requirement 3 was met, as discovered during the evaluations, participants who were not as knowledgeable were able to grasp the concepts. A main contributor to this was the additional pop-ups that would further explain a term. Number 4 was fulfilled, albeit, after the second cycle in the evaluations, the previous adjustments significantly increased the usability. Requirement 5 was

met mainly because of the feedback within the evaluations, where participants specified texts that could be altered and in what way so that they would both make sense contextually and narratively. Number 6 was met as the RA visuals all contained sparkles, as well as a specific colour palette all around.
Three requirements were not fully met, however not to the initial extent that was expected of these requirements. As number 2 states all interactions should be self-explanatory. During the testing, it was quickly realized that this was not an easy task. The very first participants did not understand the interactions within the system, so this issue was sidestepped, and a map with instructions was created to guide the user through the functionalities of the system. This addition then made the interactions self-explanatory. Number 7 tackles another difficult topic, having the system appeal to all supply chain stakeholders. 7 alongside number 2, in the evaluations, turned out to be a challenging goal. Seeing as the supply chain actors are so vast and different from each other. Each and every actor has something else they would like to get out of the project, and all of them would like to be represented accordingly; however, in this particular case, some supply chain steps require more attention and explanations, making it very complicated to satisfy all involved individuals. Number 8 was partly met, due to it, of course, narrating in Dutch, the voice however curious was still deemed as robotic.

7.4 Conclusion

The evaluation phase focused on testing whether the prototype could communicate a real-life regenerative food supply chain interactively and understandably. Initially, the idea of having the user freely explore the supply chain sounded promising, but through various testing, it quickly became clear that participants were in need of cohesiveness, and guidance, and did not enjoy ending on a feeling of “have I seen everything?”. Some freedom had to be taken away from the users, but not to an extent that made the animation lose its interactive character, instead working together with the map and instructions.
Early tests showed that users wanted more from the prototype; much turned out to be more information, specifically on RA, and more help in navigating the system. These remarks were iterated throughout the evaluations, leading to a concept that improved over time on these aspects. On the other hand, no alterations had to be made regarding the visuals, which were met with positive feedback from all users, as clear and fitting to the topic of agriculture.
The iterations between prototypes were both necessary and valuable, as participants were heard, and this led to changes being made, all thanks to their feedback. In spite of this, no further remarks about the functioning of the supply chain were received; it mirrored other real-life scenarios well and made efforts to include typical supply chain steps. A recurring requirement was trying to satisfy every supply chain stakeholder; however, it became quickly apparent that this was an ambitious task. Each participant approached the prototype with different perspectives and aims, depending on their position in or outside the chain.
The evaluation was able to confirm that the main goals of the project have been achieved. While the tool was not able to fully cater to every individual stakeholder, the prototype was able to offer an informative, interactive experience on a regenerative food supply chain. According to the evaluations, this was able to spark curiosity and encourage conversations about RA. Overall, this results in a strong foundation that brings the story of an RA supply chain to life in an accessible and engaging way.

Chapter 8 - Discussion

Research quickly revealed the many facets of RA. Due to RA's novelty, it was lacking in consensus all around; however, a definition emerged among the research conducted, where RA is an approach focusing mainly on restoring and improving soil health, enhancing biodiversity, and creating resilience in the ecosystem through natural methods. This definition shaped the core of the prototype, helping in understanding and communicating RA. Many practices fall under the term RA, again varying significantly from paper to paper. Typical methods include integrating animals, avoiding synthetic chemicals, minimizing tillage, and rotating crops. It was discovered that the implementation of RA is not without its obstacles; there is a lot of resistance in terms of acknowledging that conventional methods of farming harm nature more than necessary. As well as the financial risk of putting RA into practice, crops have to gradually get accustomed to the new practices, possibly decreasing in successful produce at the start. The absence of information may give rise to further problems, such as those about geographical areas, scientific data, or even the stakeholders themselves. Emphasizing the need for further education on this topic, which is exactly where this product may prove to be useful.

The realization phase identified several sub-systems that the project consisted of: visuals, narration, educational elements, and interactivity. The visuals were the backbone of the animation, hand-drawn in an authentic style, which was positively received in all evaluations. Narration is in the form of a voice-over for certain scenes, guiding the user along, while initially robotic, it succeeded in guiding users and turning the tool into more of an experience rather than just an informational piece. The educational elements were mainly the pop-ups with information that would appear when interacting with various objects, allowing users to explore, learn, and discover at their own pace, raising awareness of RA. The interactivity was essential in engaging the users. However, it was discovered that while interactivity adds value, it must be carefully balanced with sufficient structure and support.

From a functional perspective, the prototype met its requirements: it included all planned scenes, interactions, and informative elements. The non-functional requirements were largely achieved as well, except for fully self-explanatory interactions and completely appealing to all supply chain stakeholders. It became clear that due to the diverse target group and different stakeholder aims, fully satisfying every individual was unrealistic. Instead, the tool works well as a conversation starter and as a first step toward broader awareness of RA.

Successes include the tool's ability to visualize a real-life regenerative supply chain. Notably, it was able to do it in such a way that felt both clear and inspiring to the users. As well as having the client express their contents with the final prototype, noting that it successfully brought the idea of a regenerative supply chain to life, describing it as a promising starting point for future conversations and applications. Another achievement was that sub-systems were able to reach what they set out to do; visuals were inviting and clear, narration helped guide and engage, educational elements provided needed depth, and interactivity kept users involved.

Lessons learned involve the crucial importance of user guidance. It was observed that what the designer believed to be clear was not, additional information was needed and that freedom in interacting with the system should be given sparingly.

Limitations of the project include the vastness of the target group for the product, making it challenging to have every participant represented in terms of their aims. Therefore, some stakeholders were deemed more important than others in conveying regenerative agricultural practices. Not all stakeholders within the supply chain were available to evaluate the prototype; some perspectives were not even included, including those of the retailers and manufacturers. This absence limits the feedback to only certain

viewpoints, leaving out certain perspectives of actors within the supply chain that are as involved and crucial as other phases. However, it is able to provide the groundwork for further development, demonstrating how combining all these sub-systems can essentially communicate a complex subject in an engaging manner. The evaluations were conducted online, which allowed participants from all over the Netherlands to test the prototype, gaining a diverse group of users, contrary to this, an evaluation on location would allow for more intricate results through real-time observations. There will always be additions that would make this project soar to a higher level, though these will be discussed in Chapter 9, conclusion, and recommendations for the future

Chapter 9 - Conclusion and Recommendations for the Future

9.1 Conclusion

Returning to the research question of "How can an interactive communication tool concerning the food supply chain on regenerative agriculture in Gelderland be created to encourage knowledge-sharing and better-informed decision-making on regenerative agricultural practices between stakeholders?", it becomes clear that by combining visuals, narration, educational elements, and interaction into an animation, the system makes a real-world regenerative supply chain transparent and intelligible.

It promotes understanding by highlighting the advantages, and challenges, and providing information about how it differs from traditional agriculture, as demonstrated by the evaluations. It essentially informs the user, through a tangible, real-world example about a regenerative supply chain, helping them to visualize these implementations and ultimately supporting better-informed decisions towards RA.

The evaluations were able to uncover a setting for this tool that directly links to knowledge-sharing, utilizing it as a conversation starter, where it can accurately demonstrate RA put into practice within the food supply chain. Additionally, including the contact information of at least one real-life stakeholder allows for direct connections between concept and practice, creating a lower threshold for reaching out to current regenerative actors and serving as a stepping stone for further knowledge-sharing.

To bring back the sub-questions, the first sub-question was answered in the background research where what parties are central to a non-specific food supply chain were uncovered. These turned out to be the supplier, manufacturer, retailer, and consumer, as reflected in the discovered regenerative supply chain, as well as uncovering a hidden actor that was not present within this project. The second sub-question was additionally addressed by the background research, having discovered that challenging concepts can benefit from transitioning into inviting, understandable visuals. As demonstrated in the evaluations where all graphics were at least guided or fully understood.

The system animation aimed to be accessible and relevant to all stakeholders, despite that it was not able to focus its full attention on each of their perspectives, due to the vast number of stakeholders and corresponding aims, some being prioritized over others, such as the farmers. Instead, it is able to serve as a starting point for most actors. This project, however, was still able to demonstrate how an interactive animation can successfully communicate the concept of regenerative agriculture and support stakeholders in making better-informed decisions. It links complex agricultural practices with accessible education and consequently contributes to Foodvalley's core mission of building a food system that is sustainable, affordable, tasty, and healthy.

9.2 Future Work

The prototype, as it currently stands, can successfully communicate the core aspects it set out to do; it could always be improved upon. The entire evaluation stage is a good example of how a prototype can be altered for the better. The final system has been through many iterations already; therefore, room for improvement has decreased drastically. It manages to exceed expectations, at least those of the non-functional requirements. Naturally, some adjustments would enable the tool to realize its full potential, but these are beyond the scope of this project when it comes to time and access to information.

There are still a lot of adjustments that could be made within the narration. One main alteration that would notably improve the system would be the usage of an actual voice actor for the narration, as in its current state, it is still obvious, thankfully not blatantly, that the narrator is not human. This takes away from the experience of exploring the supply chain, seeing as that part of the narration can catch the attention

instead of the actual words being said. A professional voice actor can bring life to the voiceover, engagingly enhancing relatability, able in strengthening the impact of the narrative.

While on the subject of sound, sound effects that relate to the locations and actions could be added to enhance the experience, providing the users with an even more immersive storyline. The entire supply chain could consist of background noises as well, such as birds chirping when outside, and chatter when inside, reinforcing the connection of the animation to real-world contexts.

A recurring remark within the evaluations is that RA could be explained further in-depth; there is always more to elaborate on, and more to learn since the methods are seemingly endless and the concept is always evolving. What would help in achieving this is adding more visuals that compare traditional farming to regenerative farming, in the entire chain. This would explicitly display the contrast and better the understanding of RA as opposed to conventional. Allowing traditional farmers to relate to a chain as well, and by being pointed to the facts, most notably finances, they might be more inclined to listen to the implementation of regenerative methods.

Initially, the client wanted the supply chain to show the volumes of the product at each and every step, but this was deemed unattainable within the time frame and the privacy of the individuals involved. However, a future version of this project could very much benefit from conveying the volume of a product after each and every stage. This could work hand in hand with providing the user with information surrounding the financial situation of all stakeholders in a supply chain that turns regenerative, making the animation more transparent and interesting to farmers who are worried about what will happen in terms of their financial situation when transitioning to regenerative.

Another valuable potential addition could be linking this project with the work of the other RA thesis student, Jakub. His project focuses on visualizing farmland plots, specifically indicating which fields are regenerative and which are not. It also includes contact information for some farmers, allowing users to directly reach out and connect with RA farmers, as that was lacking within this project.

Along this supply chain, there are many actors missing, in terms of leaving behind their contact information. In an ideal animation, all stakeholders would be present and allow the users of the animation to reach out in case they had any further questions.

Another possible change would be switching up the entire food supply chain, as the current farmer is very traditional in the sense that they take care of many steps themselves. In general, farmers are less likely to be as involved in the chain as this farmer. Therefore, another example of a chain closer to a generic regenerative food supply chain might be more helpful to users.

Lastly, the animation could have different versions, each one tailored to a different stakeholder, since they all seem to have different aims in looking into an actual regenerative supply chain.

These future recommendations would be able to strengthen the animation’s impact in supporting the transition to RA in more ways than one.

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Appendix A: Grammarly Notice

Grammarly-notice:

During the preparation of this work, I used Grammarly to make sure the spelling and formatting were up to par. Afterward, I carefully reviewed and edited the content, taking full responsibility for the final version.

Appendix B: Information Letters and Consent Forms

Information Letter:

Informatiebrief: Interview t.b.v. Animatie over de Voedselvoorzieningsketen

Beste meneer/mevrouw,

Zoals u misschien al weet, is de voedselketen zeer complex. Wat als er nou een mogelijkheid was om het hele proces van boer tot bord echt te kunnen laten zien? Dit is precies waar mijn afstudeerproject over gaat.

Mijn naam is Madeleine Leertouwer, studente aan de Universiteit Twente. Ik vraag u, de onmisbare voedselketenpartners, daarom vriendelijk om mee te doen aan een onderzoek vanuit de bacheloropleiding Creative Technology in samenwerking met Foodvalley, een onafhankelijke non-profitorganisatie met een focus op een duurzamere voedselketen. Het project getiteld: “Interview t.b.v. Animatie over de Voedselvoorzieningsketen”.

Voor mijn bachelorthesis werk ik aan het in beeld brengen van een regeneratieve landbouwvoedselvoorzieningsketen door middel van een animatie, met als doel een voedselketen helder in kaart te brengen, evenals het delen van kennis en de communicatie onderling in de keten te verbeteren. Het eindproduct zou in verschillende scenario's gebruikt kunnen worden, waaronder door uw organisatie, de rest van de keten, Foodvalley en organisaties die geïnteresseerd zijn in regeneratieve landbouw.

Om ervoor te zorgen dat mijn project zo goed mogelijk aansluit bij de praktijk, zou ik graag betrokkenen, ketenpartners zoals u, interviewen. Hieronder licht ik toe waar deze brief precies over gaat.

Doel van het onderzoek

Het uiteindelijke doel van het onderzoek is een specifieke voedselketen in beeld te brengen. Dit houdt het mogelijke delen van persoonlijke data in; daarover meer in het kopje ‘Gegevens’.
Verder zal het interview ook focussen op het verkrijgen van inzicht in de perspectieven van verschillende partners binnen de ketens, hoe het ketenproces nu verloopt, de samenwerking onderling en uw mening over regeneratieve landbouw. Uw perspectief hierin is erg waardevol.

Inhoud interview

Het interview zal plaatsvinden online of op een locatie naar voorkeur, met een tijdsduur van ongeveer 20 tot 30 minuten. Met uw toestemming wordt het gesprek opgenomen en er wordt een transcriptie van gemaakt. De opname zal maximaal 1 week na het interview worden verwijderd. De data wordt naar uw keuze verwerkt in mijn onderzoek.

Gegevens
Tijdens het interview zullen er vragen aan bod komen die betrekking hebben op bedrijfsgevoelige informatie. U bepaalt zelf hoe uw gegevens worden verwerkt, door middel van drie opties waar u uit kunt kiezen in het bijbehorende toestemmingsformulier.

Deze mogelijkheden bestaan uit:

1. Volledige toestemming: waarbij de contactinformatie van uw organisatie, de functie, het ketenproces, de volgende aannemers in de keten, uw mening over regeneratieve landbouw, het product in deze ketenfase en het volume van het product in percentages weergegeven mag worden waar nodig is.

2. Gedeeltelijke anonimiteit: waarbij u zelf aangeeft welke onderdelen gedeeld mogen worden en welke geanonimiseerd moeten worden.

3. Volledige anonimiteit: waarbij alle data die herleidt naar u of uw organisatie wordt geanonimiseerd als bijvoorbeeld: bedrijf X. Gevoelige informatie zoals productvolumes wordt dan weggelaten.

Deze informatie zal gebruikt worden voor het maken van het uiteindelijke product; eveneens wordt erover in het eindprojectreport geschreven.

Deelname en terugtrekken
Deelname is geheel vrijwillig. Als u besluit niet mee te doen aan het onderzoek, hoeft u verder niets te doen; niks hoeft getekend of beredeneerd te worden.
Als u tijdens of na het onderzoek wilt stoppen, hoeft u ook geen reden te geven voor uw stoppen. Dan zal al uw data vernietigd worden, mits u dit binnen 24 uur na het interview kenbaar maakt.

In de toekomst
Na dit onderzoek zal het concept van de animatie tot leven worden gebracht. Deze moet eveneens getest en geëvalueerd worden; daarbij is uw hulp zeker welkom, graag zelfs. Uiteraard is dit ook geheel vrijwillig. Hiervoor kunt u uw contactinformatie achterlaten in het toestemmingsformulier.
Indien u een klacht heeft of baat heeft bij onafhankelijk advies, kunt u contact opnemen met de secretaris van de ethische commissie van de Universiteit Twente: ethicscommittee-cis@utwente.nl.
Als u na dit onderzoek meer informatie over het onderzoek te weten wilt komen of zelfs het eindproduct in gebruik wilt nemen, tot zover mogelijk is, kunt u een mail naar mij, m.l.d.leertouwer@student.utwente.nl, of supervisor van het project e.j.faber@utwente.nl sturen.

Met vriendelijke groeten,

Madeleine

Consent Form:

Toestemmingsformulier: ‘Interview t.b.v. Animatie over de Voedselvoorzieningsketen’

10-05-2025

Check wat van toepassing is:

- ☐ Ik heb de informatiebrief gelezen en begrijp de opzet en het doel van het onderzoek.
- ☐ Ik begrijp dat meedoen volledig vrijwillig is, en ik op ieder moment zonder reden mijn toestemming kan terugtrekken.
- ☐ Ik weet dat de onderzoeker de opname van het interview heeft en dat de transcriptie daarvan beschikbaar is voor haar en de begeleider.
- ☐ Ik geef toestemming om het interview te gebruiken voor de doelen die in de informatiebrief staan.
- ☐ Ik kon aanvullende vragen stellen en mijn vragen zijn goed beantwoord.
- ☐ Ik geef toestemming om de door mij aangeleverde onderzoeksgegevens op te slaan in de ‘Graduation Project data’-omgeving, zodat ze kunnen worden gebruikt voor toekomstig academisch onderzoek.
- ☐ Ik wil meedoen aan dit onderzoek.
- ☐ **OPTIONEEL:** Ik geef toestemming om bereikt te worden voor het vervolgonderzoek.

Data: Check welke van de opties van toepassing is:

- ◯ Ik geef toestemming m.b.t. het delen van data:
  De contactinformatie van uw organisatie, de functie van uw organisatie, het ketenproces, de volgende aannemers in de keten, uw mening over regeneratieve landbouw, het product in deze ketenfase en het volume van het product in percentages.
- ◯ Ik geef toestemming m.b.t. het delen van data in gedeeltelijke anonimiteit. Specificeer a.u.b.**:**

  _____

  _____

  _____
- ◯ Ik geef toestemming m.b.t. het delen van data in volledig anonieme vorm:
  Alle herleidbare data naar u of uw organisatie wordt geanonimiseerd. Alle gevoelige informatie (productvolumes) wordt weggelaten.

Naam deelnemer:

Handtekening: Datum: __ / __ / __

_____

Contactinformatie voor nader contact (optioneel):

_____

Ik verklaar hierbij dat ik deze deelnemer volledig heb geïnformeerd over het genoemde onderzoek.
Als er tijdens het onderzoek informatie bekend wordt die de toestemming van de deelnemer zou

kunnen beïnvloeden, dan breng ik hem/haar daarvan tijdig op de hoogte.

Naam onderzoeker (of diens vertegenwoordiger):
Handtekening: Datum: __ / __ / __

Information Letter Evaluation:

Informatiebrief: Evaluatie t.b.v. Animatie over de Voedselvoorzieningsketen

Beste meneer/mevrouw,

Zoals u misschien al weet, is de voedselketen zeer complex. Wat als er nou een mogelijkheid was om het hele proces van boer tot bord echt te kunnen laten zien? Dit is precies waar mijn afstudeerproject over gaat.

Mijn naam is Madeleine Leertouwer, studente aan de Universiteit Twente. Ik vraag u, de onmisbare voedselketenpartners, daarom vriendelijk om mee te doen aan een evaluatie van mijn project vanuit de bacheloropleiding Creative Technology in samenwerking met Foodvalley, een onafhankelijke non-profitorganisatie met een focus op een duurzamere voedselketen. Het project getiteld: “Evaluatie t.b.v. Animatie over de Voedselvoorzieningsketen”.

Voor mijn bachelorthesis werk ik aan het in beeld brengen van een regeneratieve landbouwvoedselvoorzieningsketen door middel van een animatie, met als doel een voedselketen helder in kaart te brengen, evenals het delen van kennis en de communicatie onderling in de keten te verbeteren. Het eindproduct zou in verschillende scenario's gebruikt kunnen worden, waaronder door boeren, de rest van de keten, Foodvalley en organisaties die geïnteresseerd zijn in regeneratieve landbouw.

Om ervoor te zorgen dat mijn project zo goed mogelijk aansluit bij de praktijk, zou ik graag betrokkenen, zoals u, mee willen nemen in het evalueren van mijn project. Hieronder licht ik het onderzoek verder toe.

Doel van het onderzoek
Het uiteindelijke doel is het in beeld brengen van een regeneratieve voedselketen, met een focus op het verbeteren van de communicatie onderling en het maken van besluiten richting regeneratieve landbouw. Het evalueren van het prototype helpt om dit doel te behalen. Uw perspectief hierin is erg waardevol.

Inhoud evaluatie
De evaluatie zal plaatsvinden online, onder meer op Microsoft Teams of op een applicatie naar voorkeur, met een tijdsduur van ongeveer 30 tot 45 minuten. Tijdens het evalueren van het prototype krijgt u volledige vrijheid om door de animatie te lopen. Na afloop wordt u gevraagd om wat vragen over het prototype te beantwoorden. Met uw toestemming wordt het interview opgenomen en wordt er een transcriptie van gemaakt. De opname zal maximaal 1 week na het interview worden verwijderd.

Gegevens
De gegevens die verzameld worden, in de vorm van observaties en vragen, worden met uw toestemming anoniem gebruikt in het onderzoek. Uw onderzoeksgegevens worden 10 jaar bewaard op de onderzoekslocatie, waarna ze vernietigd worden, met uitzondering van persoonsgegevens. Deze worden 2 weken na het onderzoek verwijderd en worden alleen gebruikt voor contactdoeleinden.

Deelname en terugtrekken
Als u tijdens of na het onderzoek wilt stoppen, hoeft u hiervoor geen reden te geven. Dan zal al uw data vernietigd worden, mits u dit binnen 24 uur na het interview kenbaar maakt.

In de toekomst
Indien u een klacht heeft of baat heeft bij onafhankelijk advies, kunt u contact opnemen met de secretaris van de ethische commissie van de Universiteit Twente: ethicscommittee-cis@utwente.nl.
Als u na deze evaluatie meer informatie over het onderzoek te weten wilt komen of zelfs het eindproduct in gebruik wilt nemen, tot zover mogelijk is, kunt u een mail naar mij, m.l.d.leertouwer@student.utwente.nl, of naar de supervisor van het project e.j.faber@utwente.nl sturen.

Met vriendelijke groeten,

Madeleine Leertouwer

Consent Form Evaluation:
Toestemmingsformulier: ‘Evaluatie t.b.v. Animatie over de Voedselvoorzieningsketen’

16-06-2025

Check wat van toepassing is:

- ☐ Ik heb de informatiebrief gelezen en begrijp het doel van het onderzoek, of heb hier naar voldoening vragen over kunnen stellen.
- ☐ Ik begrijp dat meedoen volledig vrijwillig is, en ik op ieder moment, zonder reden, mijn toestemming kan terugtrekken.
- ☐ Ik weet dat de onderzoeker de opname van het interview heeft en dat de transcriptie daarvan beschikbaar is voor haar en de begeleider.
- ☐ Ik geef toestemming dat het interview anoniem gebruikt wordt voor de doelen die in de informatiebrief staan.
- ☐ Ik begrijp dat gegevens worden verzameld door observaties.
- ☐ Ik geef toestemming dat mijn woorden geciteerd kunnen worden in het onderzoek.
- ☐ Ik geef toestemming dat de anonieme gegevens opgeslagen worden in de ‘Graduation Project data’-omgeving, zodat ze kunnen worden gebruikt voor toekomstig academisch onderzoek.
- ☐ Ik wil meedoen aan dit onderzoek.

Naam deelnemer:

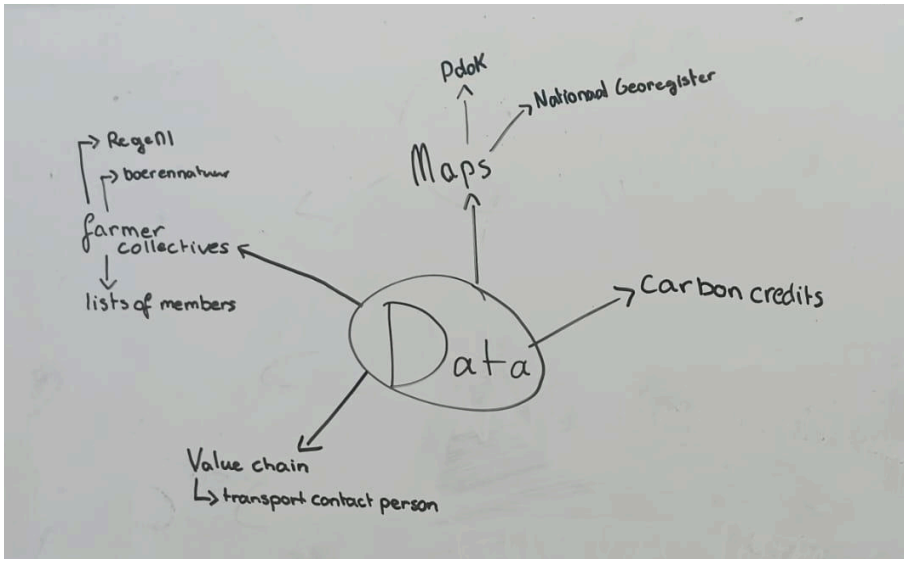
Handtekening: Datum: __ / __ / __

Ik verklaar hierbij dat ik deze deelnemer volledig heb geïnformeerd over het genoemde onderzoek. Als er tijdens het onderzoek informatie bekend wordt die de toestemming van de deelnemer zou kunnen beïnvloeden, dan breng ik hem/haar daarvan tijdig op de hoogte.

Naam onderzoeker (of diens vertegenwoordiger):
Handtekening: Datum: __ / __ / __

Appendix C: Ideation

Data Mindmap:



Appendix D: Script and Questions, Interview and Evaluations

Script and Questions Interview Farmer:

Hoi! Met madeleine weer, van de voedselketen visualizatie. Ik vroeg me af of u nog tijd had voor het intervieuw en daarvoor open stond.

Hallo en alvast heel erg bedankt dat u tijd wilde vrijmaken voor dit gesprek! Heeft u nog tijd gehad om de informatiebrief en het toestemmingsformulier door te lezen? In dat geval zou u openstaan om uw keten als voorbeeld te laten gebruiken voor mijn visualisatie?

En heeft u nu 30 minuten tijd om nu het interview af te nemen?

Het doel van dit interview is om inzicht te krijgen in uw bedrijfsvoering, uw plek in de keten, en hoe u regeneratieve landbouw toepast. Daarmee hoop ik een zo realistisch en helder mogelijk beeld te kunnen schetsen dat voor verschillende partijen in de voedselketen waardevol is.

Dan moet ik gelijk vragen of u instemt met het opnemen van het interview, waar van de opname onmiddellijk tekst van wordt gemaakt.

In ieder geval heel erg bedankt! Laten we dan beginnen…

Introductie

- Kunt u kort iets vertellen over uw bedrijf en uw rol daarin?
- Wat heeft ervoor gezorgd dat u regeneratieve landbouw bent gaan implementeren?

(‘Verwijzingen naar uw website zijn ook helemaal prima, aangezien u daar ook erg veel heeft staan’)

‘Laten we beginnen bij het begin…’

- Wat voor zaaizaad gebruikt u? En waar komt dit precies vandaan?
- Wat voor graan(soorten) produceert u precies?
- Kunt u kort beschrijven hoe een teeltseizoen eruitziet bij u, van voorbereiding tot oogst (zaaien, onderhouden en oogsten)?
- Voor welke doeleinden wordt dit graan doorgaans gebruikt?
- Is er een graansoort waarvan u graag de keten zou willen zien?
- Kunt/wilt u een grove inschatting geven van de volumes van uw graanproductie (in % of tonnen)?
- (Welke machines gebruikt u? En dan welke merken?) -alleen als je tijd hebt

Keten

- Hoe ziet de keten er na uw bedrijf uit? Naar wie gaat het product daarna? (Verwerkt u het graan zelf (drogen, opslaan, verwerken), of werkt u samen met een molenaar of verwerker?) En zou ik daar dan ook de contactinformatie van mogen hebben?
- Hoe is die samenwerking?
- Hoe wordt het graan verpakt naar de volgende in de keten?
- Welk transportbedrijf doet dit?
- Heeft u inzicht in wat er verderop in de keten met uw graan gebeurt?

Regeneratieve landbouw

- Welke regeneratieve landbouw methodes past u toe? (zoals niet-kerende grondbewerking, groenbemesters, wisselteelt, etc.)
- Als we kijken naar regeneratieve landbouw is er een specifieke mannier waarvoor u zorgt voor de vruchtbaarheid van de bodem? En monitort u de gezondheid van de grond?
- Hoe gaat u om met onkruid, plagen of ziektes – gebruikt u bepaalde biologische of regeneratieve methoden?
- Welke impact merkt u van regeneratieve praktijken op uw opbrengst, kosten of weerbaarheid?
- Is er sprake van verlies of reststromen? En zo ja, wat doet u daarmee?
- Zijn er voorwaarden of gevoeligheden waar ik rekening mee moet houden als ik uw bedrijf als voorbeeld kan gebruiken?

‘Als laatste… zou u deze animatie zelf willen gebruiken (bijvoorbeeld voor communicatie, workshops, subsidieaanvragen) en zou u bereid zijn om op een later moment feedback te geven op een eerste versie van de animatie (dat staat ook in het toestemmingsformulier)?

Dat waren mijn vragen voor nu. Heel veel dank voor uw openheid en tijd — dit helpt mij enorm om de keten vanuit praktijkperspectief in beeld te brengen. Mocht u na afloop nog iets te binnen schieten of informatie willen toevoegen, dan kunt u me altijd appen, bellen of mailen. Nogmaals dank en een fijne dag gewenst!’

Script and Questions Evaluation:

‘Hallo, welkom en bedankt dat u tijd heeft vrijgemaakt voor mijn evaluatie.

Laten we de bureaucratische acties even snel bekijken. Ik neem aan dat u de informatiebrief en het toestemmingsformulier heeft gelezen. Heeft u deze ook in kunnen vullen? Zo niet vraag ik u welke acties ik wel en niet mag hanteren, als u deze dan ook aan zou kunnen kruisen in het toestemmingsformulier voor het latere opsturen.

Even een opfrisser, laat me me weer voorstellen, mijn naam is Madeleine Leertouwer en ik studeer Creative Technology aan de Universiteit Twente. Voor mijn afstudeerproject heb ik een interacitieve animatie ontwikkeld over een regeneratieve voedselvoorzieningsketen, in samenwerking met Foodvalley.

Het doel van mijn afstudeerproject is om een voedselketen helder in beeld te kunnen brengen en hierdoor de communicatie onderling en kennisdeling te verbeteren. De keten die ik heb gekozen laat het verloop van graan zien, begin tot het eind.

De sessie duurt ongeveer 30 tot 45 minuten in totaal, waaronder het kijken naar het prototype en de vragen hierover.
Zijn er nog verdere vragen? Want anders denk ik dat we klaar zijn om te beginnen. Dan stuur ik de link naar het prototype in de chat. Ik heb een paar acties die u eerst moet doen voordat u kunt beginnen met de interactie met het prototypen.

Heeft u de link geopend? Zou u dan op de 2 streepjes met bolletjes kunnen klikken en dan op ‘fit width and height’? Dan kloppen de afmetingen. Als u het scherm nog iets groter wilt hebben kunt u nog klikken op de 2 pijltjes ernaast. Dan heb ik nog 1 ding om te vertellen en dat is of u uw muis voor het prototype zou kunnen gebruiken? En dan zou ik zeggen: gaat uw gang.’

Bruikbaarheid

- Hoe gebruiksvriendelijk vond u de animatie?
    - Hoe duidelijk was de navigatie van het systeem?
- Waren de interactiemomenten logisch?
    - Ook kwa plaats en of ze intuïtief waren?

Visueel

- Hoe ervaarde u de visuele stijl van de animatie?
- Was het duidelijk wat er werd afgebeeld?
    - Was het visueel duidelijk wat regeneratief was?
- Wat vond u thema van regeneratieve landbouw?
- Wat vond u van het kleurgebruik, tempo van animatie en sfeer?

Relevantie werk

- Denkt u dat deze animatie bruikbaar is voor uw werk? En zo ja waar?

Leren en inzicht:

- Heeft u nieuwe inzichten verworven?
    - Kunt u dit verder verduidelijken?
- Zijn er aspecten van de keten die zijn verduidelijkt?
    - Kunt u dit verder verduidelijken?
- Heeft de tool geholpen met uw begrip van regeneratieve landbouw?
    - Kunt u dit verder verduidelijken?
- Is er iets in de animatie dat u heeft verrast of aan het denken gezet tijdens het bekijken van de visualisatie?
    - Zo ja, wat?
- Heeft u de indruk dat iemand zonder voorkennis de animatie ook goed kan volgen?

Inhoudelijke correctheid

- Kloppen de stappen in de regeneratieve voedselketen keten volgens u?
- Zijn er aspecten van regeneratieve landbouw die volgens u niet genoeg naar voren kwamen?
    - Mist er iets?
    - Is iets incorrect?
    - Is iets nog onvolledig?

Verbeterpunten

- Zijn er elementen, bijvoorbeeeld inhoudelijk, verhalend of visueel, die u zou willen aanpassen of toevoegen?
- Heeft u nog verdere suggesties?

Doelmatigheid

- Vindt u dat de animatie het beoogde doel, het in beeld brengen van een regeneratieve voedselketen en het verbeteren van kennisdelen en het stimuleren van besluiten richting regeneratieve landbouw heeft bereikt?

Follow-up Evaluation Questions:

Bruikbaarheid

- Wat vond u nu van de bruikbaarheid?
- Zijn de interactiemomenten verbeterd in duidelijkheid?
    - Hoe komt dat?
- Is de navigatie verbeterd?

    - Hoe komt dat?

Relevantie werk

- Is de nieuwste versie beter afgestemd om in gebruik worden te nemen in de praktijk?

Leren en inzicht

- Zou er volgens u iemand zonder voorkennis deze versie beter kunnen volgen?
- Heeft de nieuwe versie bepaalde onderdelen beter inzichtelijk gemaakt?
    - Zo ja, welke?

Inhoudelijke correctheid

- Kloppen de stappen in de keten volgens u nog steeds?
- Is het inhoudelijk verbeterd van de oudere versie en hoe?
- Zijn er aspecten van regeneratieve landbouw die volgens u nog steeds onderbelicht zijn gebleven?
    - Mist er iets?
    - Is iets incorrect?
    - Is iets nog onvolledig?

Verbeterpunten

- Zijn de aanpassingen volgens u goed overeengekomen met wat u de vorige keer had bemerkt?
    - Zo ja, welke en hoe?
- Zijn er elementen, bijvoorbeeeld inhoudelijk, verhalend of visueel, die u zou willen aanpassen of toevoegen?
- Heeft u nog verdere suggesties voor deze versie?

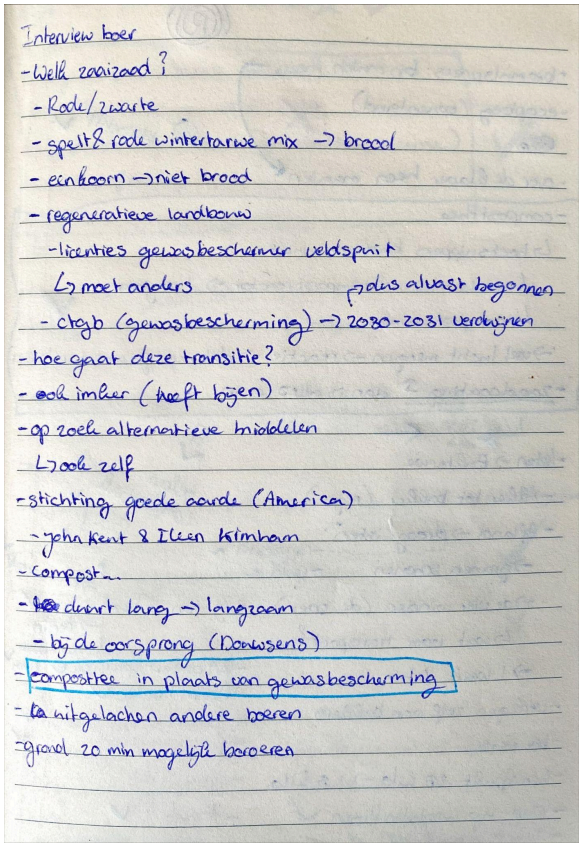
Doelmatigheid

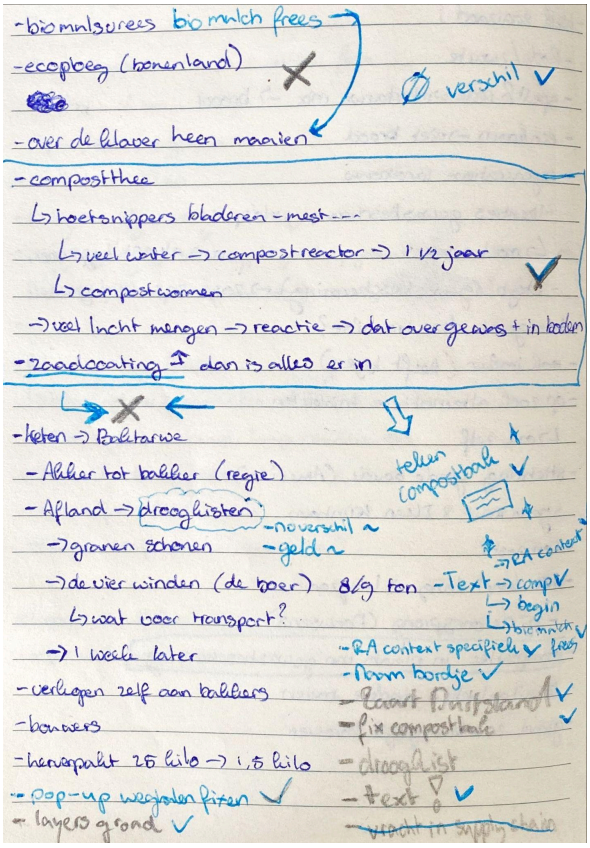
- Vindt u dat deze versie van de animatie het beoogde doel, het in beeld brengen van een regeneratieve voedselketen en het verbeteren van kennisdelen en het stimuleren van besluiten richting regeneratieve landbouw beter heeft bereikt?

Appendix E: Notes, Interview and Evaluations

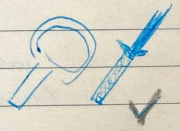
Notes Interview RA Farmer:

All lighter blue text was added later and was utilized to make sure the project contained all important information. So essentially, only the dark blue text is noteworthy.





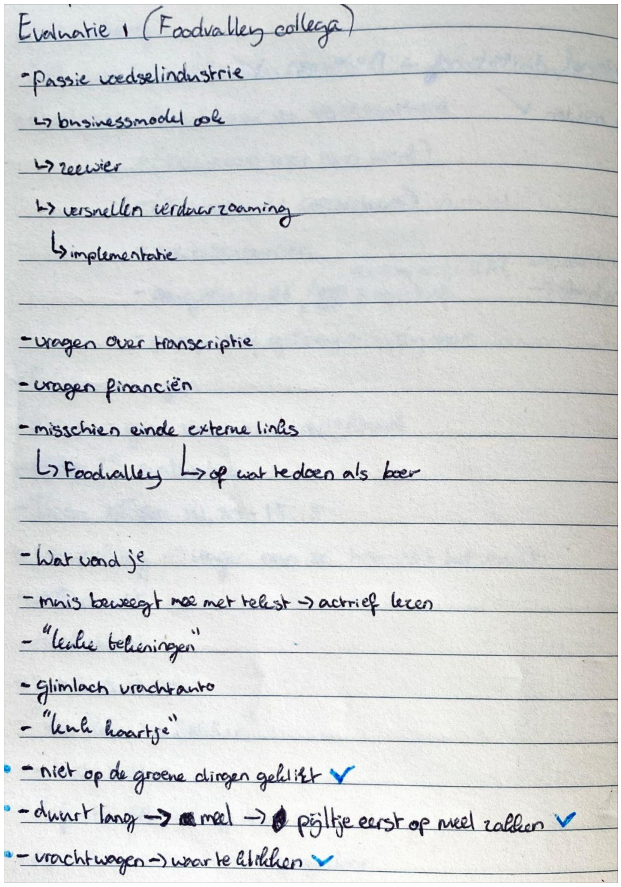
- droge bonen → tarwe zaaien
  ↳ publiek CO_2 op uit de lucht
- vlinderbloemige (bonen, peulvruchten, luzerne) ✓
  ↳ stikstofbinders
- eerst bonen → wintergranen
  ↳
- land → schuur → tractor → verpakt → verpakt
- bedrijf → malen → tractor + aanhangwagen
- malen → boer → bakkers
- malen → transport
- rode tarwe uitleg
  ↳ → Research ✓
- malen als bio
- big bags 1000 kilo → silo → papieren zak 25 kilo → detectiesysteem



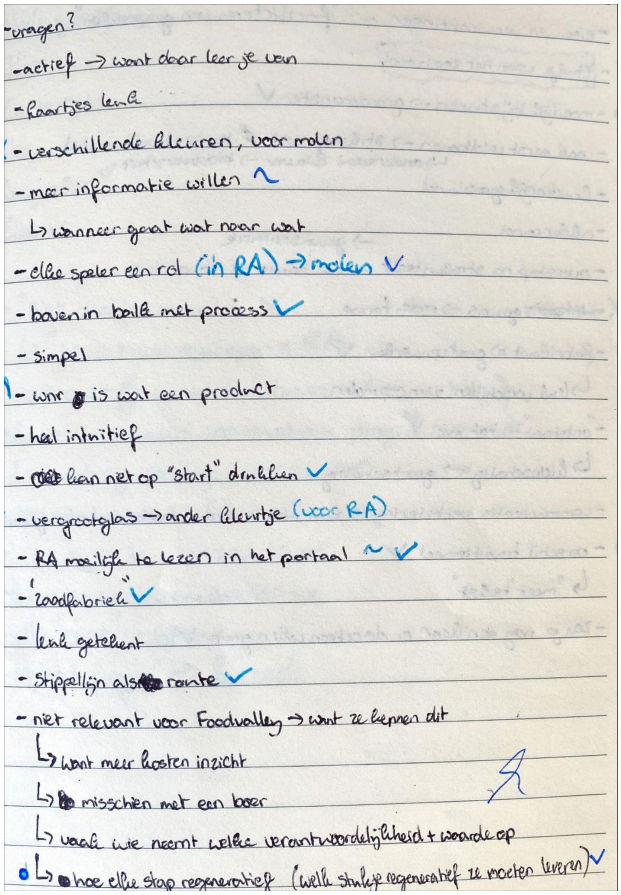
- monitoren grond → grondmonsters → opsturen ✓
- impact RA
  ↳ weerbaarheid → (niet intensief)
  ↳ ook kwa ziekte druk (niet echt)
  ↳ vooral geen foute schimmel meeldauw
  ↳ opbrengst wat minder / het zelfde ← zijn doel met minder chemie
  ↳ samenwerking andere boeren → informatie delen → helpt wel

Notes Evaluation 1:

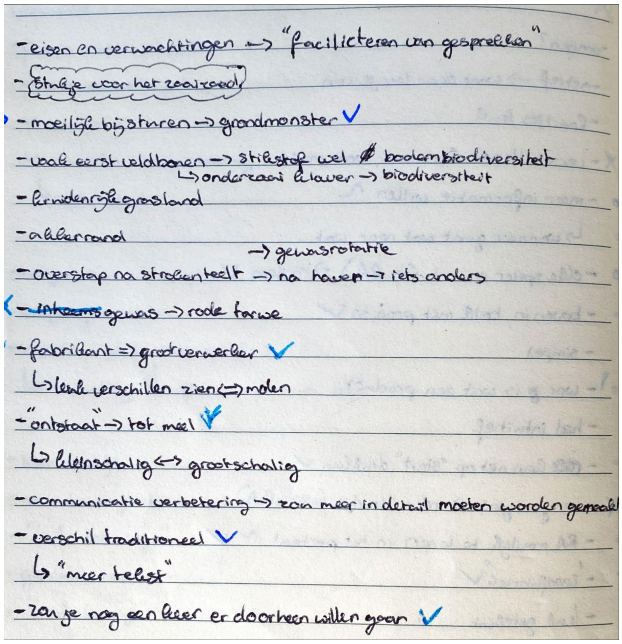
The upcoming notes from 1-5 contain a lighter blue text as well as a darker blue has been added later and was utilized in making sure the project contained all important information. So essentially, only the black text is noteworthy.



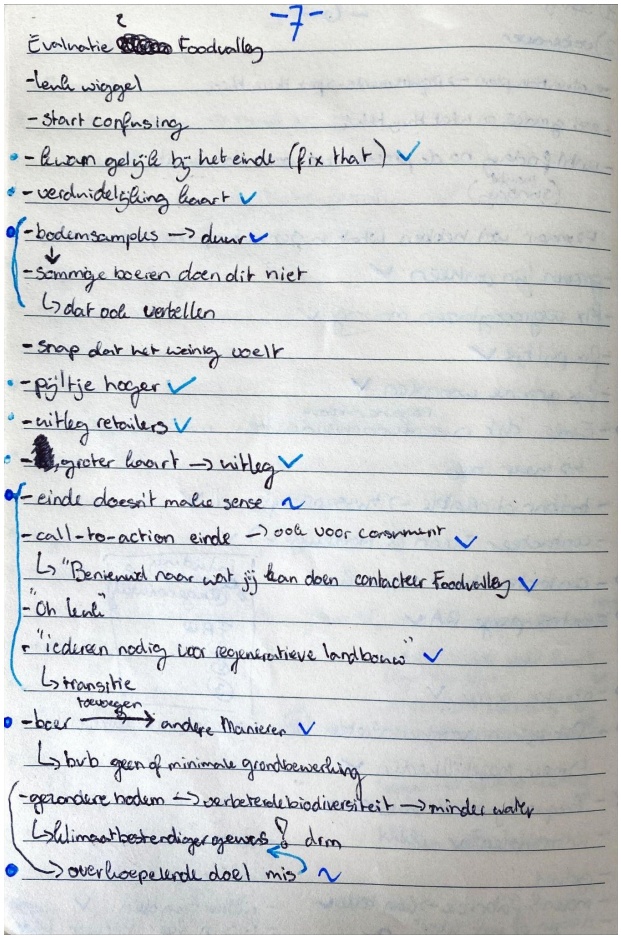
Evaluatie 1 (Foodvalley collega)
- passie voedselindustrie
  - ↳ businessmodel ook
  - ↳ zeewier
  - ↳ versnellen verduurzaming
    - ↳ implementatie
- vragen over transcriptie
- vragen financiën
- misschien einde externe links
  - ↳ Foodvalley ↳ op wat te doen als boer
- wat vond je
- mais beweegt mee met tekst → actief lezen
- "leuke tekeningen"
- glimlach vrachtauto
- "leuk kaartje"
- niet op de groene dingen geklikt ✓
- duurt lang → meel → pijltje eerst op meel zelfden ✓
- vrachtwagen → waar te klikken ✓

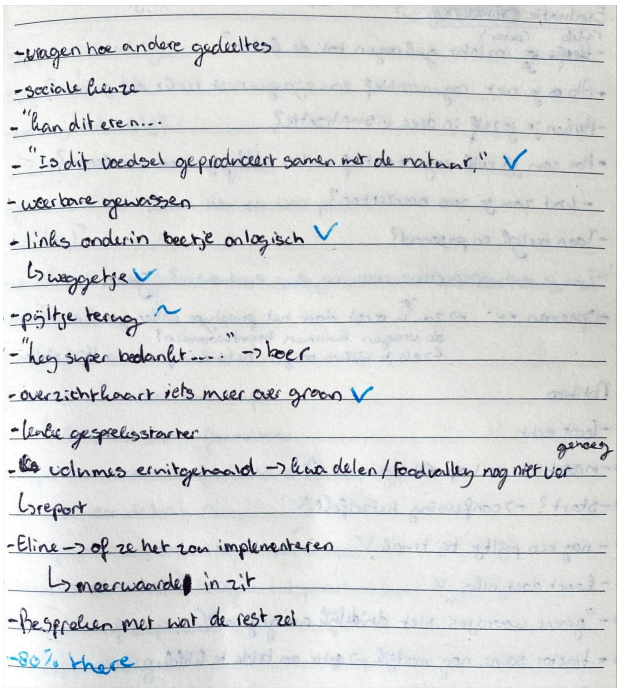


vragen?
- actief → want daar leer je van
- kaartjes leuk
- verschillende kleuren, voor molen
- meer informatie willen ~
  - ↳ wanneer gaat wat naar wat
- elke speler een rol (in RA) → molen ✓
- boven in balk met process ✓
- simpel
- wnr is wat een product
- heel intuitief
- kan niet op "start" drukken ✓
- vergrootglas → ander kleurtje (voor RA)
- RA moeilijk te lezen in het portaal ~ ✓
- "zoutfabriek" ✓
- leuk getekend
- stippellijn als route ✓
- niet relevant voor Foodvalley → want ze kennen dit
  - ↳ want meer kosten inzicht
  - ↳ misschien met een boer
  - ↳ vaak wie neemt welke verantwoordelijkheid + waarde op
  - ↳ hoe elke stap regeneratief (welk stukje regeneratief ze moeten leveren) ✓

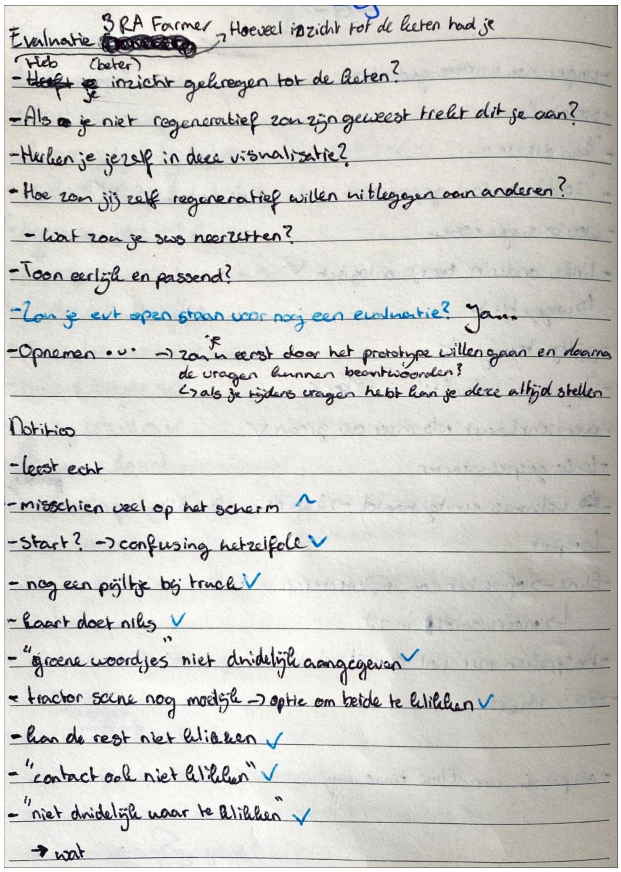


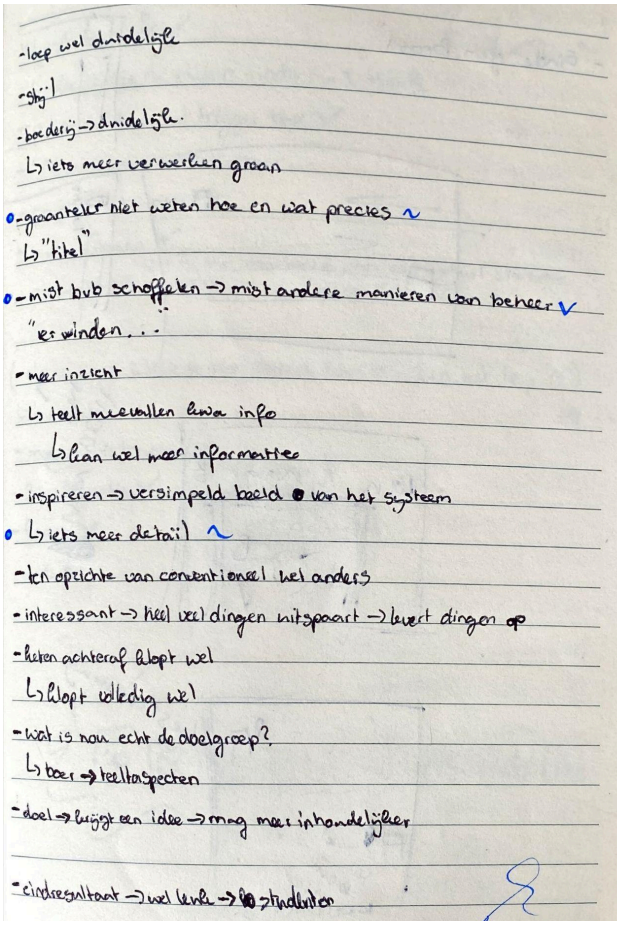
Notes Evaluation 2:



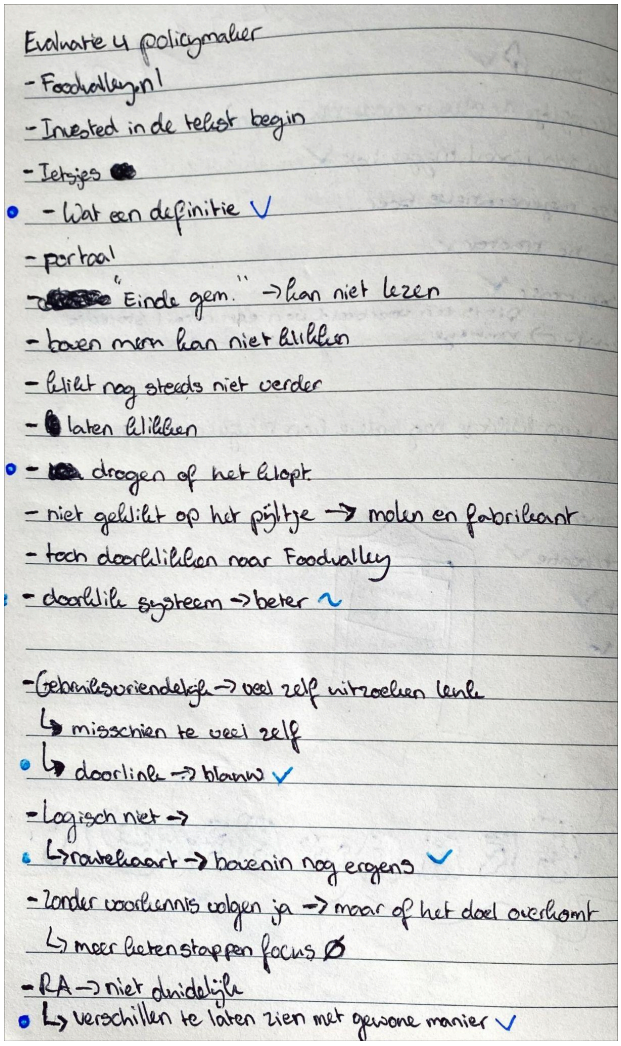


Notes Evaluation 3:

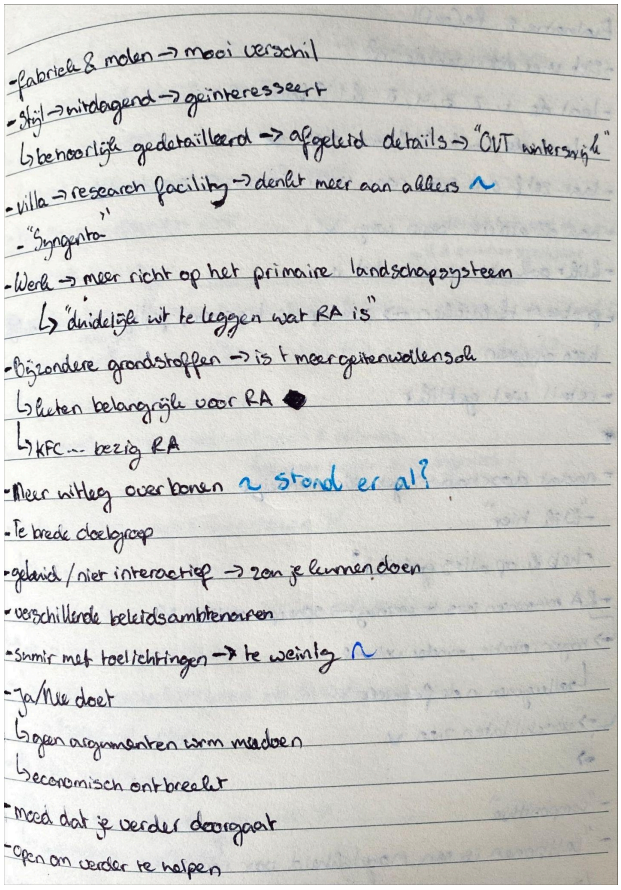




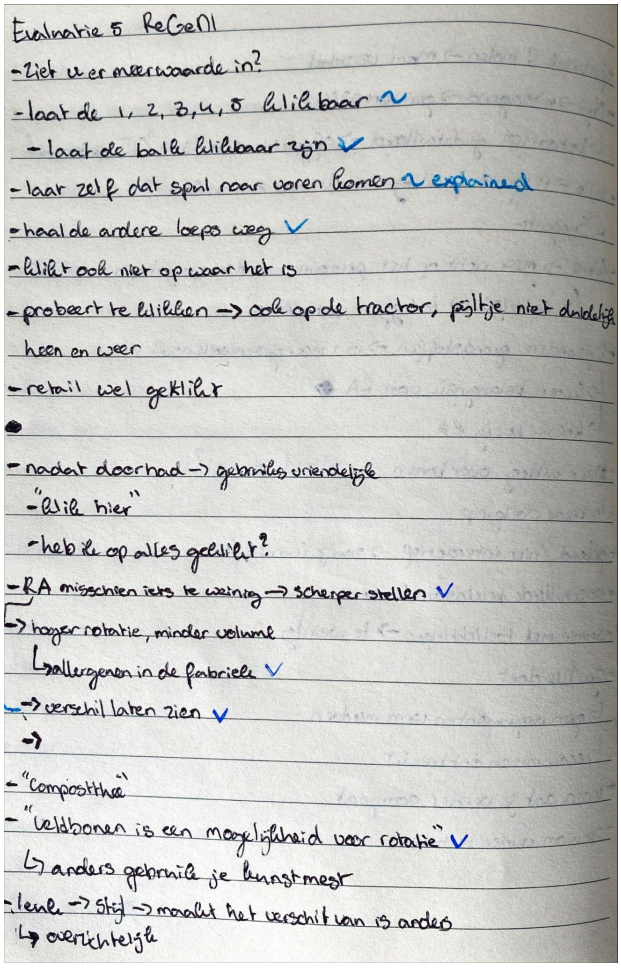
Notes Evaluation 4:

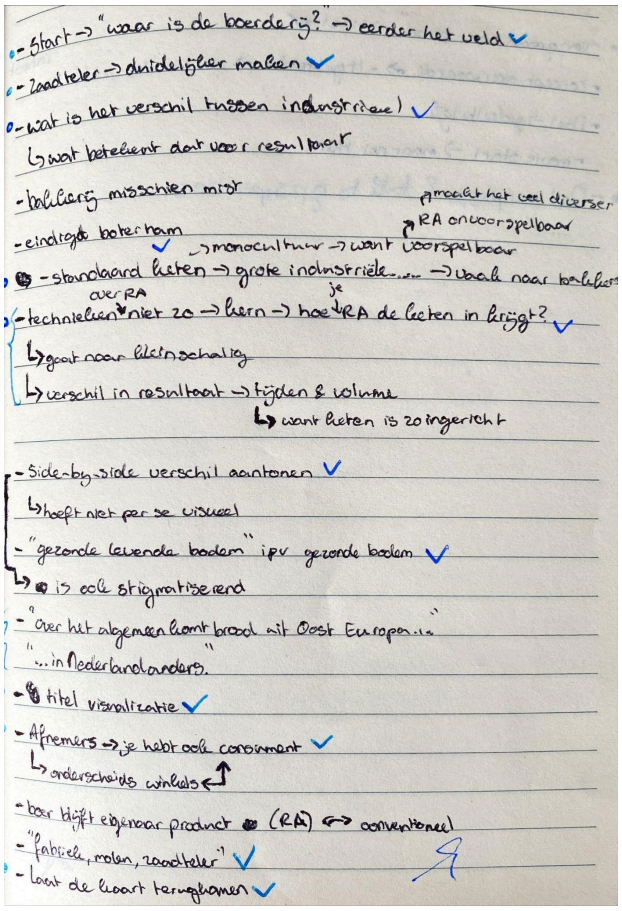

Evaluatie 4 policymaker
- Foodvalley.nl
- Invested in de tekst begin
- Ietsjes [redacted]
- Wat een definitie ✓
- portaal
- [redacted] "Einde gem." → kan niet lezen
- boven maar kan niet klikken
- blijkt nog steeds niet verder
- [redacted] laten klikken
- [redacted] dragen of het klopt
- niet geblikt op het pijltje → molen en fabrieksart
- toch doorklikken naar Foodvalley
- doorklik systeem → beter ~

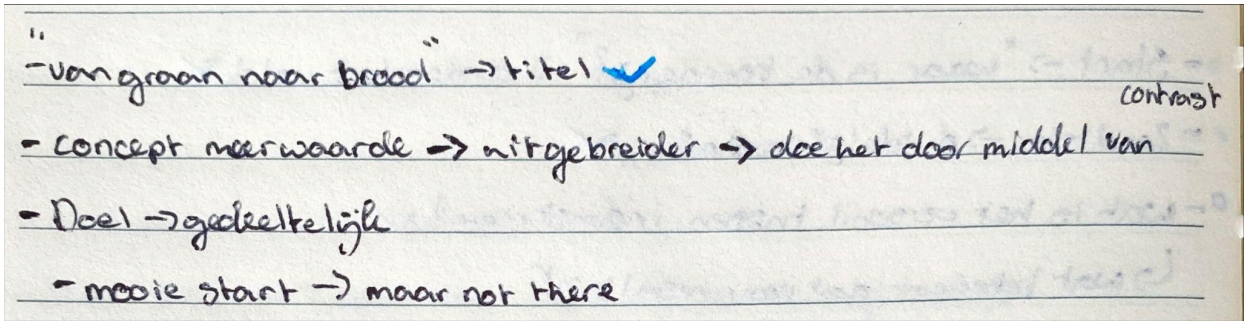
- Gebruiksvriendelijk → veel zelf uitzoeken lenk
  ↳ misschien te veel zelf
  ↳ doorlink → blanco ✓
- Logisch niet →
  ↳ ravelkaart → bovenin nog ergens ✓
- zonder voorkennis volgen ja → maar of het doel overkomt
  ↳ meer keten stappen focus Ø
- RA → niet duidelijk
  ↳ verschillen te laten zien met gewone manier ✓


- fabriek & molen → mooi verschil
- stijl → uitdagend → geïnteresseerd
  ↳ behoorlijk gedetailleerd → afgeleid details → "CVT wintersvijk"
- villa → research facility → denkt meer aan alkers ~
- "Syngenta"
- Werk → meer richt op het primaire landschapssysteem
  ↳ "duidelijk uit te leggen wat RA is"
- Bijzondere grondstoffen → is t meergeitenwollensok
  ↳ laten belangrijke voor RA [redacted]
  ↳ KFC ... bezig RA
- Meer uitleg over kansen ~ stond er al?
- Te brede doelgroep
- gelaid / niet interactief → zon je kunnen doen
- verschillende beleidsambtenaren
- Samir met toelichtingen → te weinig ~
- ja/nee doet
  ↳ open argumenten om mee te doen
  ↳ economisch ontbreekt
- mooi dat je verder doorgaat
- open om verder te helpen

Notes Evaluation 5:

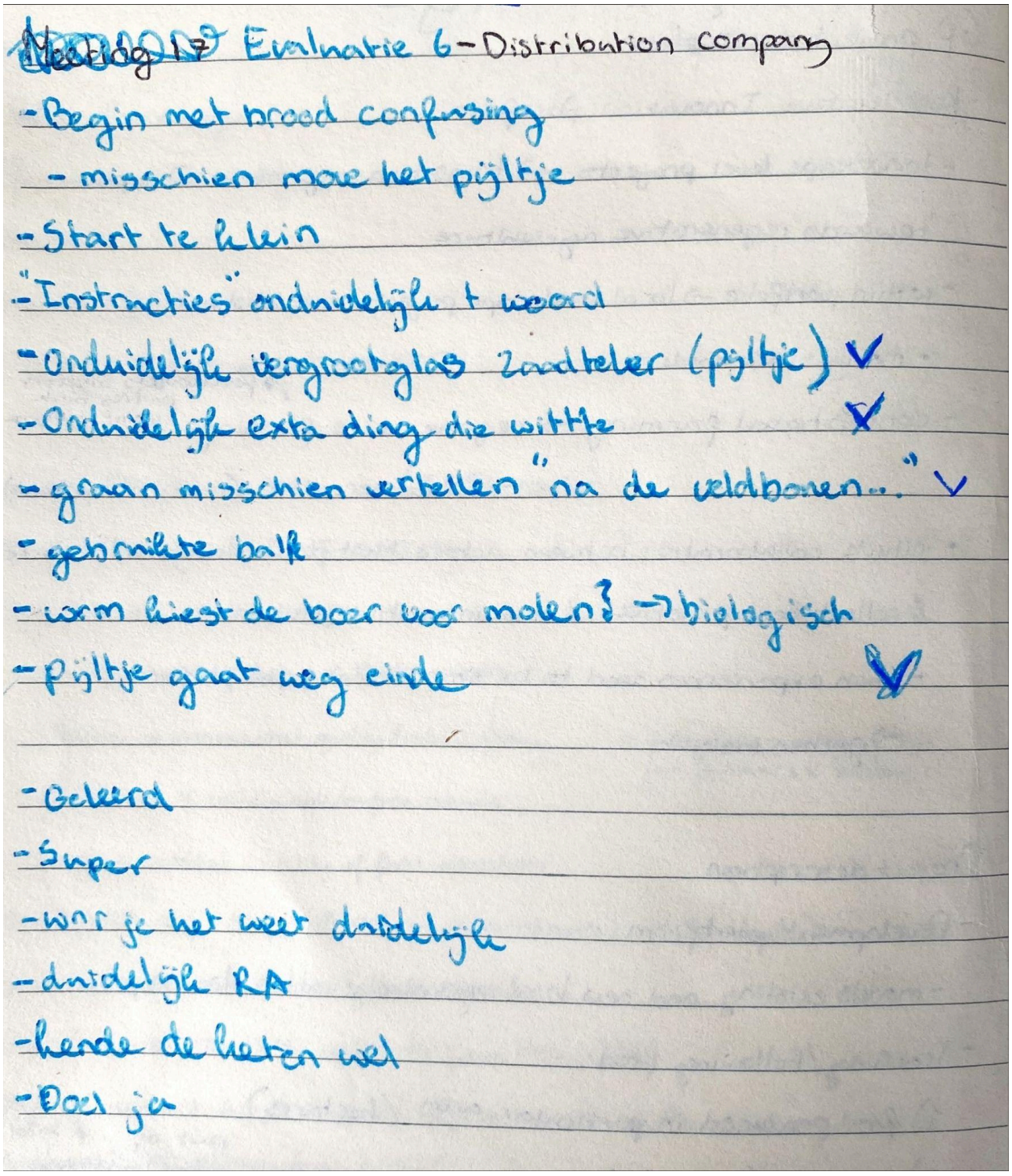

Evaluatie 5 ReCell
- Ziet u er meerwaarde in?
- laat de 1, 2, 3, 4, 5 klikbaar
- laat de balk klikbaar zijn
- laat zelf dat spiel naar voren komen → explained
- haal de andere loops weg
- klikt ook niet op waar het is
- probeert te klikken → ook op de tractor, pijltje niet duidelijk heen en weer
- retail wel geklikt
- nadat doorhad → gebruikte vriendelijke
- "klik hier"
- heb ik op alles geklikt?
- RA misschien iets te weinig → scherper stellen
→ hoger rotatie, minder volume
↳ allergenen in de fabriek
→ verschil laten zien
→
- "Compostthee"
- "veldbonen is een mogelijkheid voor rotatie"
↳ anders gebruik je kunstmest
- leuk → stijl → moeilijk het verschil van is anders
↳ overzichtelijk


- start → "waar is de boerderij?" → eerder het veld
- zaadteler → duidelijker maken
- wat is het verschil tussen industrieel
↳ wat betekent dat voor resultaat
- behulpzaam misschien mist
- eindrapport boterham → monocultuur → want RA maakt het veel diverser, RA onvoorspelbaar, voorspelbaar
- standaard keten → grote industriële ... → zoek naar verbeter
- technieken over RA niet zo → kern → hoe je RA de keten in krijgt?
↳ gaat naar kleinschalig
↳ verschil in resultaat → tijden & volume
↳ want keten is zo ingericht
- side-by-side verschil aantonen
↳ hoeft niet per se visueel
- "gezonde levende bodem" ipv gezonde bodem
↳ is ook stigmatiserend
- "over het algemeen komt brood uit Oost Europa..."
"...in Nederland anders."
- titel visualisatie
- Afnemers → je hebt ook consument
↳ onderscheids winkels
- boer blijft eigenaar product (RA) ↔ conventioneel
- "fabriek, molen, zaadteler"
- laat de kaart terugkomen

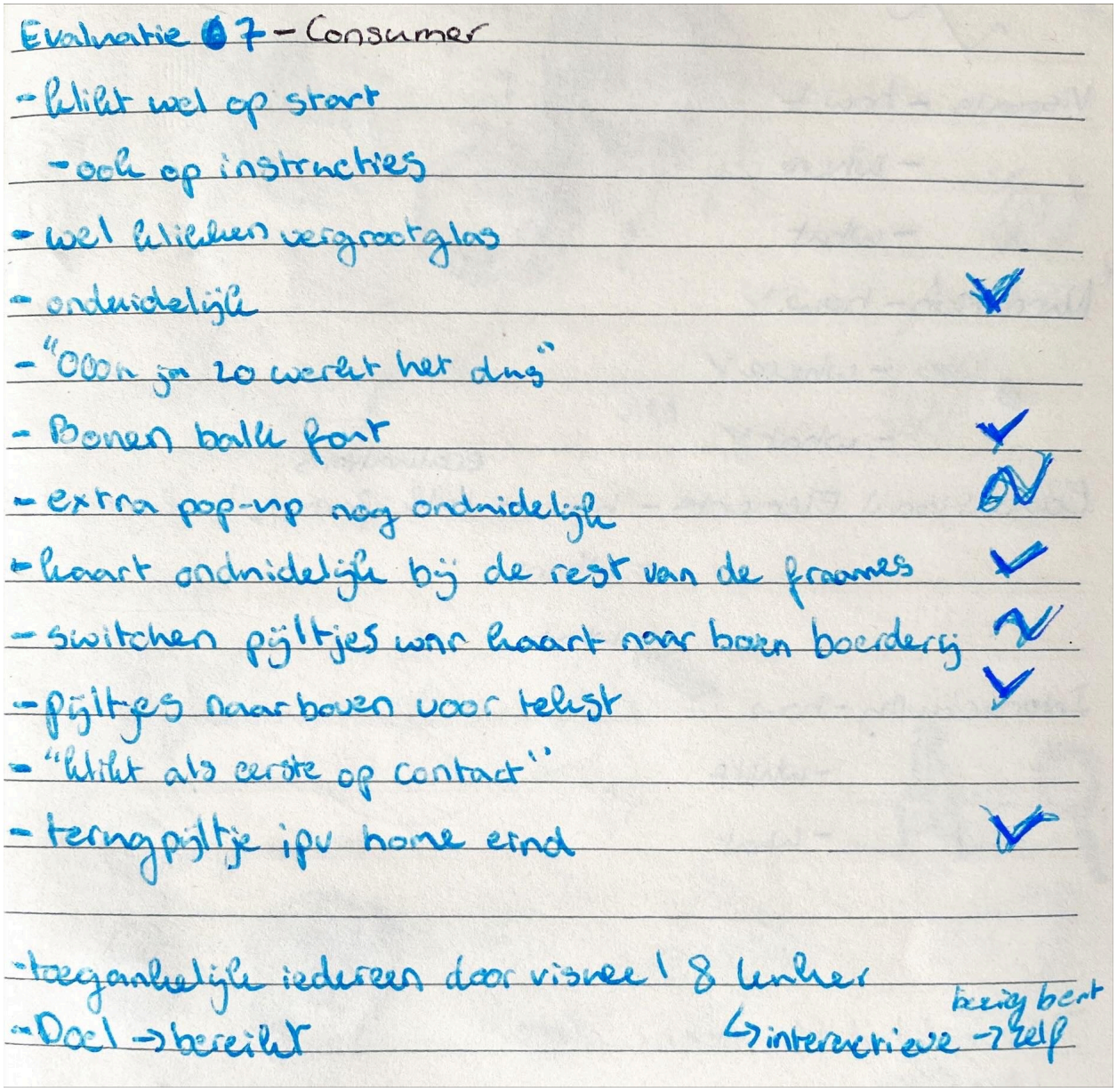

"
- van graan naar brood" → titel
contrast
- concept meerwaarde → nitrogebreider → doe het door middel van
- Doel → gedeeltelijk
- mooie start → maar not there

Notes Evaluation 6:

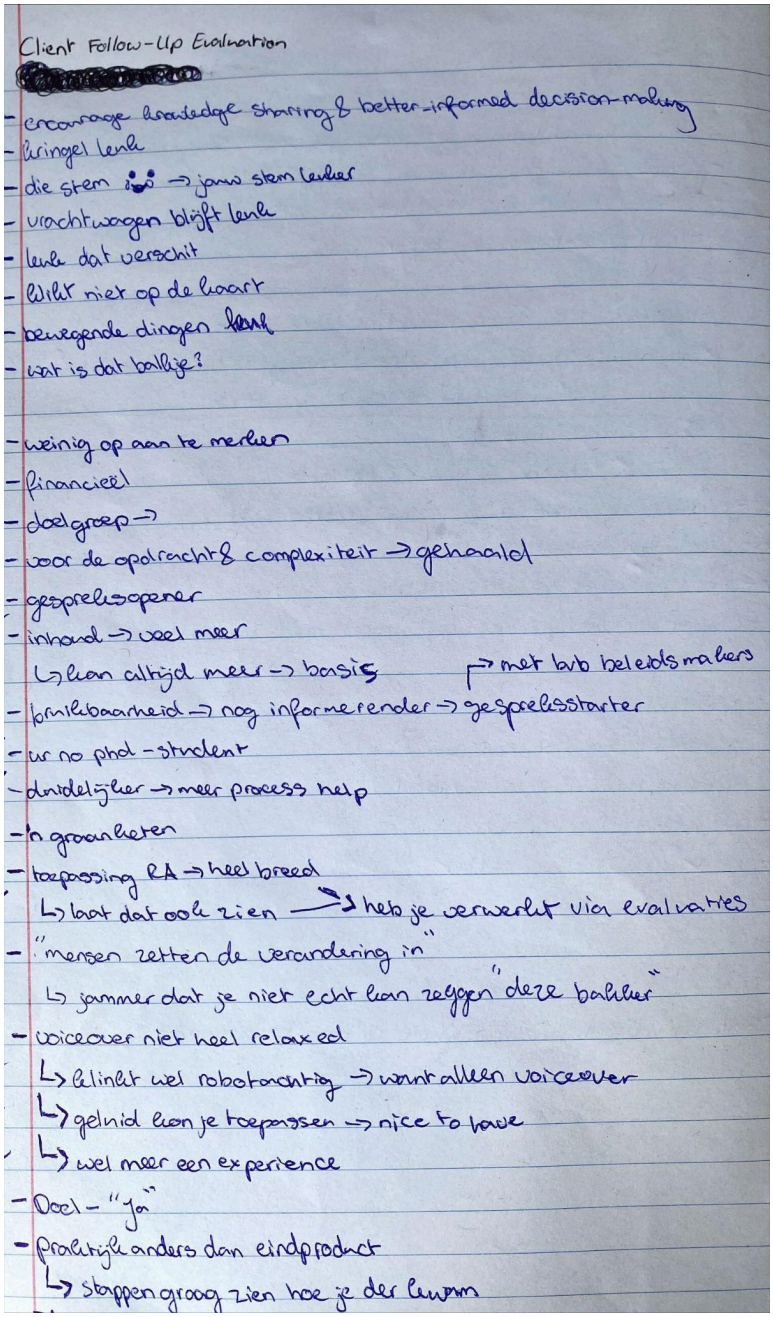
The next few notes, 6 and 7 were written in lighter blue text, the other colours were added later. So essentially, only the light blue text is noteworthy here.



Notes Evaluation 7:



Notes Follow-up Evaluation:



Client Follow-Up Evaluation

[redacted]

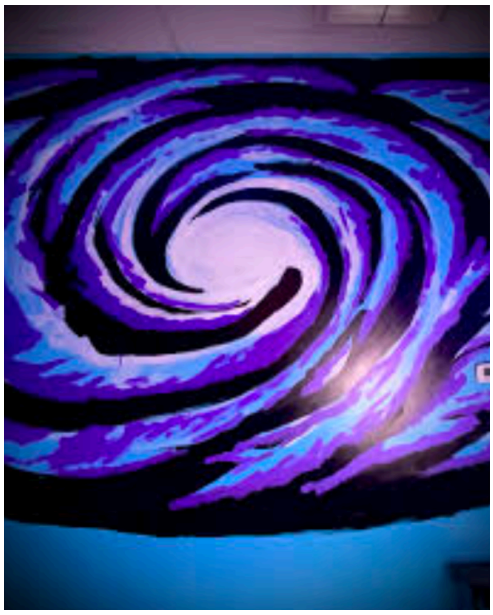
- encourage knowledge sharing & better-informed decision-making
- ringel lenk
- die stem 🐾 → jouw stem telt
- vrachtwagen blijft lenk
- lenk dat verschil
- blikt niet op de hoart
- bewegende dingen ~~lenk~~
- wat is dat balkje?

- weinig op aan te merken
- financieel
- doelgroep →
- voor de opdracht & complexiteit → gehaald
- gespreksopener
- inhoud → veel meer
  - ↳ kan altijd meer → basis → met bvb beleidsmakers
- herkenbaarheid → nog informerender → gespreksstarter
- ir no phd - student
- duidelijker → meer process help
- 'n grootheten
- toepassing RA → heel breed
  - ↳ laat dat ook zien → heb je verwerkt via evaluaties
- "mensen zetten de verandering in"
  - ↳ jammer dat je niet echt kan zeggen "deze balkjes"
- voiceover niet heel relaxed
  - ↳ klinkt wel robotachtig → vooral alleen voiceover
  - ↳ geluid kan je toepassen → nice to have
  - ↳ wel meer een experience
- Oeel - "ja"
- praktijk anders dan eindproduct
  - ↳ stappen groog zien hoe je der kwam

Appendix F: Reference Pictures

Portal:

The intermediate step of a Mural created by Choiceartist on Instagram [54].



Mill:

A grain and hulling mill named Aeolus, is located in Groningen Oldehove [55]. Photographer unknown, origins most likely from Groninger Molenarchief (Groningen Millarchive) [56].

Welcome Sign:
Welcome sign captured by AngTalunin [57].

Bakery:
Bakery museum De Oude Bakkerij in Medemblik [58] Captured by Dqfn13 [59].

Farm Shop:
Farm shop Arkelandshoeve in Ermelo [60]. Photographer unknown, most likely [60].

House:
House from VarexHuis [61].

Restaurant:
Restaurant de SteenenPlaats in [62]. Photographed by martin h on Tripadvisor [63].

Flour Factory:

Factory Koopmans [53]. Photograph from Russcher Tekst & Beeld [64].

Silo:

Grain silo from Silo Pros [65]. Photograph from Pixabay [66].

Farm:

A farm, but specifically a stop farmhouse/Dutch pyramid farmhouse, taken from Sander Douma Architecten [67].

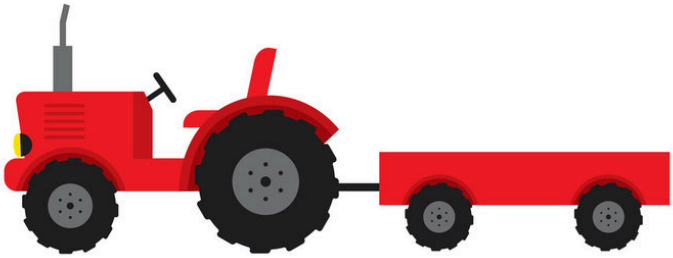
Truck:

A photograph of a truck from Shutterstock [68].

Grain bin:

A photo of a grain drying cabinet taken by the farmer of this food supply chain.

Tractor:
Tractor from Adobe Stock [69]



Appendix G: Voiceover Script Prototype

Voiceover script:
Scene 1: Eten, hmm. Wat weten we er weinig over, want waar komt ons eten vandaan? ...Is dit voedsel geproduceerd samen met de natuur? Is dit eten duurzaam?

Scene 2: Welkom bij de regeneratieve graanketen. Klaar om te ontdekken waar jouw brood vandaan komt? Klik op start en vergeet de instructies niet te bekijken. Veel plezier!

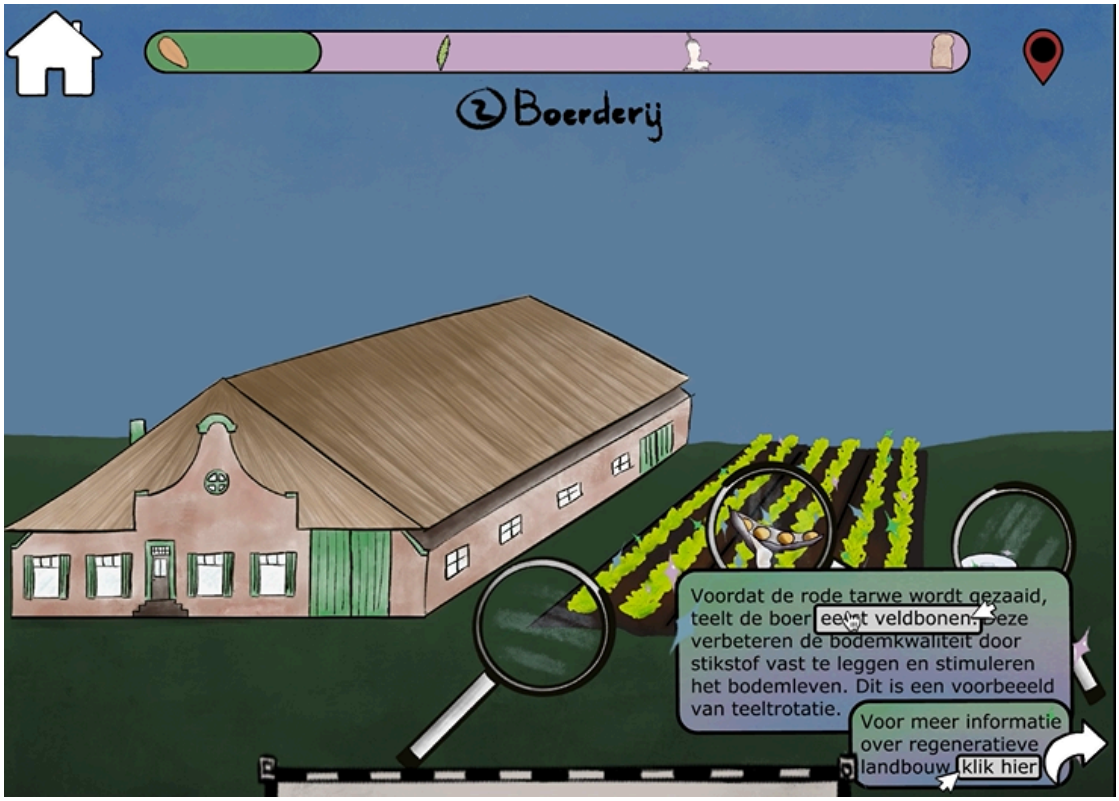
Scene 3: Regeneratieve landbouw is een complex onderwerp. Als je meer wilt weten, klik dan op ‘klik hier’ om naar een extra frame te gaan met verdere uitleg.

Scene 4: Je bent alweer aan het einde van de regeneratieve keten gekomen. Kijk gerust nog eens rond of neem een kijkje bij Foodvalley om meer te ontdekken!

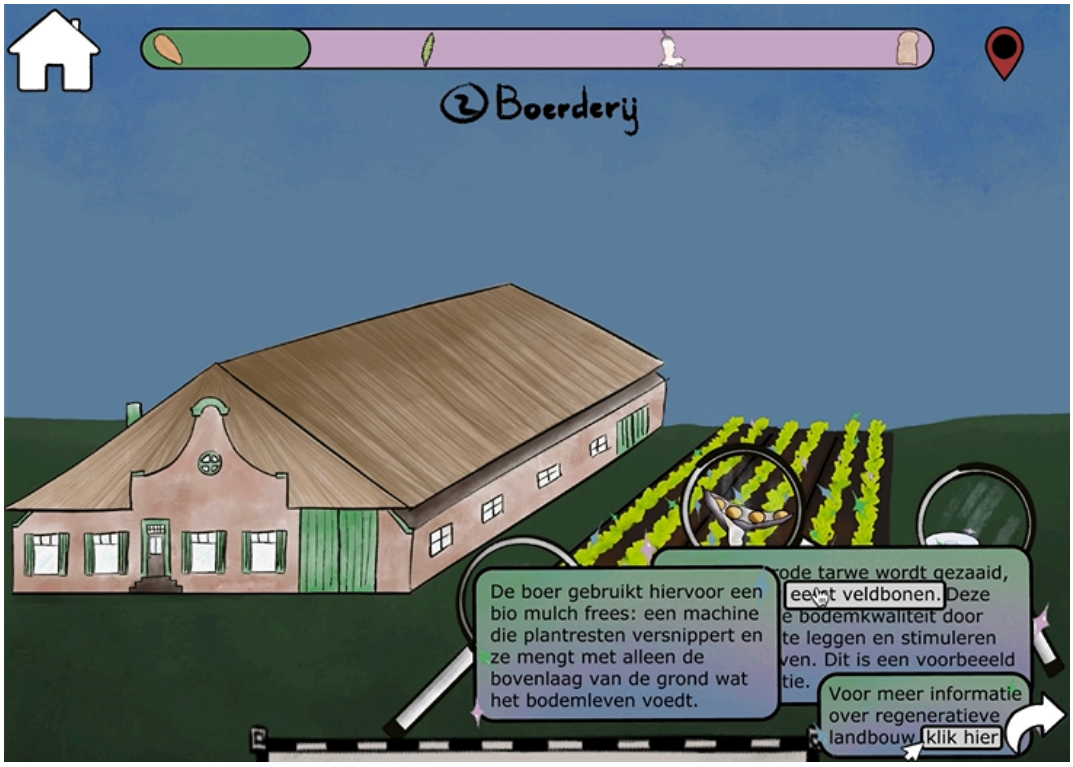
Appendix H: All Scenes

Scene 3 - Interacting with the Pop-up:

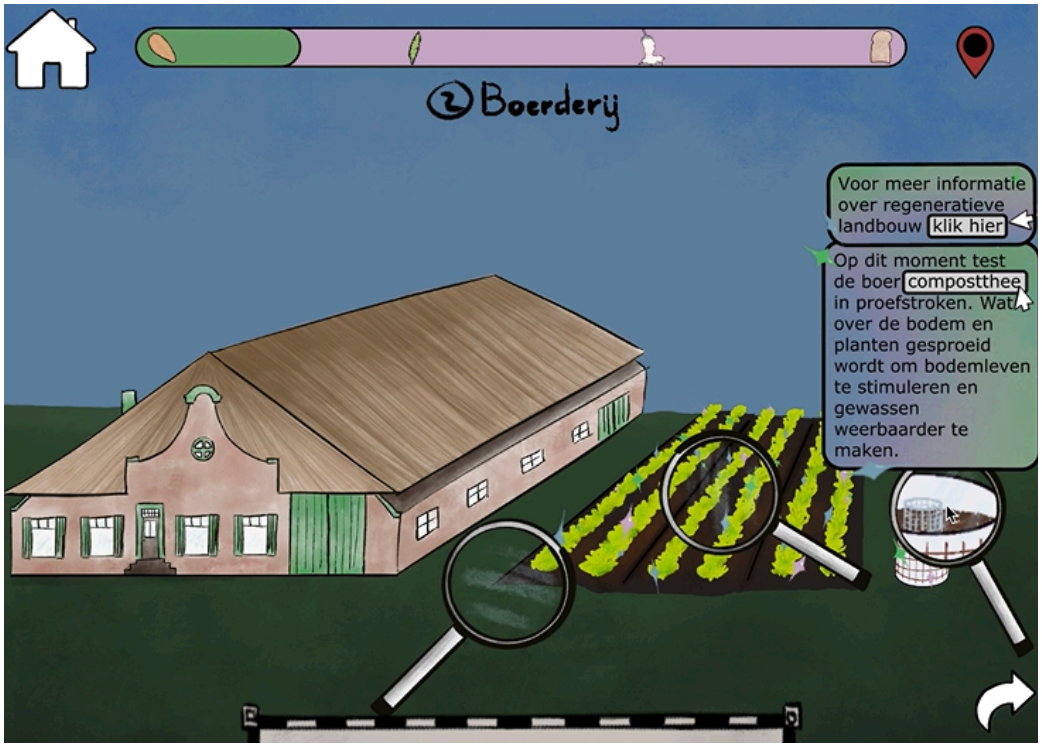
Scene 5 - Second Magnifying Glass:



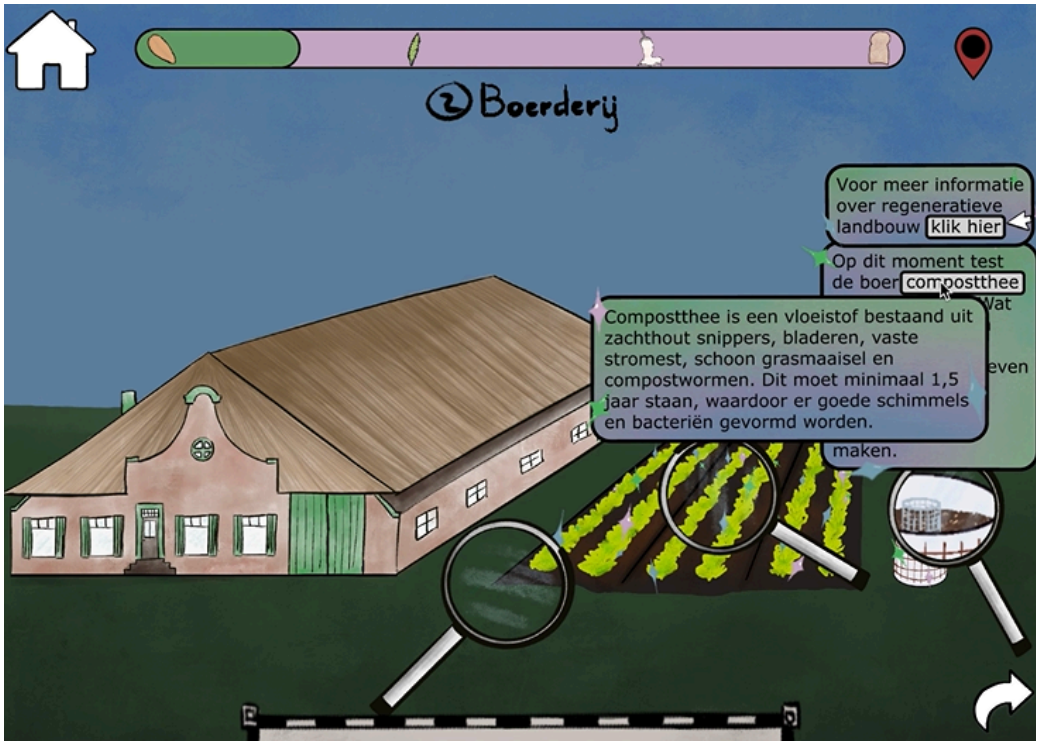
Scene 5 - Second Magnifying Glass, Additional Pop-up:



Scene 5 - Third Magnifying Glass:

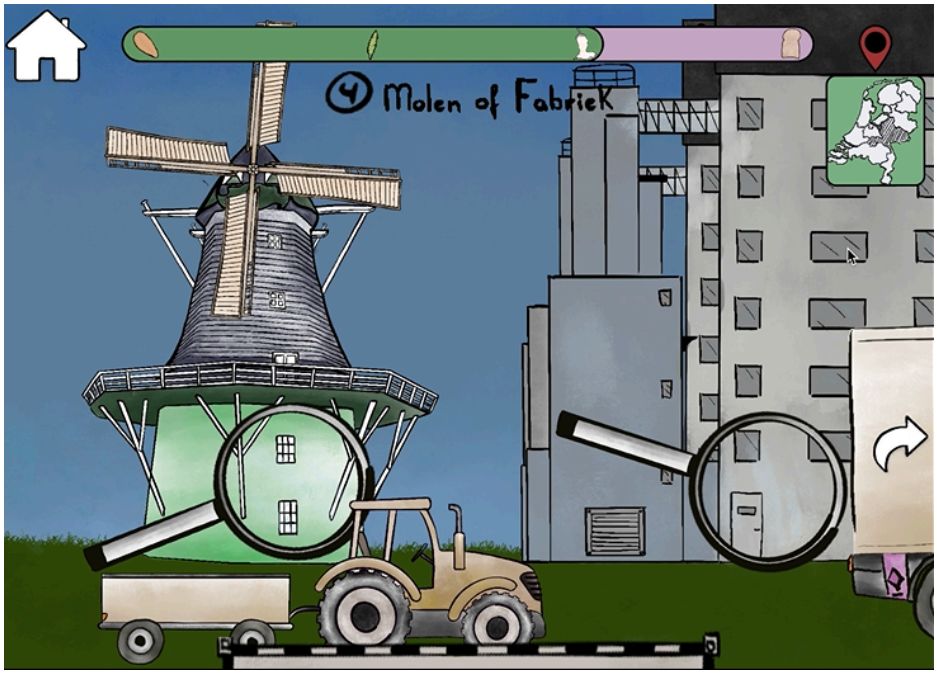


Scene 5 - Third Magnifying Glass, Additional Pop-up:

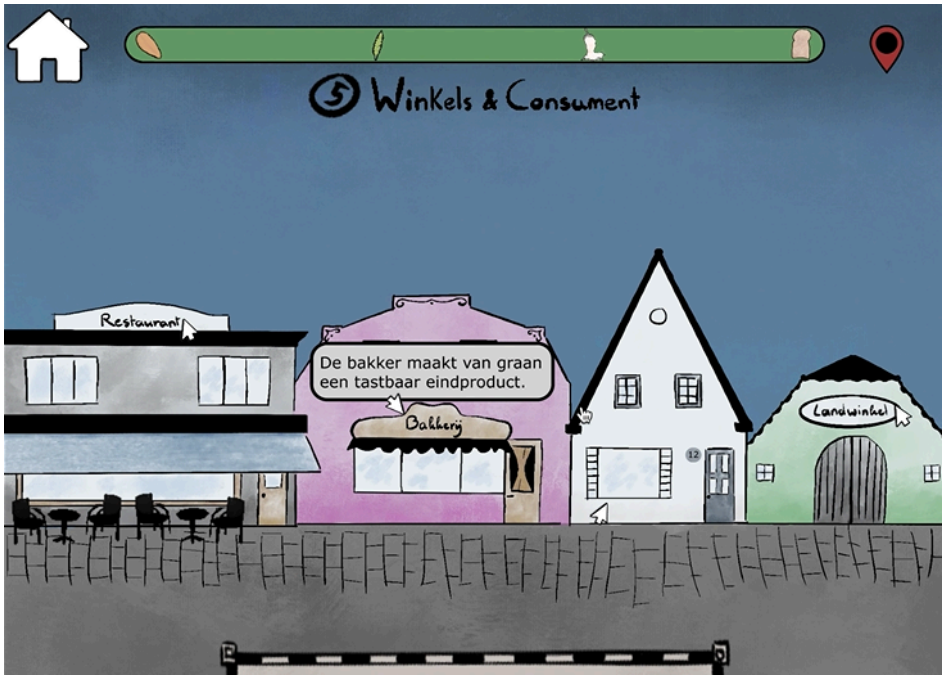


Scene 5 - Pin

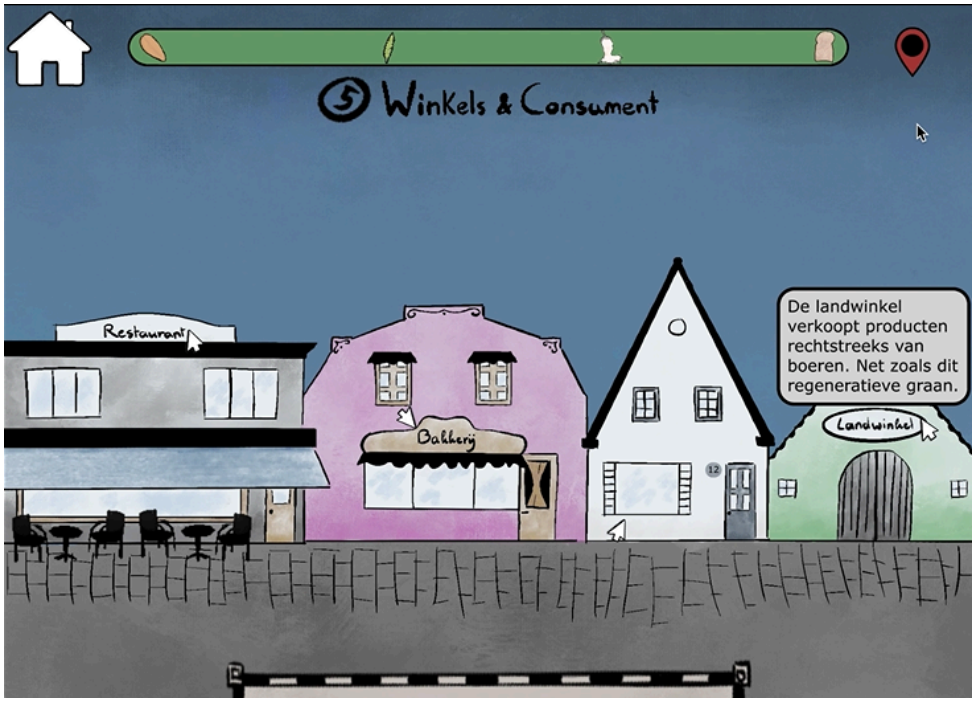
Scene 9 - Pin



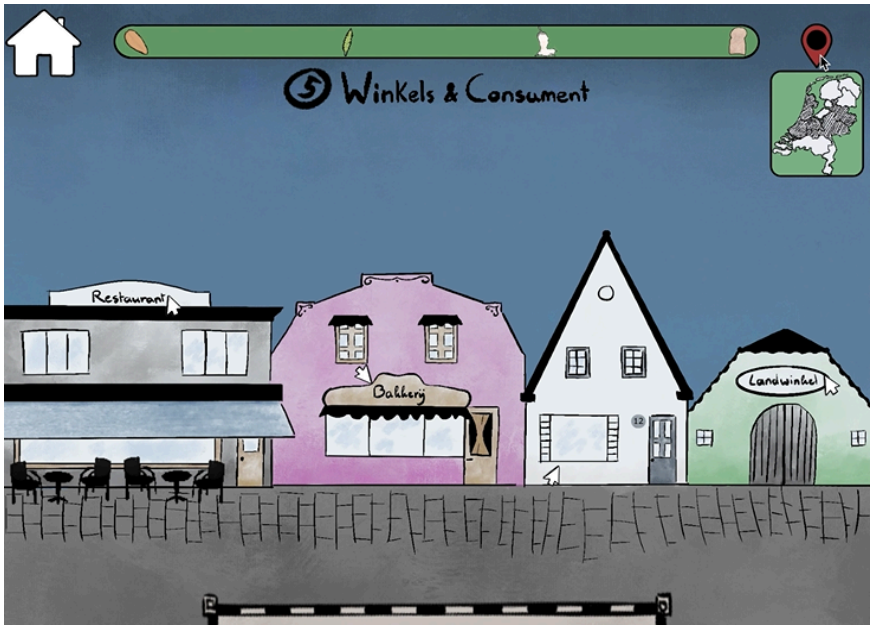
Scene 10 - Pop-up Bakery



Scene 10 - Pop-up Farm Shop


Winkels & Consument
Restaurant
Bakkerij
De landwinkel verkoopt producten rechtstreeks van boeren. Net zoals dit regeneratieve graan.
Landwinkel

Scene 10 - Pin


Winkels & Consument
Restaurant
Bakkerij
Landwinkel