Identifying and designing business models for innovative Flying Sensor services in Mozambique

Supporting the transition from a donor funded programme to a profitable company.

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van hall larenstein
university of applied sciences

ThirdEye
FutureWater HiView

SECURING WATER FOR FOOD: A GRAND CHALLENGE FOR DEVELOPMENT

USAID
FROM THE AMERICAN PEOPLE

SWEDEN

Ministry of Foreign Affairs

Word of thanks

This thesis would not have been possible without the time and dedication of the many people in Mozambique who were involved in this research, *Muito obrigado!* I have experienced how critical and passionate colleagues can make a difference, I am grateful to Sam van Til, Jan van Til and Martijn de Klerk for their guidance, and trust during this research. And for together enjoying life-besides-work during our time in Mozambique. I very much appreciated the guidance and support of my academic supervisor, Annemarie Westendorp.

Executive summary

How to be a commercial business, and at the same time reach out to the rural poor and enable them to increase their food production and improve their livelihoods? The key ingredient for success is getting the right business model! This research intends to support the transition of the ThirdEye project from a donor funded programme to a profitable company.
The ThirdEye project is providing crop health information with the use of Flying sensors in Mozambique. A Flying sensor is a drone with a high-resolution near-infrared camera that can detect crop stress. This information is key to enabling an increase and efficiency in food production. The information supports farmer's decision making regarding the use of their (limited) recourses. (seed, water, fertilizer, pesticides, human power) Use of drones for precision agriculture and crop management is exploding across the world. Drones and other high tech services supporting precision agriculture are considered the key to the future of agriculture. It is widely recognised that these technologies can play an important role in food security globally while reducing the stress on the environment.

The execution of the ThirdEye project is now halfway. The project has shown promising results, Flying Sensors advice benefitted approximately 2,500 households and conducted flyovers on 1000 hectares of land. The ThirdEye project is unique as it is a first trial in a developing country to supply information on a regular base to small holder farmers using Flying Sensors. This brings along challenges in contextualising the concept in a business environment. ThirdEye aims to be a commercial business, not a development or philanthropic activity. This means ThirdEye wants to achieve business objectives such as growth, supply security and market expansion.

A total of 25 Interviews with farmers, the public sector, the private agro sector and development agencies, have led to the design of 11 business models. It can be concluded that the business models which have more emphasis on serving small holder farmers generate lower revenue then models which also provide additional services to other customers, such as: Land use surveying, infrastructure monitoring , digital elevation model, Yield indication and topographical surveys. The new business models afford opportunity in terms of smallholder farmer inclusion and do not exclude commercial farmers, or other customers. This will also spread risk. There will always remain a trade-off between financial gain and smallholder inclusion. The models support the transition from a donor funded programme to a profitable company. When depending on funding for services to smallholder farmers the scale will be limited by funds and donor decisions. When a business model generates profit without high partner dependence, it can grow, evolve, and adapt in new markets.
Business models with an inclusive smallholder focus are (potentially) rather complex. It is adviced that: When establishing the identified models ThirdEye should guard not to oversimplify the model. It is believed that any model involving smallholder farmers should aim at also linking the farmer to other services such as agronomic advice, inputs, finance, knowledge and markets. The company lacks the reach to engage directly in all these activities. If ThirdEye wants to boost smallholder farmers' quality and supply, it should focus on using Flying Sensors to complement existing extension efforts and not reinvent the wheel. This means strengthening existing services to small holder farmers instead of trying to be an individual service.

This research aims to provide a good basis for further discussions, decision-making, and ultimately establishment of a sustainable company. Each identified business model can be regarded as a series of interlocking, sometimes changing, pieces of a jigsaw puzzle. This research provideds the start of the puzzle however to fit the pieces together more market research, a design of an operational plan and validation is needed. This will be done by SNV Mozambique (Netherlands Development Organization) this research will function as the basis for SNV.

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Acronyms.

NDVI	Near Difference Vegetation Index
RGB	Red Green and Blue
DEM	Digital Elevation Models
SWFF	Securing Water for Food

Chapter 1 Introduction

Farmer inspects NDVI advice map, Xai-Xai March 2016

Chapter 1: Introduction

The use of drones for precision agriculture, and crop management is exploding across the world. The extended use of drones enables agricultural professionals to cost effectively gather crop health information without waiting for satellite passes or paying high costs of manned-aircraft flights.

Drones (and other high tech services supporting precision agriculture) are considered the key to the future of agriculture. It is widely recognised that these technologies can play an important role in food security globally while reducing the stress on the environment. (F.Weilbach, 2016 & N. fleming 2016)

The ThirdEye project is providing crop health information with the use of Flying Sensors in Mozambique. A Flying Sensor is a drone with a high-resolution near-infrared camera, that can detect crop stress. The ThirdEye project is unique as it is a first trial in a developing country to supply information on a regular base to smallholder farmers (bottom of the pyramid customers) using Flying Sensors.

Extension services for relatively well-off commercial farmers were (and still are) increasingly delivered by private advisory service providers worldwide, but these rarely serve the rural poor. The ThirdEye project aims to be a self-sustaining company delivering its Flying Sensor services to smallholder farmers. ThirdEye aims to be a commercial business, not a development or philanthropic activity. This means ThirdEye wants to achieve business objectives such as growth, supply security and market expansion. But at the same time ThirdEye wants to reach out to the rural poor and to enable them to increase their incomes and improve their livelihoods. A smallholder inclusive business model demands innovation and change. However, it is not clear where to begin and how to generate revenue. This thesis research will focus identifying and designing a number of potential business models.

1.1 ThirdEye project

In response to a call of the Securing Water for Food program (launched at the 2013 World Water Week in Stockholm), FutureWater/HiView (see annex: 3. Corporate information) submitted a proposal titled "The ThirdEye: Flying Sensors to Support Farmers' Decision Making". Of the over 500 submissions 17 were selected to be granted. The ThirdEye project was one of these. Securing Water for Food is a Grand Challenge for Development is supported by the United States Agency for International Development (USAID), the Swedish International Development Cooperation Agency (Sida), and the Ministry of Foreign Affairs of the Kingdom of The Netherlands (MFA-NL) collectively.

Appropriate information at the right location and timing is essential for farmers to take decisions regarding application of their limited resources such as water, seeds, fertilizer and labour. ThirdEye provides this essential information: (i) at an ultra-high spatial resolution (NDVI), (ii) at an unprecedentedly flexibility in location and timing, (iii) at a spectrum outside the human eye, and (iv) at an in-country business oriented approach. ThirdEye aims to trigger a major transformation in farmers' decision making regarding their agronomic practices. Instead of relying on common-sense management, farmers will be able to take decisions based on facts. The Flying Sensor information helps farmers to see when and where they should apply their limited resources. With information from Flying Sensors they can manage also their inputs to maximize yields, and simultaneously reduce unnecessary waste of resources. For a more detailed description of the project see annex: 2. Description of ThirdEye.

Progress (2014 – 2016)

- Farmers estimate a water consumption reduction of 39%.

- More than 15,000 people have access to our services.
- The number of people benefitting from the ThirdEye services is over 12,500.
- Flying Sensor information is currently collected from over 1000 ha.
- 14 Flying Sensor Operators have been trained and obtained their license.
- 8 Flying Sensors have been supplied and are all used on a daily basis.

1.3 Problem statement

Lack of insights in business potential for the ThirdEye project.

The execution of the ThirdEye project is now halfway. The project has shown promising results, Flying Sensor benefitted approximately 2,500 households and conducted flyovers on 900ha hectares of land. ThirdEye has received 'seed' funding for their initial piloting and start-up phases. Now the positive impact of ThirdEye is proven, the project enters a new stage. ThirdEye has been challenged to set up a sustainable business model that creates value to farmers backed by a long-term commercial viable, business case for the organisation/ThirdEye.

Mozambique has been selected by FutureWater as country to pilot their concept. However, the concept of Flying Drones has not yet been applied in any emerging market (P. Droogers, 2014), let alone focussing on smallholder farmers as end users. This brings along challenges in contextualising the concept in a new business environment. The initial business approach was to set-up a network of Flying Sensor operators who are expected to turn into profitable entrepreneurs, generating revenue by selling their Flying Sensor services directly to smallholder farmers (see chapter 2.1 original business plan.). Recent experiences of ThirdEye staff led the conclusion that a business plan solely focussed on sales to smallholder farmers will not be profitable. Due to a low ability or willingness to pay for the service. Without a sustainable business model the ThirdEye project will not receive funding for the last phase of the project and will not be able to sustain itself after funding. The ThirdEye team does not have the time and agricultural business expertise to establish a smallholder inclusive business model. This led to the following problem statement: Lack of insights in business potential for the ThirdEye project.

1.4 Research questions

1.4.1 Objective and main research question

The aim of this study is to identify business models, which serves as the basis to develop an elaborated business and organisational plan. The business models will serve as a blueprint for a strategy how ThirdEye can be profitable. This, together with the problem statement, resulted in the following research question: *What suitable business models can be identified for the ThirdEye project?*

1.4.2 Sub research questions

In order to answer the main question a number of sub components needs to be examined.
It is necessary to examine why the original business model did not work, what potential stakeholders are, how the organization sells its services, and what extra services could be sold. These components are divided into sub questions. The sub questions are answered by presenting several business models. The recommendations are based on these models.

1. What limits farmers' ability or willingness to pay?
2. What are the different value propositions which can be offered to the market?
3. What are the segment(s) of clients that are addressed by the value propositions?
4. What are the key resources and stakeholders? needed to make the business models possible?

5. What are the key activities necessary to implement the business models?
6. What are potential revenue streams generated by the business models?

The results of the sub questions 2 to 6 will be translate into business models. The business models will be analysed using strengths and weaknesses analyses, which will result in recommendations for the ThirdEye project. Figure 1 depicts how the problem statement, research ,questions, business models and recommendations are related.

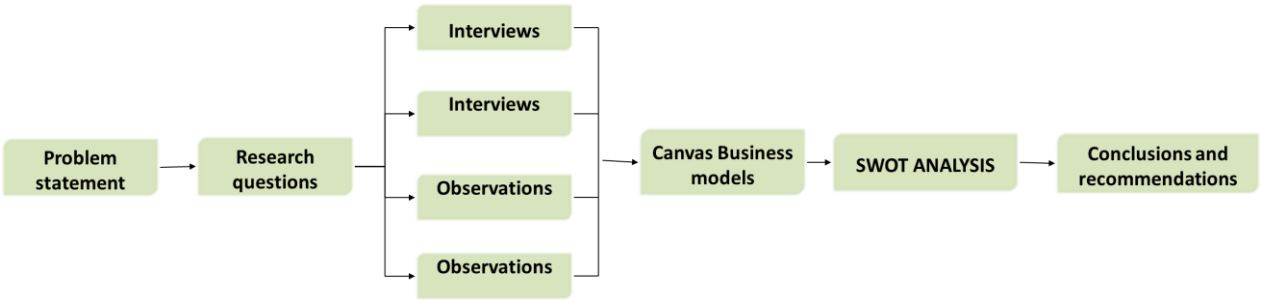


Figure 1: Organization of research

1.5 Methodology

The type of methodology used in this research is a case study. A case study aims at understanding the case in depth, and in its natural setting, recognizing its complexity and its context. It also has a holist focus, aiming to preserve and understand the wholeness and unity of the case (K. Punch, 2005).

Fieldwork was conducted in Mozambique from 26 February till 26 May 2016.

The research started with an empty 'canvas' on the wall of the FutureWater office. This empty canvas allowed the ThirdEye team to draw their business ideas and analysis on the canvas. This functioned as a starting-point for the research. For more information about the business model canvas see chapter 2.1 original business plan. For the result of the interactive session see annex 1.

1.5.1 Interviews

From the main research question it can be deduced that an assessment is needed of the current state of issues surrounding the business environment of ThirdEye, target groups and sales of services. These research goals require qualitative research. This mainly consisted of semi-structured interviews, the idea behind the Semi-structured interview is to let people express themselves in their own words regarding the related subjects (K. Punch 2005). In total 25 representatives of companies have been interviewed. The 25 interviewees(See annex; 7)have been selected based on their current or potential (business) involvement with the ThirdEye project, and their willingness to be interviewed. Interviewees have been identified during the earlier mentioned canvas exercise with the ThirdEye team and in interviews with employees from the already established stakeholders HICEP and RBL, interviews with farmers, research on internet, through network event: Start MozUp (hosted by Dutch embassy), and contacts of acquaintances. Once identified the stakeholders have been contacted and approached for a personal meeting. In this meeting the aim has been to: Interact with the stakeholders to explain the project, determine their needs, determine willingness to pay, willingness to collaborate. The semi-structured interviews where set-up as a conversation, allowing new ideas to be brought up during the interview as a result of what the interviewee says.

Effort have been made to conduct the interviews in an open manner giving respondents the possibility to tell their own story and give information they themselves consider important. The 9 Building Blocks of a (canvas) business model concept, where used as a guideline to cover all the relevant aspects and information needed from the interview. A definition of the concepts and indicators is explained in chapter 2.6.ThirdEye is operating in Xai-Xai and Chókwè at the moment therefore focus has been on these areas.

At the beginning of every interview I would start by telling my name, followed by an explanation of my goals. The intention was to make people as comfortable as possible in order to increase their willingness to participate and to share important information. When approaching a potential partner I started the interview with a presentation about the ThirdEye project. Representatives of 25 organisations were interviewed(annex: 7). Moreover, there were 2 collective interviews fashioning the opportunity to make observations regarding how farmers perceive the service and willingness to pay. The interview was conducted in a group setting by USAID during a 3 day site visit (for interview see annex: 6). The location in which the interviews took place varied, smallholders were mainly interviewed on the field, and representatives from organizations in their office. Several interviewees have been visited multiple times and third parties engagements have been established. Interviews with organisation where conducted in English. Interviews with farmers translation to Shangani or Portuguese was done by one of the Flying sensor operators.

1.5.3 Observations

Observations (e.g. joining staff during their work) were put into practice throughout this study, since it is useful and an important contribution to triangulate the findings of the interviews to get a clear view of the business environment. Moreover, in order to bring reliability and validity to the study, observations and statements from different sources e.g. ThirdEye team, organizational, informal, and so forth, were combined to enable seeing the issues from different points of view.

1.5.4 Data management

In this study, documentary data covered any website, reports, organizational memoranda, where the relevancy of the documents and its reliability was taken into account. The main goal was to combine the different range of data with interviews and observations in order to ensure the quality of the Information produced. ThirdEye provided data referring to their past programs as well as the outlook. In order to be able to manage all the data gathered during this study, field notes, pictures, interviews (taped, recorder or written), digital documents and hardcopy documents were stored either in a plastic folder or in two separate hard disks, besides that Microsoft Office Word and Excel, were used for the digital documents. Unfortunately majority of the taped voice records of interviews have been lost when the phone used for this broke down.

The study did not include data from all the chain actors. In truth, many more interviews with potential stakeholders would have benefited the research. However this was not possible due to the time schedules.

1.5.5 SWOT and Business model canvas

Outcomes of the sub questions will be translated into multiple business model canvas (See chapter 2.6 for more info). The Business Model Canvas will be combined with a strength weakness opportunities and threats analysis. SWOT analysis provides four perspectives from which to assess the elements of a business model, while the Business Model Canvas provides the focus necessary for comparing the business models. A SWOT analysis defines the strengths, weaknesses, opportunities and threats of an organization. SWOT asks four big, simple questions. The first two—what are your business models strength and weaknesses?—assess the organization internally. The second two—what opportunities does the business model have and what potential threats does it face?—assess the organizations position within its surroundings. Of these four questions, two look at helpful areas

strengths and opportunities) and two address damaging areas. It is useful to ask these four questions with respect to both the overall business model and for each of its nine Building Blocks . This approach of evaluating business models is derived from Osterwalder *et al.*, evaluating business models p.218. In order to compare different business models each of the different building blocks is awarded a numerical score. This business model ranking intends to provide a good basis for further discussions, decision-making, and ultimately establishment of sustainable business models. See figure 1. How the SWOT analysis and the business model canvas are related to the sub questions.

1.5.6 Reliability of the research

To ensure reliability of the research, the respondent had space to ask questions, if something was not clear. Each interview is conducted separate from the other respondents. All the above measures are taken to ensure the reliability of the interviews. However, it is wise not to assume that neutrality exists, there is always a bias. The interviewers identity, in this case: connected to ThirdEye, foreigner, man, young etc. might have influenced on the outcome of the interview.

Chapter 2

Setting the scene

Areal image made with Flying Sensor of a farmer meeting in Chókwè, March 2016

Chapter 2: Setting the scene

This chapter describes the circumstances in and around the study. First, a description of the working definitions is given. Then, location and characteristic, presenting physical information, next the climatic and political situation will be given. Following this the rules and regulations affecting the project will be addressed. This is followed by a description of the original business plan. Finally the concept used for generating new business models is provided based on literature.

2.1 Working definitions

1. Smallholder farmer are farmers owning small-based plots (les then 5 ha) of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labour.
2. Flying Sensor is a combination of a flying platform(drone) and camera. Flying Sensor operator is a person whom is trained to advice farmers using a Flying Sensor.
4. Household a group of people, who own the same productive resources, live together and feed from the same pot.

2.2 The research area

The research took place in Mozambique (21times larger than the Netherlands, Wikipedia). The project is currently running in the southern province Gaza in the agricultural areas surrounding the cities Xai-Xai and Chókwè. For a overview of ThirdEye service areas see annex 13.

Figure 2: Location of Xai-Xai (right marker) and Chokwé (left marker) in Mozambique.

Xai-Xai is a relatively large city and capital of the Gaza Province. Xai-Xai is located close to the Indian Ocean, on the Limpopo River, and is in a wide, fertile plain where rice is grown. it is at an elevation of 32 feet (9.8 m) (from Wikipedia 2016) Xai-Xai is 200 kilometres from Maputo. In the coastal area of Xai-Xai there are sandy soils and dense human populations. The ThirdEye service is delivered to farmers in collaboration with Regadio do Baixo Limpopo (RBL lower Limpopo irrigation scheme). RBL is responsible for water management and is delivering farmers advisory and infrastructure

services. Water is retrieved/received from hills and main activity in the irrigation scheme of Xai-Xai is drainage of access water into the Limpopo. The total irrigation scheme consists of 70.000 ha. The ThirdEye project is concentrated in Nhampozoene Agrarian House entailing 1018 farmers and over 388 ha. For farmers in the Nhampozoene agrarian house crop production is very important and livestock is of less importance. The average farm size is 0,5 ha. Main crops grown by the farmers are maize, cabbage, onion, and cassava.

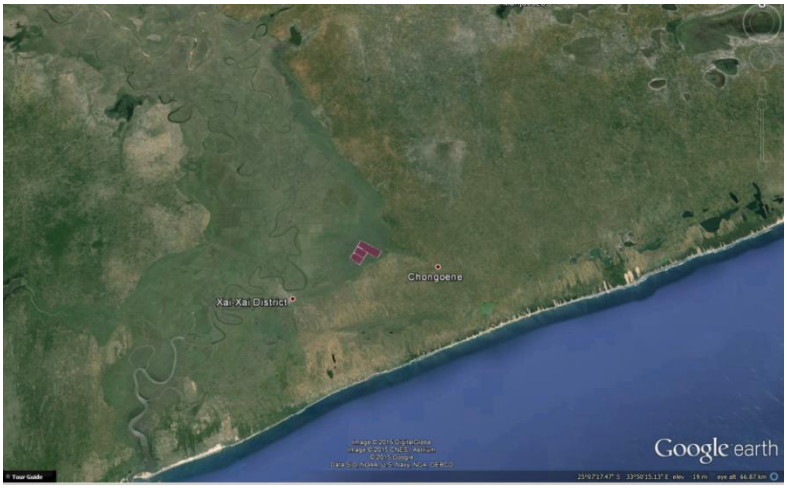


Figure 3: Location of Xai-Xai

The second area where ThirdEye delivers its service is Chókwè, this is a rural town and capital of Chókwè District in the province of Gaza in Mozambique. It is located about 230 km north of the capital city of Maputo. This agricultural town is noted for its tomatoes.(from Wikipedia 2016) In 2013, the city "was devastated by the flooding of the Limpopo River. Most of its 70,000 residents escaped with whatever they could grab." (S.Sukuma, UNICEF visits flood victims in Mozambique 2013) The flooding was a result of water excess from the Limpopo river. During the research, 3 year after the flooding, the devastation was still visible and farmers are still recovering, next to that large sections infrastructure are affected. The large irrigation scheme managed by Public Hydraulic Company of Chókwè (Empresa Pública Hidráulica deChókwè)HICEP of approximately 37,000 ha, mostly for rice, maize and vegetables, is the major feature of the district. ThirdEye service areas D5A, D5B, D6 and Canal Esquerdo are within the irrigation scheme managed by HICEP. Farmers cultivate plots between 0.5ha and 1 ha Soils close to the river are sandy but fertile, while the rest are sandy loam in texture.

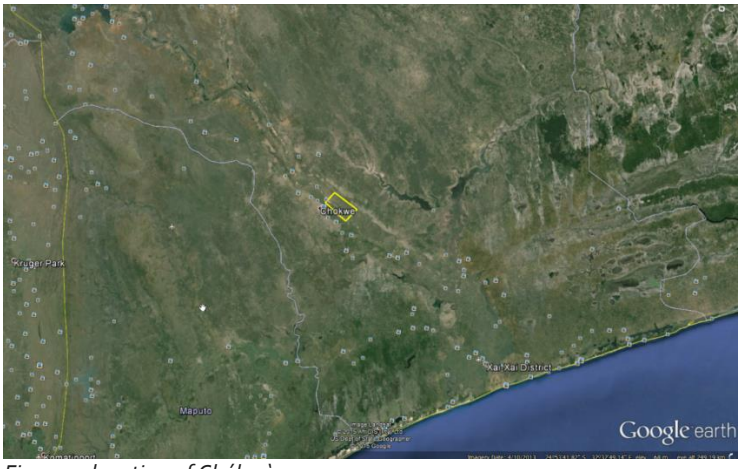


Figure 4: location of Chókwè

The farming systems in the the area of Chowké consist principally of rice, sugar cane, and vegetable cultivation on slightly heavier clay soils. In Xai-Xai main crops are maize, cabbage, onion, and cassava. For both areas farming systems can be characterized as: small family plots, fertile soils, home consumption of crops, 70-90% of the farmers are women. Summarized below are the main challenges that farmers face:

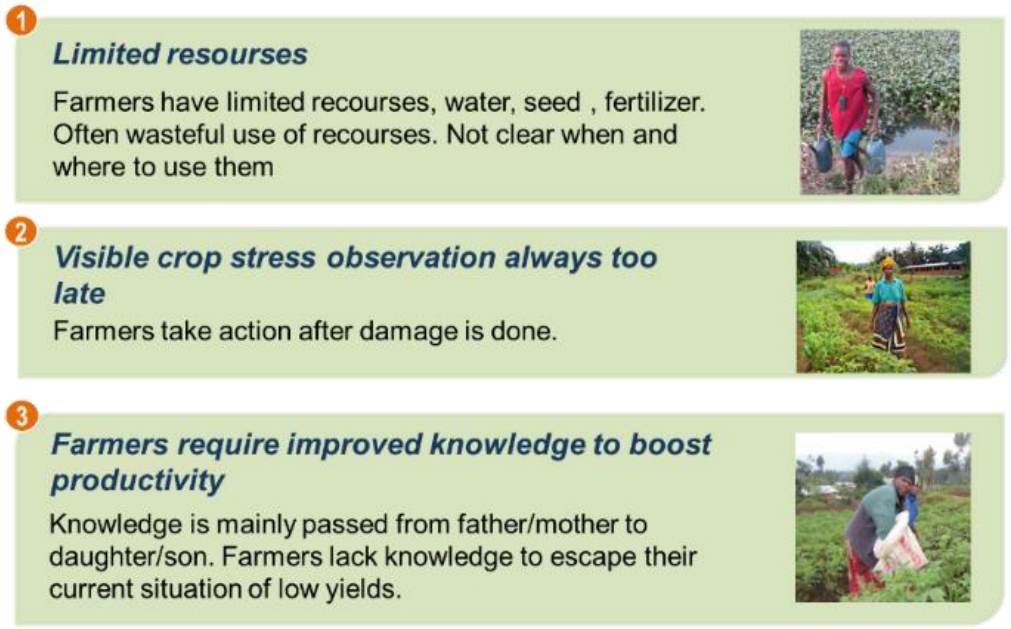


Figure 5: Challenges of smallholder farmers in Mozambique.

2.2.1 Climate

Both Xai-Xai and Chókwè are located in the basin of the Limpopo River, which runs from northwest to southeast through the Gaza district, emptying into the Indian Ocean near Xai-Xai. The Limpopo is the second largest river in Africa that drains to the Indian Ocean, after the Zambezi River. (from Wikipedia 2016) In Xai-Xai the average rainfall is 887 per year, In Chókwè the average rainfall is 662mm per year. (from Wikipedia 2016)

In Mozambique farmers are extremely dependent on water for cultivation of crops, farmers within the ThirdEye project are located in irrigation schemes providing them with a supply of water. However this supply of water is at risk. The country has been hit by flooding in the north and extreme drought in the south. 462,000 people are receiving food aid (AllAfrica, Mozambique: Food Aid Available for Drought Victims This Month.2016) at the moment. Farmers receiving the ThirdEye services are situated within irrigation schemes, unlike their rain fed colleagues farmers with access to irrigation have been able to plant – although much delayed- in 2016. However the chances of planting crops for the second season this year reduce every day as El Niño, becomes stronger. (El Nino is a climate cycle that impacts normal wheatear patterns in southern Africa.) The southern regional water board (ARA-Sul) has been forced to halt discharges from the Massingir dam supplying water for irrigated agriculture along the Limpopo Valley. Every drop of water must be used rationally stresses Helio Banze, general manager of ARA-Sul,(AllAfrica, Mozambique: Water Shortage in Gaza Now Critical 2016).

A recent study by the National Institute for Disaster Management (B. Van Logchem, *et al.* 2012**)** of Mozambique suggests that within ten years the impact of climate change will be increasingly felt within the Limpopo Corridor. The soil moisture content before the onset of the rains is set to decrease and higher temperatures and droughts are expected to increase in the southern region(where Xai-Xai & Chókwè are located.) A relatively dense network of rivers crossing from west

to east provides ample potential for irrigation, but this strategy is still underdeveloped.(IFAD ASAP program 2012) This again stresses the necessity of the ThirdEye and other projects to improve irrigation and water management. Without adapting, it is expected that farmers will not be able to manage the new and increasing risks due to climate change that threaten their livelihoods and discourage them from investing in inputs for their food production.

2.3 Political situation

It is not within the scope of this thesis to elaborately investigate the political situation of Mozambique. However a brief description of current developments will be given to understand the macro environment that influences the business strategies for ThirdEye. Since the beginning of 2016 Mozambique is transferring from a relatively stable country towards a country in crisis. Not only is Mozambique facing a severe drought as mentioned above. Major foreign donors (UKAID, USAID, Dutch Government, IMF, World Bank etc.) have suspended their contributions to the government budget. This has to do with recent revelations that the government kept massive debts (+/-$1 billion) a secret. Next to this the conflict between militants of the opposition Renamo party and the government Frelimo forces has erupted again causing thousands to flee to neighbouring countries. These developments have an impact on the research: 1.Making expansion to the north impossible at present and in short term. 2. Making short term funding via government officials unpredictable. Below a number of headlines are selected are selected to give an impression:

"Mozambique's Secret Debt Triggers Economic Crisis"
"Donors Continue to Backtrack from Mozambique"
"Mozambique Urged to Probe Reports of Mass Grave"
"Mozambique: Renamo Blamed for Attack on Police Base"
"Mozambique: Main Opposition Official Shot"
"Mozambican Refugees Face Uncertain Future in Malawi"
"Mozambique: Water Shortage in Gaza Now Critical"
(Headlines AllAfrica.com June 2016)

2.4 Policies and regulations

The Mozambican government pursues strict rules for the (commercial) use of drones within its borders. ThirdEye belongs among the few who have obtained a license to fly with drones. However this license only entails the Chókwè and Xai-Xai irrigation schemes. When expanding to a new area a new license is needed, the current licence needs renewal as well. The Ministry of Agriculture and the Ministry of Defence both have a say in this. The license request has to be accompanied by various documentations including:

- Technical specification of the drones to be used;
- Full description of the equipment;
- Indication of the areas where the research operation will be done
- Indication of the intended length of the "research activities".

The license request is a lengthy process and little has been documented on the legal rules and regulations in Mozambique that are subject to change. Therefore renewal or expansion of the license stays uncertain.

2.5 Original business model

In order to comprehend the set-up of the current running ThirdEye structure it is key to understand the original business plan. As written in the proposal (P. Droogers, 2014) for the Securing Water for Food program the initial approach was to set-up a network of Flying Sensor operators who are expected to turn into profitable entrepreneurs. These operators' tasks include: visiting to the

communities, making aerial images with Flying Sensors, processing the imagery into maps and advise about potential interventions farmers could take. These operators where able to support 200 ha or +/- 400 small-scale farmers, assuming that information is collected and shared with the farmers in a group setting on a weekly basis. During the initial phase of the project this information will be provided for free and operators will obtain payment from the project. After one year, farmers have to pay for the services. Based on FutureWater/HiView experiences with Flying Sensors total costs for an end user (assuming the average farm size in Mozambique of 0.5 hectare) are estimated at US$ 0.95 per farmer per month. (P. Droogers, FutureWater Proposal to USAID 2014) Recent experiences of ThirdEye staff have exposed that the willingness of farmers to pay for the services, is very low. (see annex 5.)

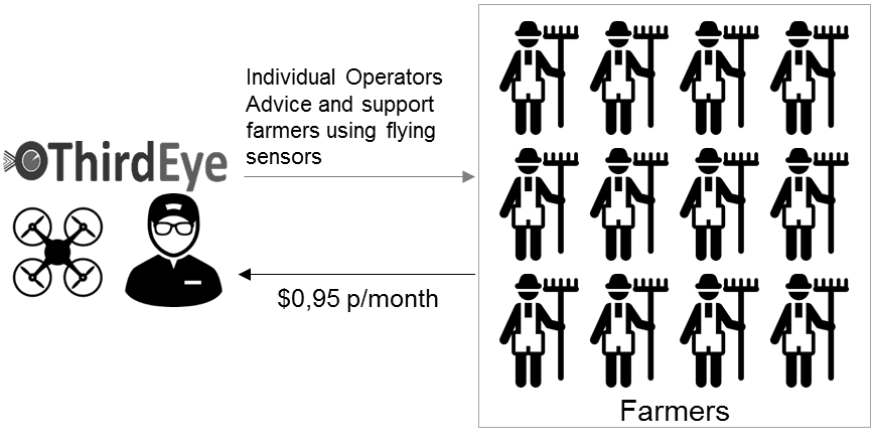


Figure 6. Original business plan,

2.5.1 Customer Focus of original business plan
Smallholder farmers, in Xai-Xai and Chókwè.

2.5.2 Product and services
The application of the Flying Sensors is focused at crop monitoring, delivering a NDVI crop status report and advise to smallholder farmers. However the applications of Flying Sensors are numerous, land use surveying, canal monitoring, crop height measurement and more.

2.5.3 Delivery of information
Information is hard-copy delivered to farmers, Flying Sensor operators plan a meeting via farmer association presidents where they hand over the NDVI reports and provide advice.

2.5.4 Operational activities
Originally, for every field Flying Sensor operators in the ThirdEye project 1. fly one day to make pictures, 2. use 1 day to process images into advisory reports and 3. spend one day to deliver advice and give extension to chiefs of farmer associations.

2.5.5 Operational structure
At the moment ThirdEye is not an official company, there are Flying Sensor operators who are being paid per "round". Each round consists of a flight, processing images and delivering advice to farmers. This is documented and approved by FutureWater staff in Netherlands, payment is made by partner WE Consult. Support and training in Mozambique is delivered by FutureWater staff. The overall goal is that by end of 2017 there is an operational structure for ThirdEye, making it a self-

sustaining company in Mozambique. This can be in the form of one company, individuals paying a service centre, franchising or leasing. The ThirdEye management has expressed preference for a structure where Flying Sensor operators act like entrepreneurs e and have their own businesses.

2.5.6 Cost

It has been calculated that costs for an end user (assuming the average farm size in Mozambique of 0.5 hectare) are estimated at US$ 1 dollar per month.

2.5.7 Key partners involved

The list bellow provides an overview of the key organisations ThirdEye collaborates with (as was the case in February 2016).

WE Consult

WE Consult is a consultancy agency based in Maputo and provides ThirdEye with, technical and logistical support; communicate with operators and farmers on the ground when the team is not in Mozambique. WE Consult also focuses on ground water modelling and geophysical surveys.

Public Hydraulic Company of Chókwè (Empresa Pública Hidráulica deChókwè) (HICEP)

HICEP is a public company responsible for the management of water and land in the Chókwè area. The water provided for the irrigation scheme is licensed by ARA-Sul and is coming from the Masir dam. HICEP has to pay a high water bill to ARA-SUL and is facing difficulties collecting payment for the amount of water used Farmers are charged for the volume of water used, a farmer has to provide his cropping plan/calendar then volume needed is calculated by using crop estimates. HICEP has the power to distribute and to dislocate people from their land if the area is not beingused. This consequently leads to the possibility to collect more funds through water fees. HICEP provide ThirdEye with: Access to farmer associations, Agricultural extension officers working part-time for ThirdEye. Farmers serviced by ThirdEye are united in 4 associations

Regadio do Baixo Limpopo (Xai-Xai)

Regadio do Baixo Limpopo (lower Limpopo irrigation scheme) (Xai-Xai) is a public company responsible for water management and is delivering farmers advisory and infrastructure services. Water is retrieved/received from hills and main activity in the irrigation scheme of Xai-Xai is drainage of access water into the Limpopo. Farmers are supposed to pay for services provided by RBL however only 10% of farmers is paying RBL. Flying Sensor information has been delivered to 1018 farmers and over 388 ha under management of RBL. This area has been extended even more (to around 600 ha) during my thesis period. RBL provides ThirdEye with: Access to farmer associations, Agricultural extension officers par-time working for ThirdEye. The Regadio is only 5 years old and is not as developed and organized as the Regadio in Chókwè.

World Hope (SWFF awardee)

Word Hope is an international organisation with an office in Xai-Xai. World hope is a colleuge SWFF awardee. Providing affordable green houses. World hope acts as a facilitator of office space, transportation, and support with other logistics.

INIR Irrigation Institute(Instituto Nacional de Irrigação, Ministério de Agricultura)

A good relationship with the Institute is important for continuation of ThirdEyes permission to fly within Mozambique.

USAID/ SNV

SNV Netherlands Development Organisation specialist expertise in Agriculture, Energy and Water, Sanitation & Hygiene. And USAID which provides economic, development and humanitarian

assistance around the world in support of the foreign policy goals of the United States. They were appointed by the SWFF program to deliver technical assistance to ThirdEye.

Other
The ThirdEye team is having exploratory discussions as part of expanding business activities with: Tongaat Hulett Mafambisse Beira (large) sugar cane plantation, Green belt fertilizer supplier, AFAP promotor of fertilizer use in Africa.

2.6 Business model concept used in this research.

A key concept used in this research is Osterwalder *et al*. 2005 business model.
"A business model describes the rationale of how an organization creates, delivers, and captures value" (Osterwalder, *et al*., 2005) This is a broad term how it is understood during this research is as follows: A business model determines how the business makes money. It identifies the services that customers value and shows how it needs to be operated to allocate those funds for the services rendered to customers.

2.6.1 Business plan

A business model can be easily mistaken for a business plan however the business plan provides more details, it states the companys operational and financial goals for the future and how it proposes to meet them. It takes the focus of the business model and builds upon it focussing on for example Business Philosophy, The History of the business partners, Quality control, Financial plan etc.

2.6.2 Justification business model instead of business plan

With regard to the original business plan the current situation demands innovation and change, however it is not clear where to begin. Therefore the deliverables of this thesis research will be a number of potential business models. For this the canvas business model has been chosen because, it will allow an in-depth approach, a quick assessment, without getting lost in the details. The business models will provide a view on the essential elements of a potential business. Overall the business models will be the building blocks for an business(plan).

2.6.3 The business model canvas

The business model canvas offers the possibility of result-oriented brainstorming, with management and key personnel of the organization, to innovate business model ideas.

Osterwalder *et al.*, (2005) believes a business model can best be described through nine basic building blocks that show the logic of how a company intends to make money. The nine blocks cover the four main areas of a business: customers, offer, infrastructure, and financial viability.

Central to the model is the value proposition. It is the value proposition that is linking the supplier and the customer. On the supply side should be clear which parties are required to realize the Offering, which activities they undertake and what resources they require. On the buyers side it must be clear what the customers want, what their needs are and how the relationship is established and maintained with them. At the bottom the model shows which costs are incurred to operate the business model and the revenue now and in the future think of it.

2.6.4 The 9 Building Blocks

1. Customer Segments
An organization serves one or several Customer Segments.

2. Value Propositions
It seeks to solve customer problems and satisfy customer needs with value propositions.

3. Channels
Value propositions are delivered to customers through communication, distribution, and sales Channels.

4. Customer Relationships
Customer relationships are established and maintained with each Customer Segment.

5. Revenue Streams
Revenue streams result from value propositions successfully offered to customers.

6. Key Resources
Key resources are the assets required to offer and deliver the previously described elements . . .

7. Key Activities
. . . by performing a number of Key Activities.

8. Key Partnerships
Some activities are outsourced and some resources are acquired outside the enterprise.

9. Cost Structure
The business model elements result in the cost structure.

Chapter 3
Results

Flying Sensor operator Nelson performing a landing, Chókwè May 2016

Chapter 3: Results

The following chapter presents the results of the sub questions, first sub question 1 will be answered to create better understanding what limits farmers' willingness and or ability to pay for the ThirdEye services. Next the outcomes of the sub questions 2-7 will be presented in the shape of multiple business model canvas .The Business Model Canvas will be combined with a SWOT analysis.

3.1 Farmers willingness to pay

The original business model focused on supporting smallholder farmers in exchange for payment for the services provided. However, an interview conducted by SNV Mozambique showed that there is a willingness to pay up to 20 MT($0,40)/ha per month for the service. At 1 MT/ha, 100% of farmers was willing to pay. At 10 MT($0,20)/ha most farmers were willing to pay. At 40 MT($0,80)/ha farmers expressively that it is not possible for them to pay at current productivity levels. This means a shortage compared with the earlier anticipated US$ 0.95 per farmer per month.(see 2.5 original business plan) A survey conducted by the ThirdEye team confirmed this.(for both surveys see annex 5)These results from surveys conducted by ThirdEye and SNV concluded that this target group is only to a limited extent able or willing to pay The seasonal nature of agricultural income and collection of payment is an added complexity. To conclude, a business plan solely focussed on sales of their services to smallholder farmers is not financially feasible for ThirdEye. This chapter tries to give an understanding in farmers priorities for their expenditure. The results are an combination of observations in the field and secondary data.

Traditionally, farmers were served by public extensionists. During the 1990s, however, confidence declined in the effectiveness of public-sector extension agencies. That led to the emergence of privatization of extension. However most of these extension services are focussed on relatively well-off commercial farmers, but these rarely serve the rural poor because of the complexity of their livelihoods involved (Mariana Wongtschowski, *et al.*, 2009). Larger-scale farmers have been able to secure access to these services, they have the capital to pay for services. And large-scale farmers have the output to attract agribusiness firms willing to (pre) finance services for them (out grower schemes).

There are many products and services available in the agricultural market. Most of them are traditional products, such as machinery, irrigation systems, pesticides, seeds and related products that are available in different formats and sizes for different segments of the market. Some of them are consultant-like services, aimed to improve the yield of farms. Others provide services to groups of farmers, enabling them to access quality infrastructure and services at a part of the cost. In general smallholder farmers only purchase the very necessary of these products and services. One of the smallholder farmers interviewed by the author in Chókwè said: All available money is spend on land preparation, nursery, transplanting, bird chasing, weeding, and harvest(08/03/2016). Farmers said they need the help from the reports but do not want to pay for the service. As of now, farmers were given the service for free. Farmers would like for the farmers association to pay on their behalf.

An earlier conducted survey by the ThirdEye team and the information collected by SNV Mozambique showed low willingness to pay for the ThirdEye service. (see: Annex 5) During interviews in the field both in Chókwè and Xai-Xai farmers expressively stated that they do not have money.(See Annex 5 and Annex 6) Farmers in Xai-Xai even requested a new bridge to cross one of the irrigation channels. It is highly possible that stating a very low willingness to pay and setting demands for inputs during surveys and interviews is part of negotiating tactics from the farmers. However these smallholder farmers are poor and regarding willingness to pay, literature seems to agree that smallholder farmers are not in the position to pay for most services, even if the service is

producing improvements in crop production and livelihood of the user. Several remarks confirming this:

> *"Supporting farmers' organizations remains a challenge because the farmers do not yet pay for the cost of the assistance they receive."(M.Wongtschowski, et al.2013)*

> *"It is almost impossible to get smallholder farmers to pay directly for training and technical support – they were too used to getting this for free from the government through extension services or from NGOs" (L.Temple, 2013)*

> *"Many rural smallholder farmers are both poor and caught up in the poverty cycle. Thus, they may have an ultra-low (or non-existent) willingness to pay for extension services." (MAgri, UKaid, 2015)*

Farmers representatives and irrigated area managers are aware of the benefits of the ThirdEye service and have a role in its dissemination. Observations over time lead to conclude that not a lot of farmers are convinced (or even aware of) the ThirdEye service value proposition, this seriously limits willingness to pay. Secondary data of SNV shows that in august 2015 farmers where not or little aware about ThirdEye's value proposition. 'Performed demonstration showed that farmers are not aware of the benefits of ThirdEye's value proposal.' (Annex.5) During Interviews as part of the USAID site visit(annex. 6) in march with Farmer Association Presidents and a group of farmers in Chókwè and Xai- Xai showed that according to these presidents farmers' needs are satisfied and that farmers value the service. At that time Farmers in Chókwè have been actively receiving advice and NDVI reports for 9 months(maize and rice) these farmers stated that reports help them to selectively apply fertilizer to stressed areas, add more water, add pesticides, and/or control the weeds. Next to that they declared that yields were getting a lot better (increasing). In Xai-Xai farmers were experiencing difficulties with their cultivation due to drought. Next to that farmers had not received reports for 3-4 months due to the loss of the two operators. However Farmers thought the service would greatly help with spotting and removing weeds on time. According to Farmers the images help identify where there is natural vegetation versus crops. The reports also help with identifying where tertiary channels are clogged and need to be cleaned. Farmers are responsible for maintaining the tertiary channels and the maps have supported decision making on when and where to clear channels. In Xai-Xai during the same interview farmers stated that the reports let farmers know what areas are stressed but do not inform on what changes need to be made. For them it was difficult to tell if the issue is from the water, the soil or another source. Observations over time lead to conclude that not a lot of farmers are convinced (or even aware of) the ThirdEye service. Basically it indicates a problem according to Mr. Constancio Machanguana from ESNEC university (annex 7. List of interviewees) "ThirdEye is trying to sell a problem identification, it would be better to sell a solution. Problems don't sell" this could be an important reason why willingness to pay is low, farmers don't see a short term solution. ThirdEye only identifies the problem however smallholder farmers do not have the resources to solve them. Furthermore smallholder farmers have an average of 0.5 ha. This is relatively easy to observe from the ground, that NDVI identifies problems for farmers 10 days in advance is not clear to farmers.

The farming system for smallholder farmers in Chókwè and Xai-Xai is very basic (no use of inputs, traditional farming practices) especially in Xai-Xai. ThirdEye is providing farmers access to knowledge supporting their farm management decisions. However it can be concluded that the information provided by ThirdEye is often not relevant for smallholder farmers as they lack access to the recourses to do something with this information.

3.1.1 Access to finance (money)

The smallholder farmers find it difficult to access credits and barely have any kind of savings. Therefore they don't have the possibility to invest in cultivation. As mentioned above farmers only

invest in the very necessary. If farmers would have access to credits or start gaining some more revenue they would be able to purchase some of the goods and services available in the market. In Xai-Xai there are no credit possibilities for smallholder farmers. In Chókwè Dr. Soares Xerinda the President of HICEP is working on installing credit facilities for farmers: Farmers have to ask HICEP for statement of ownership of land, go to the bank (CPL Bank) with this statement they can receive credit. And purchase inputs. Projects such as PROSUL, AFAP, and iDE (annex 7.) are further developed in providing access to finance, in other parts of Mozambique.

3.1.2 Access to markets

Smallholder farmers (both men and women) producing in Xai-Xai are mainly focussed on home consumption securing food for their family, surplus is being sold to middleman. Smallholder farmers in Chókwè are more market oriented however have limited options available to sell their crops. In both cases farmers face difficulty with: distance to market, no knowledge on market prices, access to transport. Better access to markets would enable farmers to save cost and time and generate more revenue. HICEP and RBL are both in process of setting up value chain programs with processing units for farmers, this is a positive outlook.

3.1.3 Access to knowledge

The majority of Smallholder farmers interviewed did not complete primary education. The farmers receive extension service from HICEP, RBL, ISPG, and governmental extension however these extension officer are under-utilised. Extension officers at RBL are responsible for two agrarian blocks which means servicing a total of approx. 2000 farmers, this is similar with HICEP. Farmers have limited access to new technics and procedures, and knowledge is mainly passed from father to son, and from neighbour to neighbour. Farmers lack knowledge to escape their current situation of low yields. This is the problem ThirdEye is trying to solve ThirdEye services have led to a higher production and thereby proves that access to knowledge can improve the farmers production.

3.2 Business models

In this part of the report 11 business models are presented. The business models are a result of the interviews (annex 7.) and field observations mentioned in the methodology and answer the sub questions. It is believed that the following models support the transition from a donor funded programme to a profitable company. This makes it possible for ThirdEye to maintain its social focus, supporting decision making of smallholder farmers in Mozambique.

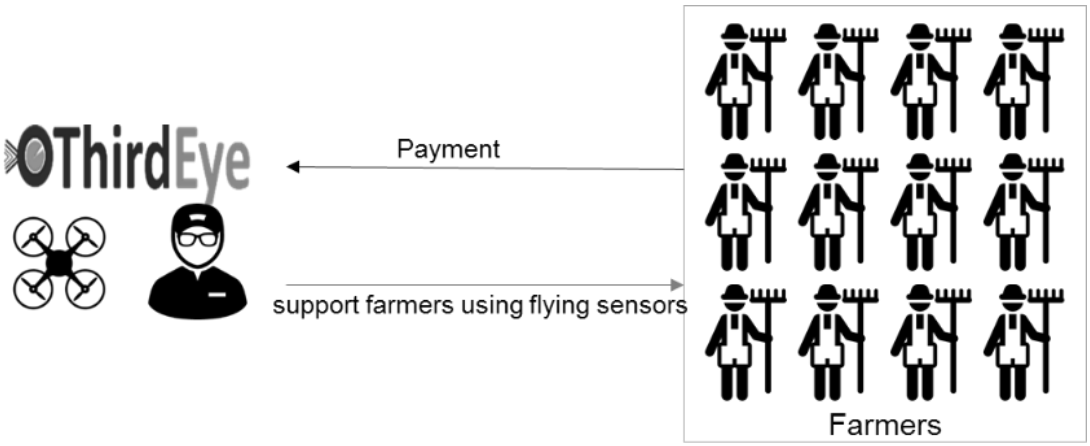
Business model 1: Smallholder farmers pay for NDVI areal information and advice.
Business model 2: "Robin hood" Business model
Business model 3 : Funding for services to farmers.
Business model 4: contract farming / out grower schemes.
Business model 5: Credit and insurance
Business model 6: Agro input providers.
Business model 7. Farm business advisors.
Business model 8: Selling Improved effectiveness of extension services.
Business model 9: use additional services to generate revenue for ThirdEye.
Business model 10: Data collection.
Business model 11. Enabling others to perform Flying Sensor services.

Business model 1: Smallholder farmers pay for NDVI areal information and advice.

<table>
<tr>
<td rowspan="2">Key Partners
• NGO's active in agriculture development
• Agribusiness companies
• Public institutions in charge of ag.development and managing irrigation areas HICEP/RBL
• INIR
• WE Consult</td>
<td>Key Activities
• workflow: a. Flights, b. Processing, c. Advisory to farmers.
• Maintain equipment
• Organize farmer meetings
• Diagnose crop problems and make recommendations
• Activities are seasonal
• Project management
• Flight operations support
• Administration
• New customer acquisition
• Partner & Customer management
• Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
• Relevant NDVI information enabling an increase and efficiency in food production.</td>
<td>Customer Relationships
• Solution oriented and practical information.
• Intensive communication needed.
• Group communication</td>
<td rowspan="2">Customer Segments
• Smallholder farmersin Mozambique.</td>
</tr>
<tr>
<td>Key Resources
• Drone equipment
• Local network partners.
• FutureWater/HiView expert staff.
• Flying license</td>
<td>Channels
• RBL
• HICEP
• Local partners/ngo's
• word-of-mouth
• Awareness campaigns</td>
</tr>
<tr>
<td colspan="2">Cost Structure
• Operators salary
• Supplies; Hardware, software
• Overhead
• Expensive key activity: Extensive extension work

• Total cost per farmer per month 0,78$/month
• Total cost per ha per month 2,24$/month</td>
<td colspan="3">Revenue Streams
• Low revenue contribution to overall revenue
• Low willingness or ability to pay
• At 10 MT($0,20)/ha most farmers were willing to pay. (SNV survey 20 farmers, 2015)
• Fee model could be: Flat fee structure for annual usage, Fee per ha, Fee per farmer using service.</td>
</tr>
</table>

Business model 1: Small Holder Farmers Pay for service.



Although smallholder farmers ability or willingness to pay is low, charging a (small) fee may be useful to establish credibility and prevent abuse. However the collection of payment is complex and the revenue should at least exceed costs of collection. In this model farmers pay to receive advice gathered by Flying Sensors. ThirdEye delivers NDVI information and advice to support management decisions for farmers business. This will lead to increased productivity, product quality and lower costs of production. For this model it is important that farmers see/believe in the benefit of the service, the quality of extension advice is of great importance. Farmers' representatives and irrigated area managers are aware of the benefits of the ThirdEye service and have a role in its dissemination. Observations lead to conclude that only a minimum of farmers are convinced (or even aware of) the ThirdEye service value proposition. In existing regions farmers can be reached through established contacts with farmer associations, HICEP and RBL. Flying Sensor operators are able to manage these contacts themselves and cost on acquisition and public relations can be minimised.

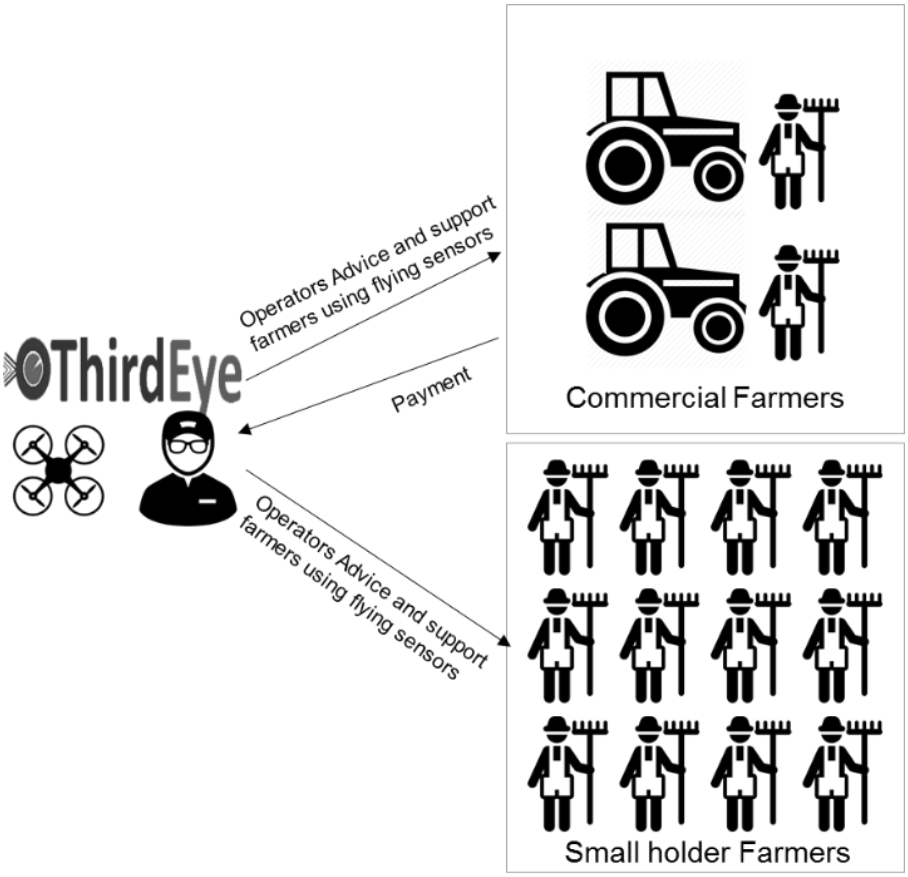
	Internal		
Positive	**Strengths** • Established activities • Good relation with farmers • Good relation with key partners • Clear value proposition • New innovation "pioneer"	**Weakness** • willingness to pay is low. • collection of payment is complex • customers not convinced of value proposition	negative
	Opportunity • Value chain projects in Xai-Xai and Chókwè creating access to resources for farmers • Large customer group	**Threat** • Drought • Complex and politically sensitive drone regulations	
	External		

SWOT Business model 1: Smallholder farmers pay for NDVI areal information and advice.

Business model 2: Robin hood business model.

<table>
<tr>
<td rowspan="2">Key Partners
ARA-CENTRO
ARA-SUL
HICEP
RBL
Institutions and companies working with large scale farmers.
INIR
WE Consult</td>
<td>Key Activities
Orthomosaic for overall visual view on weak crop areas.
NDVI mapping for In detail crop status information
DEM (digital elevation model) of crops at a 10-20 centimeter accuracy
Organization and management.
Activities are seasonal
Marketing of service to large scale farmers.
For 200 ha: 2 days flying, 2 days processing, advice is optional
Project management
Flight operations support
Administration
New customer acquisition
Partner & Customer management
Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
ThirdEye delivers best possible information to manage your business and crops, leading to increased productivity, product quality and lower costs of production.</td>
<td>Customer Relationships
Solution oriented and practical information.
Limited communication needed.
Limited extension advice needed.</td>
<td rowspan="2">Customer Segments
large scale commercial farmers
smallholder farmers
Agribusiness companys
Plantations
Agri-sul
Tongaat hulet
ECO bana plantation Chókwè
TCO Agriculture
Taboca companies via AFAP.</td>
</tr>
<tr>
<td>Key Resources
Drone equipment
Training of operators
Access to large scale farmers
Expansion of flying license area
Local network partners.
FutureWater/HiView expert staff.</td>
<td>Channels
Reach farmers through public Irrigation schemes: ARA-CENTRO, ARA-SUL, HICEP, RBL
ThirdEye operators have to do marketing activities.</td>
</tr>
<tr>
<td colspan="3">Cost Structure
$31,22 per Ha/Year without extension advice.
$38,16 per Ha/Year including 2 days extension advice per month.
$45,09 per Ha/Year including 4 days extension advice per month.
Calculations are based on 200Ha farm.
Operators salary
Administrative work + PR
Supplies; Hardware, software
Overhead</td>
<td colspan="3">Revenue Streams
High willingness to pay
Depending on number of large scale farmers, prospect of high contribution to overall revenue.
Fee model: Fee per ha</td>
</tr>
</table>

Business model 2: "Robin hood" Business model



It will be financially attractive for ThirdEye to include large-scale commercial farmers in the customer segment. The main beneficiaries and customer group should be smallholder farmers however, a relative distribution of 60% small-scale farmers and 40% large–scale farmers is agreed by USAid. Large scale farmers are willing and ready to pay for the services delivered by ThirdEye. Thereby financing a part of the services delivered to poorer farmers. Especially in Chókwè irrigation scheme large scale farmers (cultivating more than 200ha) are active. These farmers can't visit every corner of their farms therefore having Flying Sensor information supports them in making decisions on when/ where to apply pesticides, start harvest etc., without having to spend a lot of time.

For services delivered to large scale farmers a tailor made package of services is expected to be the best approach. 1 Flying Sensor operator can service approx. 400ha in 3-5 days depending on amount of advice needed. Farmers have different needs regarding extension advice. It is presumed that not all large scale farmers have an interest in extension advice, therefore cost structure with no, basic and extensive extension advice is given. A local operational manager should be in place to coordinate the services delivered to large scale farmers. Apart from NDVI crop monitoring advice, large scale farmers have shown interest in DEM maps for land levelling and flood protection purposes.

Agri-Sul an agricultural holding company in Macaratane (Chókwè area) is interested in crop monitoring for 300ha of sugar cane and 60ha of bananas. Next to this they are establishing a dike and are interested in acquiring DEM services. A proposal has been submitted, however to date no reaction has been received.

A demo for 2 commercial tomato and sugar cane farmers within the Chókwè irrigation scheme triggered positive reactions as well. As quoted from one of the farmers 'this will help, making long

term planning' both commercial farmers are willing to pay +/- 15 dollar a year per ha. The figure of 15 dollar was given as approximate cost as these where the most relevant calculations at the time. In reality it will be more expensive. TCO Agriculture is a Portuguese company starting an agriculture branch with an plantation in Chókwè and is interested in NDVI information.

In Xai-Xai 3 commercial farms have been identified and approached (with less success)

Moz India Agro, a collective of 5 Indian families owning +/- 800Ha and cultivating Aromatic/medicinal plants rice, maize and legumes. Mr. Rui Rakesh Pitambar representive of Moz India Agro reacted very enthusiastic, a second meeting and demo flight was planned. However after consulting with investors in India Mr. pitambar cancelled the meeting as Moz India Agro is considering to limit their activities due to problems with saline water in rice cultivation and current political situation in Mozambique. (Mr. Rui Rakesh Pitambar)

A positive meeting with Ms.Wang Chengmei from Wanbao Africa agriculture development, LDA(WAADL) showed perspective for a collaboration: WAADL is located in the RBL area and cultivates 20.000HA in Mozambique in total. According to an article from S.Chicava (2015) WAADL plans to invest US$289m in Xai-Xai over a period of 3-5 years starting from 2012, mainly to grow rice, although some crops like maize are also being grown on a small scale (S.Chicava 2015). WAADL is also expanding its activities to Chókwè irrigation scheme, the most important in Gaza. Here, the company received a concession of 6,000ha where it will produce rice in collaboration with local farmers; 2,000 of those hectares will be used for the companys own production for a period of 20 years with the potential of renewal, while the remaining 4,000 will be used by local farmers with the support of the Chinese company thorough a technology transfer and contract farming model. (supported by China Development Bank (CDB)) (S.Chicava, 2015) The figures look impressive however due to this years drought only 8000ha with access to irrigation is planted. In a second meeting with Ms.Wang Chengmei she stated that the company has financial problems and therefore is not interested in procurement of ThirdEye services. Next to that a small desk research reveals multiple accusations of land grabbing by WAADL from local communities in Xai-Xai. (C.Anesi, 2013) (S.Assarsson the Guardian, 2014). For ThirdEye it wouldn't be beneficial not to work with customers affiliated with land grabbing. The Third large scale farmer identified in Xai-Xai is Italian farmer Mr. Micelle Sammartini, however due to illness a meeting never took place.

By executing this model cost for smallholder farmers decreases with increasing number of large scale farmers. Next to this the commercial farms provide an ideal environment to further develop the Flying Sensor services and technology.

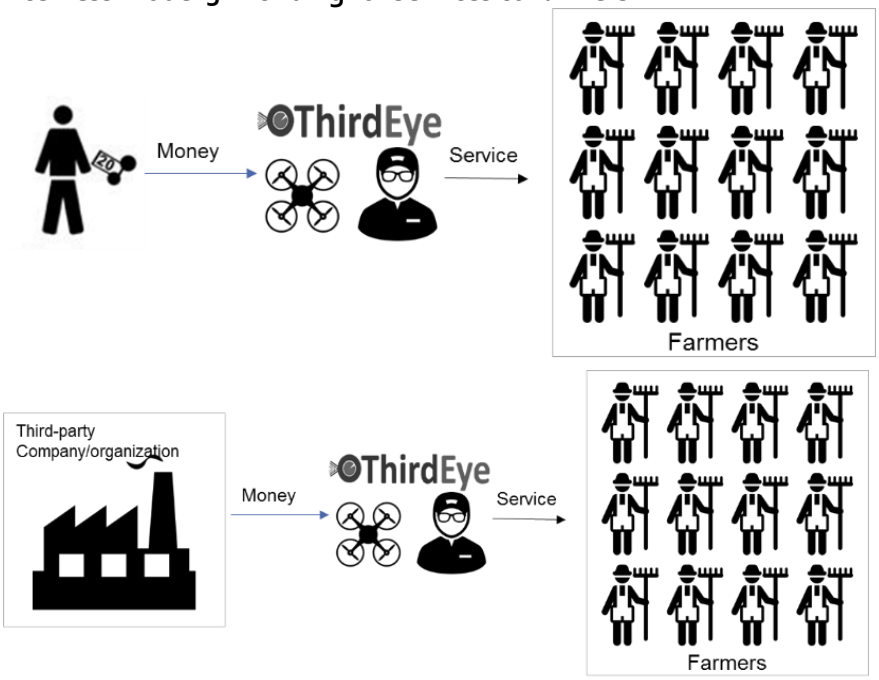
	Internal		
Positive	**Strengths** • Established activities • Easy to combine with services delivered to smallholders • Clear value proposition	**Weakness** • Ratio of 60% smallholders 40% large scale farmers	negative
	Opportunity • Cost for smallholder farmers decreases • Combination with additional services • customers show willingness to pay	**Threat** • Drought • complex and changing drone regulations • (international) Commercial organisations are withdrawing from Mozambique • Political instability	
	External		

SWOT: Business model 2: "Robin hood" Business model

Business model 3: funding for services to farmers

<table>
<tr>
<td rowspan="2">Key Partners
RBL
HICEP
AFAP
iDE
ISPG
ESNEC
INIR
WE Consult</td>
<td>Key Activities
proof of investment impact
complement goals and milestones set by donor.
Acquisition.
Project management
Preparing proposals
Regular services to smallholder farmers
Flight operations support
Administration
New customer acquisition
Partner & Customer management
Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
Improved livelihood of farmers.
Water saving
80% ThirdEye Beneficiaries are women</td>
<td>Customer Relationships
Formal
Professional
Large amount of paper work</td>
<td rowspan="2">Customer Segments
NUFIC
AFAP
USAID
SWFF
Available grants
CSR programs
NGO’s
Drone manufactures
RBL
HICEP
Ara- sul</td>
</tr>
<tr>
<td>Key Resources
Drone equipment
Training of operators
Access to large scale farmers
Expansion of flying license area
Local network partners.
FutureWater/HiView expert staff.</td>
<td>Channels
Network of USAID
Network Dutch Embassy</td>
</tr>
<tr>
<td colspan="2">Cost Structure
High Management cost
Operators salary
Administrative work + PR
Supplies; Hardware, software
Overhead</td>
<td colspan="3">Revenue Streams
Donor pays for ThirdEye services delivered to smallholder farmers .
Unpredictable revenue stream
Fee model could be: Flat fee structure for annual usage, Fee per ha, Fee per farmer using service. Fee per % yield increase, Fee per % water saving.</td>
</tr>
</table>

Business model 3 : Funding for services to farmers.



In this model a development organization, donor agency, international NGO or a company further along in the value chain finances ThirdEye. This is a quick way to establish a network of Flying Sensor operators and increases farmers' yields. However, it is not a long-term solution. This model will most probably function in a "project mode" following targets and mile stones set by the donor and for set period of time. End goal of ThirdEye (December 2017) is to establish a financially Independent business. Therefore funds out of (international)Corporate Social Responsibility programs and or donor funding can be part but not central to the business model.

Helping the poorest smallholder farmers grow more crops and get them to market is the world's single most powerful lever for reducing hunger and poverty.'
Bill Gates, World Food Prize speech, 15 October 2009.

In order to boost the establishment of ThirdEye it can be considered to approach institutions and large companies investing in Mozambique (CSR projects) to pay ThirdEye service on behalf of farmers. ThirdEye has all the right ingredients for a CSR project or funding, it is innovative, drones are hot and happening and there is a proof of concept, the project is already having a positive impact, and helping to improve the livelihood of poor smallholder farmers. Another approach would be contacting drone manufacturers for funding.

This model will most probably function in a "project mode" and requires a high level of communication and management therefore cost for a highly skilled manager should be emended.

Actors in the agricultural value chain are willing to pay on behalf for farmers. Irrigation schemes, agribusiness firms and NGOS are examples of value chain actors who benefit from increased agriculture output and productivity of farmers and willing to pay for ThirdEye services. RBL is one of these stakeholders and singed a contract agreeing to pay for the service with the purpose of benefitting local farmers, this fee is based on a price per farmers. A similar proposal has been made to HICEP however the board has not decided yet.

Co-writing donor funding proposals shows much potential, directors of both HICEP and RBL have expressed their interest in co-writing a proposal/ applying for a grant for continuation of current project, both of them have ideas on where to apply. Directors of iDE and AFAP have suggested to co-

write a proposal for a new project/in-corporate in their existing projects. Together with ISPG University ThirdEye will apply for a grant within the NUFIC program of the Dutch government.

Instead of funding another option is Impact investment, these are investments made with the intention of generating social and environmental impact alongside a financial return.
Impact investments target a range of returns from below market to market rate, depending upon the circumstances.

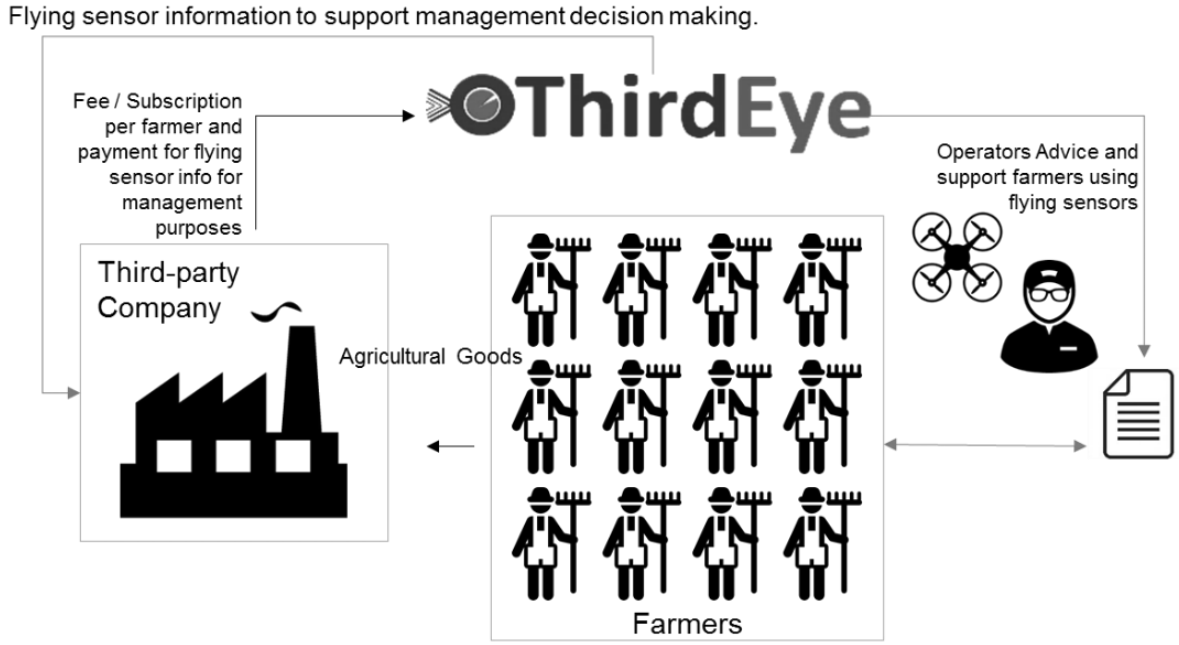
	Internal		
Positive	**Strengths** • FutureWater/HiView expert staff. • SWFF network • right ingredients for a CSR/donor project	**Weakness** • Not a sustainable model • Dependent on donor interest • No full time ThirdEye Manager with competencies to acquire and execute donor projects	negative
	Opportunity • customers show willingness to pay • Co-writing of proposals	**Threat** • complex drone regulations • (international) organisations are withdrawing from Mozambique • Dependent on international donor willingness to pay	
	External		

SWOT: Business model 3 : Funding for services to farmers.

Business model 4: Out growers Schemes

<table>
<tr>
<td rowspan="2">Key Partners
INIR expansion of license is needed
We-consult</td>
<td>Key Activities
For this model the original workflow can be used: a. Flights, b. Processing, c. Advisory to farmers
Flights on request might be needed to gather info for management
Project management
Flight operations support
Administration
New customer acquisition
Partner & Customer management
Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
ThirdEye ensures suppliers (farmers) have increased productivity, product quality and lower costs of production.
ThirdEye delivers a overview of crop status and stage supporting decision making and planning.</td>
<td>Customer Relationships
practical information.
Limited communication needed.
Limited extension advice needed.</td>
<td rowspan="2">Customer Segments
Agribusiness firms executing an out grower scheme.
Complexo Agro-Industrial Chókwè
DADTCO
Tongaat Hulett</td>
</tr>
<tr>
<td>Key Resources
A manager is needed for accusation, contact with organization etc.
Drone equipment
Training of operators
Access to large scale farmers
Expansion of flying license area
Manager with competencies to acquire and execute donor projects
Local network partners.
FutureWater/HiView expert staff.</td>
<td>Channels
Agri platforms in Mozambique
Use contacts from public irrigation schemes</td>
</tr>
<tr>
<td colspan="3">Cost Structure
$31,22 per Ha/Year without extension advice.
$38,16 per Ha/Year including 2 days extension advice per month.
$45,09 per Ha/Year including 4 days extension advice per month.
Calculations are based on 200Ha farm.
Operators salary
Administrative work + PR
Supplies; Hardware, software
Overhead</td>
<td colspan="3">Revenue Streams
Bulk purchases or subscriptions ordered by an organization, for NDVI services delivered to farmers.
Cost of service is deducted from payment to farmers for their produce.
Payment for management information gathered by Flying Sensor services.
High willingness to pay
Prospect of high contribution to overall revenue.
Fee model: Fee per ha, fee per flight, fee per farmer</td>
</tr>
</table>

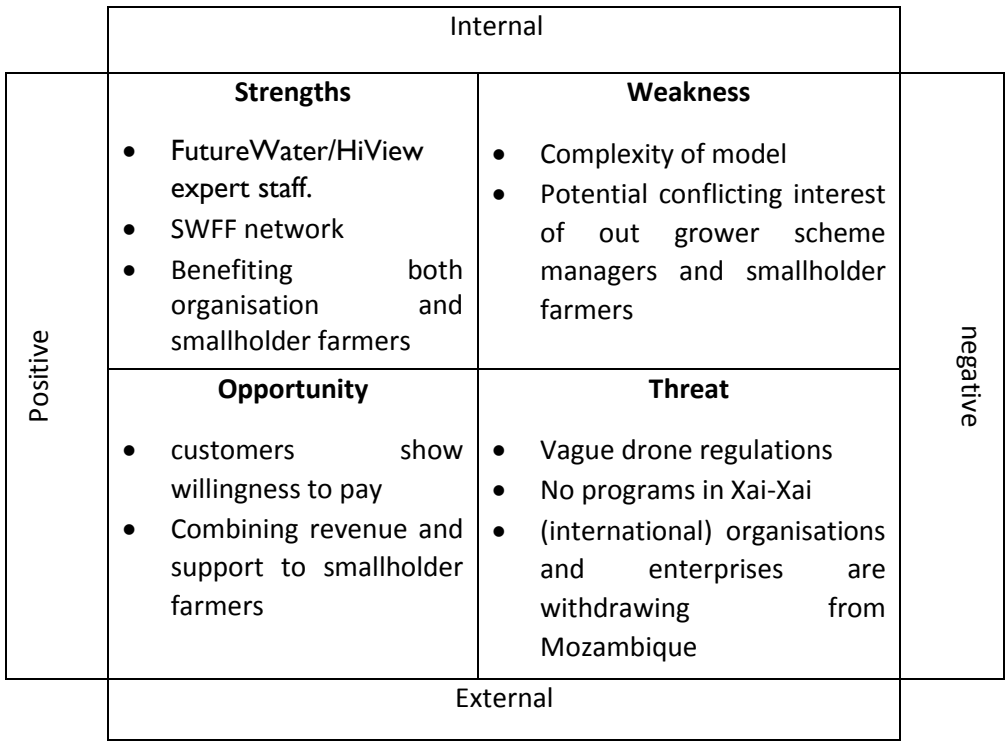
Business model 4: contract farming / out grower schemes.



Agribusiness firms, whom source and produce raw materials into finished goods, will be the customers of this model. These firms benefit from ThirdEye services delivered to farmers. ThirdEye helps by ensuring their suppliers (farmers) have the best possible information to manage their business and crops, there could be a case for them (Agribusiness Firms) to benefit from the farmers increased productivity, product quality and lower costs of production. The agribusiness organisation can pay for the service delivered to farmer or cost of service delivered can be included in contract with farmer and deducted from price farmers receive for their crops. This is common practice with agro-inputs. Financial burden can be shared between the Agribusiness firm and the contracted farmers. Flying Sensor services can be delivered on behalf of an organisation to smallholder farmers: NDVI mapping for In detail crop status information, advisory, advise can be given by ThirdEye employees or by staff of the company.

Prior to this research the ThirdEye team was already in contact with Tongaat Hulett, this large agribusiness company focussed on sugar cane is interested in providing NDVI advisory for their plantations (See business model 2) and to provide the information to small scale farmer of whom they purchase crops. Complexo Agro-Industrial De Chókwè is an owner of 12ha processing plant have been contacted and an introduction to the project has been given. They support local farmers to cultivate rice, cashew and tomato, they are currently re-organising and are interested in ThirdEye services. Outside the current project regions there are more out grower schemes, particularly in the north. This research led to a plan for an (paid) pilot with DADTCO an company working with an out grower scheme sourcing cassava.

Next to supporting farmers and there by the source of goods for the agribusiness firm, the data gathered with Flying Sensors can be of great value for the management of such a firm. The Agribusiness firms sourcing materials from farmers, get information about what crops farmers are growing, control farmers in what quantities(bio mas) plus the status and timing of the current seasons crops stage. This information is valuable to plan crop protection, harvest, capacity, processing, sales and marketing activities. The same flights can be used for this however the processing and presentation of information is different. Agribusiness firms might need receive training on implementation of maps after this only flying and delivering of maps is needed.

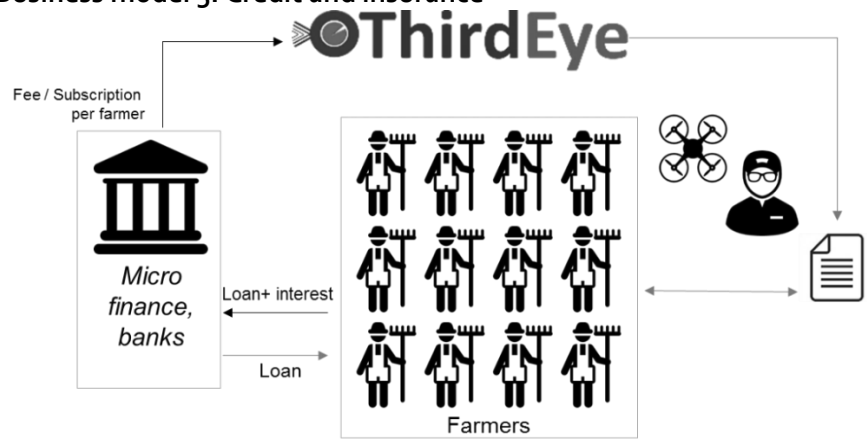


SWOT: Business model 4: contract farming / out grower schemes.

Business model 5: Credit and insurance

<table>
<tr>
<td rowspan="2">Key Partners
HICEP
RBL
INIR
WE Consult
NGO's promoting access to finance for smallholders</td>
<td>Key Activities
For this model the original workflow can be used: a. Flights, b. Processing, c. Advisory to farmers.
Accusation, contact with organisation etc.
Project management
Flight operations support
Administration
New customer acquisition
Partner & Customer management
Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
ThirdEye reduces the risk of crop failures (the likelihood of paying claims and depth)
Flying Sensor services on behalf of loan and insurance firms to smallholder farmers: NDVI mapping for In detail crop status information, advisory.</td>
<td>Customer Relationships
Formal
Professional
Large amount of paper work</td>
<td rowspan="2">Customer Segments
CPL bank Chókwè.
iDE
Banco terra (division of Rabobank in MZ)
CCOM
Pro-Crédito
NGO's promoting access to finance for smallholders</td>
</tr>
<tr>
<td>Key Resources
A manager is needed for accusation, contact with organization etc.
Drone equipment
Training of operators
Access to large scale farmers
Expansion of flying license area
Local network partners.
FutureWater/HiView expert staff.</td>
<td>Channels
Dr. Soares Xerinda the President of HICEP is also president of CPL.</td>
</tr>
<tr>
<td colspan="3">Cost Structure
$31,22 per Ha/Year without extension advice.
$38,16 per Ha/Year including 2 days extension advice per month.
$45,09 per Ha/Year including 4 days extension advice per month.
Calculations are based on 200Ha farm.
Operators salary
Administrative work + PR
Supplies; Hardware, software
Overhead</td>
<td colspan="3">Revenue Streams
loan and Insurance firms pay for Flying Sensor spatial information.
Fee model could be: Flat fee structure for annual usage, Fee per ha, Fee per farmer using service. Fee per % yield increase, Fee per % water saving.</td>
</tr>
</table>

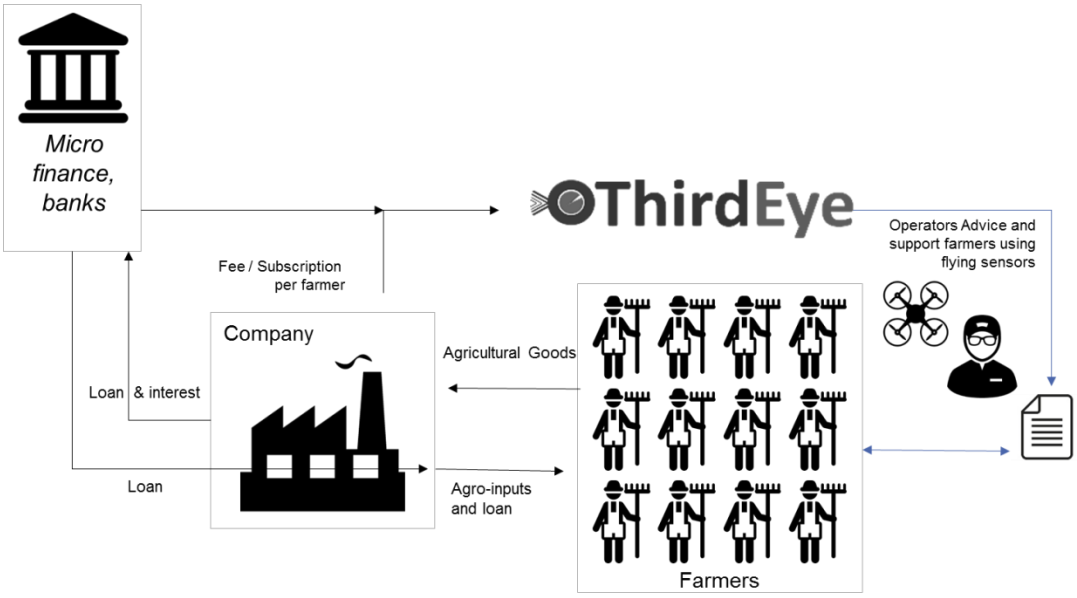
Business model 5. Credit and insurance



Micro Insurers and Micro loan firms are (beginning to) offering loans and crop or drought insurance to smallholder farmers in Chókwè. This is already common for large scale farmers, therefore this model is applicable for them as well. In order to reduce the risk of crop failures (the likelihood of paying claims and debt) Micro Insurance and loan firms may be willing to provide their clients with ThirdEye services into their premiums. Often loans are given in collaboration with out grower schemes or land provider.

HICEP has recently installed credit facilities for farmers: Farmers have to request HICEP for statement of ownership of land, go to the bank (CPC Bank) with this statement to get credit for seeds and fertilizer. After harvesting this credit is paied of. Furthermore HICEP has installed a new paying system, in which farmers pay HICEP with part of their harvest. HICEP mechanically harvests for farmers and keeps part of the yield as payment. This system is now in place for rice and being developed for maize. The PROSUL project is providing credit services on a large scale in southern Mozambique including Chókwè for cassava cultivation and in Xai-Xai for horticulture.

There are multiple organisations delivering credit services to smallholder farmers including iDE whom might be interested in this model. However these organisations are mainly located outside Chókwè or Xai-Xai



Possible Combination of loan and insurance via an outgrower-schemes.

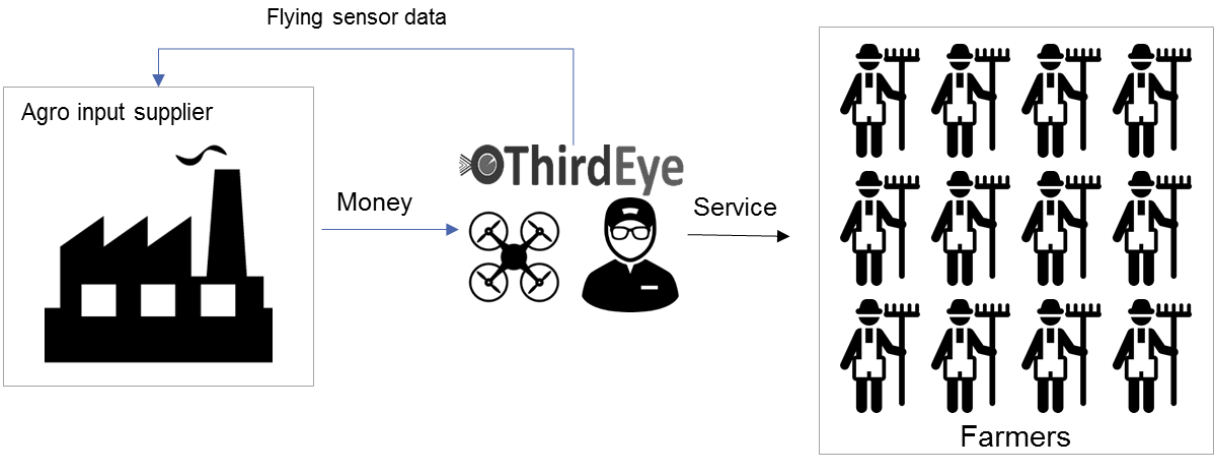
Positive	**Strengths** • FutureWater/HiView expert staff. • SWFF network	**Weakness** • Complexity of model • Loans for smallholder farmers are applied on a small scale	negative
	Opportunity • Organisations are beginning to offer credit facilities in Chókwè • international organisations are less involved if the local organisations provide the insurance and loans • combining with out-grower schemes	**Threat** • complex and complicated drone regulations	
	External		

SWOT: Business model 5. Credit and insurance

Business model 6: Agro input providers.

<table>
<tr>
<td rowspan="2">Key Partners
• AFAP
• INIR
• WE Consult</td>
<td>Key Activities
• NDVI mapping for In detail crop status information, advisory.
• Design advisory form with marketing.
• Project management
• Flight operations support
• Administration
• New customer acquisition
• Partner & Customer management
• Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
• ThirdEye identifies the need for inputs.
• ThirdEye supports producers in where and how much fertilizers to apply
• by using NDVI maps farmers can concentrate the application on where it is really needed reducing the wasteful use of inputs.</td>
<td>Customer Relationships
• Formal
• Professional</td>
<td rowspan="2">Customer Segments
• AFAP
• Sava
• Greenbelt
• Whole sale Agro dealers
• Rural agro dealers</td>
</tr>
<tr>
<td>Key Resources
• A manager is needed for accusation, contact with organization etc.
• Drone equipment
• Training of operators
• Access to large scale farmers
• Expansion of flying license area
• Local network partners.
• FutureWater/HiView expert staff.</td>
<td>Channels
• AFAP can assist in meeting and talking with private partners
• Agribusiness Partnership Contract (APC)</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Operators salary
• Administrative work + PR
• Supplies; Hardware, software
• Overhead</td>
<td colspan="3">Revenue Streams
• Agro input provider pays for Flying Sensor spatial information.
• Agro input supplier pays for marketing via ThirdEye.
• Agro input suppliers pay for ThirdEye service on behalf of farmers</td>
</tr>
</table>

Business model 6. Agro input providers.



Organizations producing and/or distributing agricultural inputs (fertilizers, seeds, pesticides, agricultural equipment, etc.) may use NDVI information to show the need for their products, identify problem areas, and distribute its marketing message to its target market (farmers in need of fertiliser). Using ThirdEye can help an agro input supplier deliver extension and create trust with farmers.

The African fertilizer and Agribusiness partnership (AFAP) could be a key partner in this model, AFAP an NGO with a range of (financial) mechanisms to support private sector reducing the cost of input logistics with the final goal of making inputs accessible and affordable by- small scale farmers. AFAP encourages responsible fertilizer (and other input) use in which ThirdEye could play a role by using NDVI maps farmers can concentrate the application on where it is really needed reducing the wasteful use of inputs. AFAP has offered to sing an agribusiness Partnership Contract (APC) with ThirdEye. This is a flexible agreement that provides financial, technical and logistical assistance. In return for AFAP assistance ThirdEye commits to making significant contributions that benefit smallholder farmers. Furthermore AFAP is already collaborating with the dutch ministry of affairs with the goal to improve agriculture in the Zambezi Valley and would like to incorporate ThirdEye services in this project.

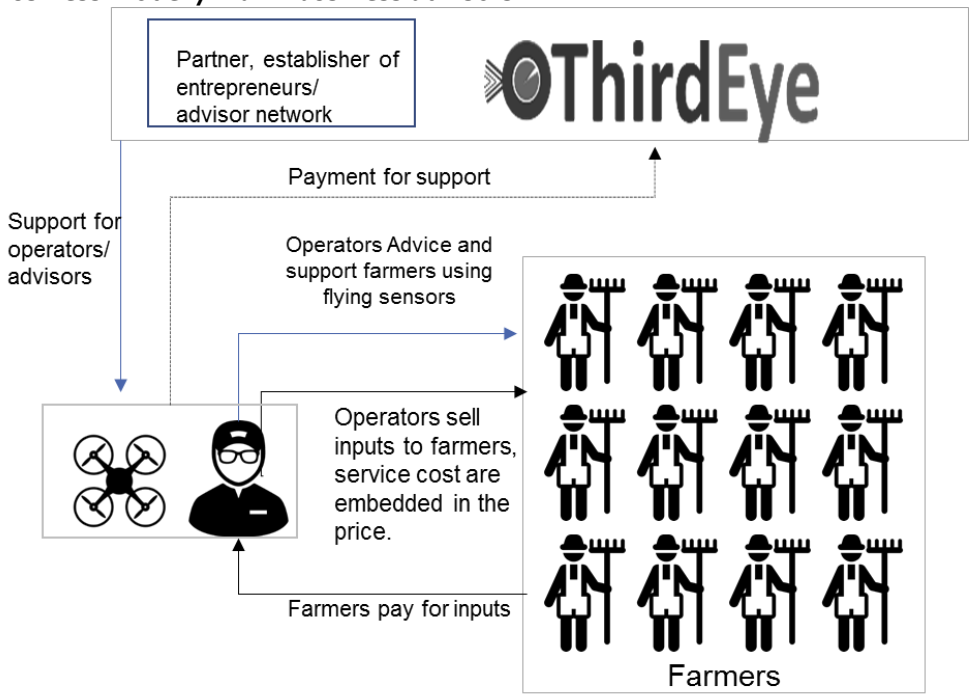
SWOT: Business model 6. Agro input providers.

	Internal	
Positive	**Strengths** • FutureWater/HiView expert staff. • Strong potential partner	**Weakness** • Focus of agro input suppliers not on smallholder farmers
	Opportunity • Co-writing of proposals • Agribusiness Partnership Contract	**Threat** • Vague drone regulations • (international) organisations are withdrawing from Mozambique
	External	negative

Business model 7: Individual entrepreneurs. Local input retailors and farmer advisors.

<table>
<tr>
<td rowspan="2">Key Partners
• iDE
• IFC
• SME toolkit
• INIR
• WE Consult</td>
<td>Key Activities
• Entrepreneurs/advisors are trained to become Flying Sensor operators.
• A manager is needed for accusation, contact with organization etc. The Flying Sensor operators require a support point for soft/hard ware management etc.
• Create enabling environment for entrepreneurs
• Project management
• Flight operations support
• Administration
• New customer acquisition
• Partner & Customer management
• Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
• ThirdEye optimizes service delivered by private farmer advisors.</td>
<td>Customer Relationships
• Solution oriented and practical information.
• Limited communication needed.
• Limited extension advice needed.</td>
<td rowspan="2">Customer Segments
• Smallholder farmers</td>
</tr>
<tr>
<td>Key Resources
• Support unit
• Drone equipment
• Training of operators
• Access to large scale farmers
• Expansion of flying license area
• Local network partners.
• FutureWater/HiView expert staff.
• Business support for Flying Sensor operators</td>
<td>Channels
• iDE
• business advisors</td>
</tr>
<tr>
<td colspan="2">Cost Structure
• Setting up a support unit
• Operators salary
• Administrative work + PR
• Supplies; Hardware, software
• Overhead</td>
<td colspan="3">Revenue Streams
• Agro input provider pays for Flying Sensor spatial information.
• Agro input supplier pays for Flying Sensor information.
• Agro input supplier pays for marketing via ThirdEye.
• Agro input supplier gets supplied with drone and training as a loan and pays this back.
• Agro input supplier pays per farmers, ha for ThirdEye service.</td>
</tr>
</table>

Business model 7. Farm business advisors.



Rural Agro-dealers/ advisers are enterprises that deal directly with farmers, in general they are characterized by the following: small stores with limited storage, trading in different products and services, owner managed usually one or two employees. In this model individual entrepreneurs sell productivity enhancing inputs and technologies to farmers. Furthermore they provide advice and training to the farmers on how best to use these inputs to achieve profitable results, the cost of the advice is 'embedded' in the price of the inputs or deducted from the farmers harvest after marketing on his/her behalf. The Rural Agro-dealers/ advisers could use Flying Sensors areal information to improve their service. This type of model could be set up in Chókwè and Xai-Xai however it is already being applied (without Flying Sensors) by iDe. Marco Machado country director Mozambique at International Development Agency (iDE) is interested to incorporate Flying Sensor services within their Farm Business Adviser program(FBA). iDE trains people to advice farmers and link them to markets, e.g. advice farmers on what crop to grow and help them selling it and earning money. FBAS often get paid in yield not in money farmer business advisors earn an average 900USD per year by servicing farmers. Hundreds of farmer business advisors are active in northern Mozambique. FBAS are always part of the community, make money of trading. The individual farmer business advisors are supported by comercio aseslemica valorade agriculturas(CAVA). These are companies where both farmers and farmer business advisors are stakeholders. CAVA is the link between farmer business advisors and markets allowing selling and buying collectively. Next to that it functions as a support centre for the farmer business advisor with training and technical and logistical support. ThirdEye could corporate within this program in different ways: deliver areal information to the CAVA's, train and supply farmer business advisors with Flying Sensors.

ThirdEye has trained 9 Flying Sensor operators, it is interesting to consider a "farmers business advisers' model inspired on iDE within Xai-Xai and Chókwè, individual advisors would earn an income by advising smallholder farmers, next to that the (micro)-entrepreneurs facilitate the access to knowledge, technology, finance etc. which is missing at the moment furthermore it would be an independent system. Wherein ThirdEye functions as a service point for the entrepreneurs regarding Flying Sensor related assistance. Key to this model is that Flying Sensor operators have a high level of business management and technical knowledge as well. Furthermore an entrepreneur should get a loan in order to pay for the training and drone equipment. During this research Mr. Samuel Sitoe, has been interviewed Mr. Sitoe is a business lecturer (Business Planning for new ventures and Entrepreneurship.) at the ESNEC university he was very enthusiastic. "This morning I did not know this existed, now I feel we really need it! " Next to being a lecturer he manages the Small Medium Entrepreneurship tool kit and other projects for IFC World Bank program. He can potentially link one-man operator companies to business training and investments. IFC blends investment with advice and resource mobilization to help the private sector advance development The newly-launched SME toolkit, a management training tool backed by IFC, is supporting the growth of smaller businesses across the continent. SME toolkit is a training system that strengthens the management skills of owners, managers,

and staff of small and medium-sized enterprises (SME.) SME toolkit intends to lead small and medium businesses worldwide towards more sustainable practices and enable them to access finance and new markets by providing comprehensive business management solutions.

In this system it will be complicated to guarantee the distribution of 60% smallholder farmers and 40% large scale farmers, as entrepreneurs are more motivated to service large scale farmers for practical and financial reasons.

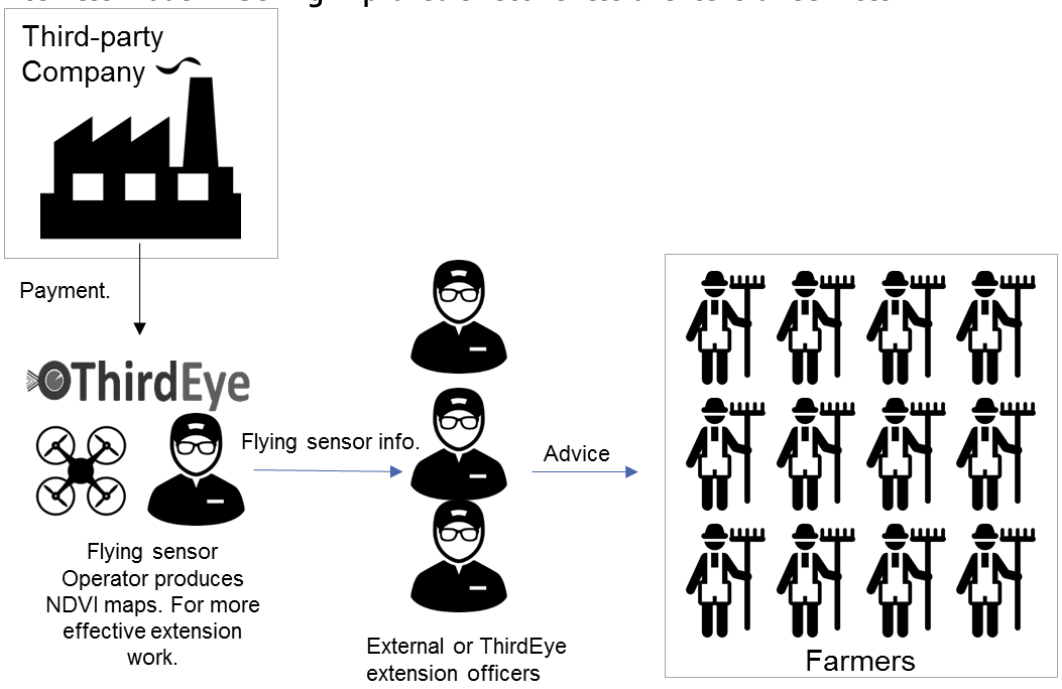
	Internal	
Positive	**Strengths** • FutureWater/HiView expert staff. • Strong potential partners	**Weakness** • Complicated to guarantee the 60% smallholder farmers and 40% large scale farmers distribution. • Business skills of Flying Sensor operators is low • Management challenges
	Opportunity • potential partners. • SME and IFC interested to collaborate • Independent network of entrepreneurs	**Threat** • Vague drone regulations • (international) organisations are withdrawing from Mozambique • Drought
	External	negative

SWOT: Business model 7. Farm business advisors.

Business model 8: Selling Improved effectiveness of extension services.

<table>
<tr>
<td rowspan="2">Key Partners
• INIR
• WE Consult</td>
<td>Key Activities
• For this model the original workflow can be used to service the end user: a. Flights, b. Processing, c. Advisory to farmers. 1 Flying Sensor operator can service 400 farmers per month.
• Acquisition at extension providers
• Improvement of NDVI advice
• Project management
• Flight operations support
• Administration
• New customer acquisition
• Partner & Customer management
• Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
• ThirdEye optimizes service delivered by extension provider.</td>
<td>Customer Relationships
• Formal
• Professional</td>
<td rowspan="2">Customer Segments
• Ministry of agriculture
• Public companys
• Irrigation scheme management
• Out grower schemes
• PROSUL project
• HICEP
• RBL
• CAIC
• ARA-SUL
• ARA-Centro</td>
</tr>
<tr>
<td>Key Resources
• Drone equipment
• Training of operators
• Expansion of flying license area
• Local network partners.
• FutureWater/HiView expert staff.</td>
<td>Channels
• Network</td>
</tr>
<tr>
<td colspan="2">Cost Structure
• Administrative work + PR
• Supplies; Hardware, software
• Overhead</td>
<td colspan="3">Revenue Streams
• customer pays for Flying Sensor spatial information enabling better deployment of extension staff.
• Bulk purchases or subscriptions ordered by an organisation to deliver ThirdEye extension to farmers.</td>
</tr>
</table>

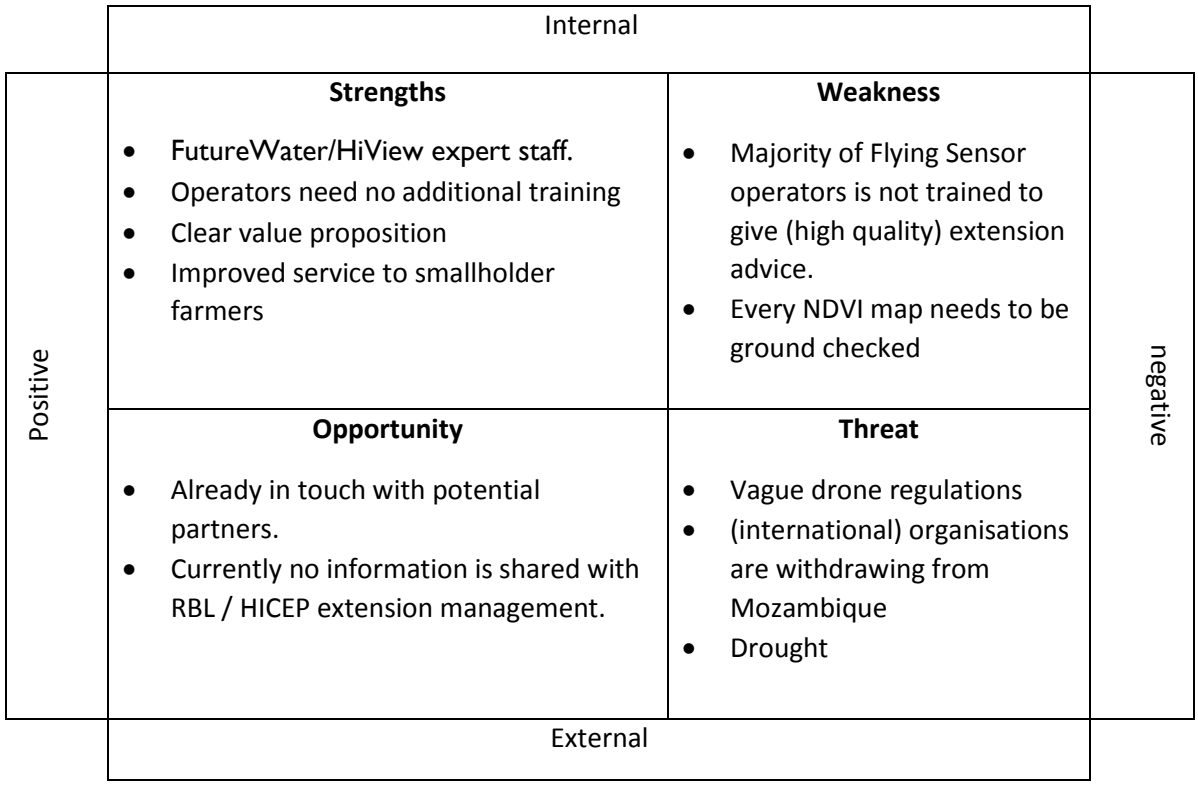
Business model 8: Selling Improved effectiveness of extension services.



Organisations currently offering agriculture extension services may be willing to outsource parts (or all) of their program to ThirdEye. Existing extension services are typically under-resourced,(RBL 1 extension officer 2000 farmers) ThirdEye can provide a more cost effective agriculture extension services to farmers, by using the NDVI maps .

At the moment the main ThirdEye service is delivering a crop status report and extension advice to the farmer. This advice is not communicated to the extension provider, currently the ministry of agriculture, RBL and HICEP. In this model ThirdEye should be viewed as being complimentary to existing face-to-face extension service. The extension workers can either be a ThirdEye operator delivering a crop status report and extension advice to the farmer. Or one ThirdEye operator can focus on flying and processing NDVI maps, enabling access to NDVI information for multiple extension officers.

Often extension workers are under-utilised because they spend more time on administrative tasks and travelling than they do working with farmers. (Rogerio Manhaussele, RBL operations director 18/05/2016 and D. Tricarico, *et al*. 2016) When using the ThirdEye service extension workers only need to travel to visit farmers facing extreme cases, shown on maps. The extension service provider saves money by eliminating travel costs and can reposition those funds towards ThirdEye.

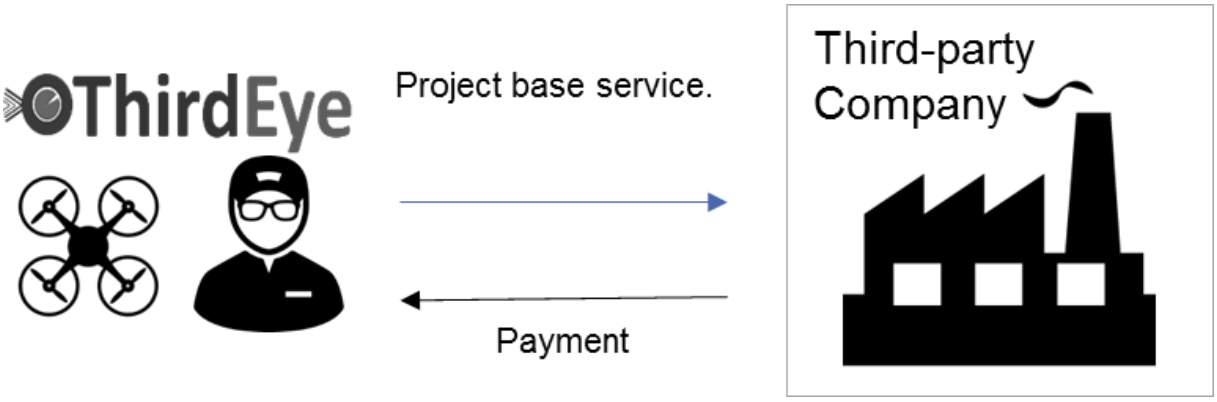


SWOT: Business model 8: Selling Improved effectiveness of extension services.

Business model 9: Use additional services to generate revenue for ThirdEye.

<table>
<tr>
<td rowspan="2">Key Partners
• INIR
• WE Consult</td>
<td>Key Activities
• Flying and processing into: orthomosaic, NDVI, DEM, 3D models.
• Linking images to expert interpretation
• Project management
• Flight operations support
• Administration
• New customer acquisition
• Partner & Customer management
• Troubleshooting and complaint handling.</td>
<td rowspan="2">Value Proposition
• ThirdEye delivers Aerial information, Data Processing, and all aspects of surveying and Mapping.</td>
<td>Customer Relationships
• Tailor made packages.
• Guard for conflicting interests of different customers.</td>
<td rowspan="2">Customer Segments
• WE Consult
• ISPG
• TCO Agriculture
• AgriSul
• Petrageo</td>
</tr>
<tr>
<td>Key Resources
• Local network partners.
• FutureWater/HiView expert staff.</td>
<td>Channels
• Local partners network</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Administrative work + PR
• Supplies; Hardware, software
• Overhead
• Extra training
• Travel cost</td>
<td colspan="2">Revenue Streams
• Fee per project
• High willingness to pay</td>
</tr>
</table>

Business model 9: use additional services to generate revenue for ThirdEye.



The current application of the Flying Sensors is focused on crop monitoring, delivering a NDVI crop status report and advise to smallholder farmers. However the applications of Flying Sensors are numerous (see annex:4) output can be: high resolution pictures, 3d models, (DEM) digital elevation maps these can be used for: Land use surveying, Canal monitoring, crop height measurement and more. Alternatively, one could think of creating attractive packages that could combine several products Flying Sensors give a (large scale) geographically detailed overview about crop status, crop stage, infrastructure status and land use which is very interesting for managers, land use planners, policy makers and farmer associations for their decision making. (example to decide on where to construct a new canal, or to see which farmers are not maintaining their land.)

ThirdEye Flying Sensors can be used for:

- Land use surveying -> to control farmers
- Lan use surveying -> to optimize land use
- Detection of natural vegetation -> to detect unused plots
- infrastructure monitoring -> to identify and improve maintenance
- Dike monitoring -> to identify and improve maintenance, for flood protection
- Results monitoring per farmer basis -> to monitor farmers individually
- Cadastre (land register) map -> improvement in effectiveness of extension services & to control farmers.
- Supplying land use and cadastre database -> archiving, contract purposes
- A DEM (digital elevation model) can show the elevation of the terrain and the height of the crops. Depending on ground measuring of control points it is possible to generate DEMs with an accuracy of up to 10-20 cm.
- Difficult terrain mapping -> 3D models and NDVI maps can be provided.
- Evaluation of drought stressed areas
- Yield indication and calculation
- Topographical surveys
- GPS surveying
- (earth) volume calculations -> mining industry

These additional services could provide a great source of revenue for ThirdEye, however before any of these services can be executed additional training needs to be provided to the Flying Sensor operators.

Multiple organisations have shown great interest in additional services. Petrageo, an Italian company doing geological research in Mozambique, has shown interest in collaborating on projects, HICEP is in the process of levelling a large part of the irrigation and has shown great interest in DEM-

maps, Agrisul is located near to the Limpopo river and is interested in DEM maps supporting the establishment of a dike against flooding. The Portuguese company TCO Agriculture is interested in DEM maps as well, RBL would like to have a monthly overview of their entire area to see what crop stage farmers are in. WE Consult has expressed interest in DEM maps as well and stressed the great potential to offer this service to other consultancy firms as well. ISPG University commissioned by the municipality of Chibuto is investigation the restoration of an old water reservoir. They have approached ThirdEye to survey an area of 1500ha of swamp which is hard to access from the ground.

These additional services will be on project basis, often an organisation will have one-time assignments, making income unpredictable. When implementing this model it will be difficult to offer a continuous service to smallholder farmers and at the same time be flexible for additional service projects.

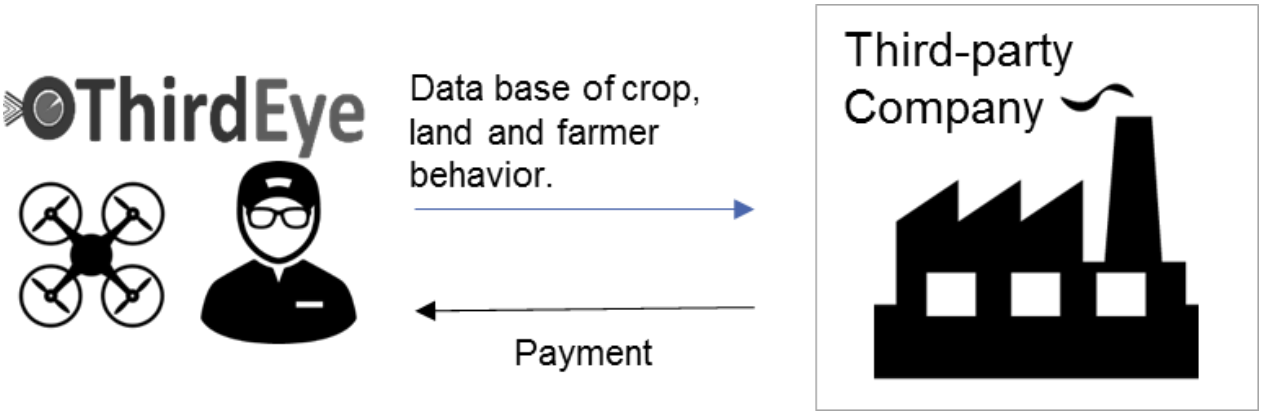
	Internal		
Positive	**Strengths** • FutureWater/HiView expert staff. • High revenue • Established network with many interested parties • More experience compared to competition	**Weakness** • Complicated to guarantee flexibility needed for project assignments • No license to fly putside irrigation schemes of Chókwè and Xai-Xai • Project management / customer relation skills of Flying Sensor operators is low • Management challenges • Operators need additional training • Additional hardware and software is needed	negative
	Opportunity • potential partners, especially •	**Threat** • Complex drone regulations • (international) organisations are withdrawing from Mozambique • Competitors offering drone services on project base. • Drought	
	External		

SWOT: Business model 9: use additional services to generate revenue for ThirdEye.

Business model 10: Data collection

<table>
<tr>
<td rowspan="2">Key Partners
• INIR
• WE Consult</td>
<td>Key Activities
• Project management
• Flight operations support
• Administration
• New customer acquisition
• Partner & Customer management
• Troubleshooting and complaint handling.
• Processing data
• making data representable/workable</td>
<td rowspan="2">Value Proposition
• ThirdEye delivers geological high detail areal information.
• Ideal for organizations: doing research, expanding activities etc.</td>
<td>Customer Relationships
• Trust
• Formal
• Professional
• Only once in a few years</td>
<td rowspan="2">Customer Segments
• Agro-input companies
• Research institutes
• Government
• NGO’s</td>
</tr>
<tr>
<td>Key Resources
• Local network partners.
• FutureWater/HiView expert staff.
• Flying Sensor hardware and software</td>
<td>Channels
• Local partners network</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Administrative work + PR
• Supplies; Hardware, software
• Overhead
• Making presentable of data</td>
<td colspan="2">Revenue Streams
• Payment for data
• Long term perspective
• Payments only periodically</td>
</tr>
</table>

Business model 10: Data collection.



Research organisations, governments, NGOs, and companies (e.g.market research for agro inputs) have an interest in data concerning agriculture, water and smallholder farmers. Gathering data can be expensive, time consuming or simply impractical. Over time when ThirdEye has collected a large amount of data such as: crop status over time, cropping practices and patterns over time, pest migration etc. This data can be very valuable.

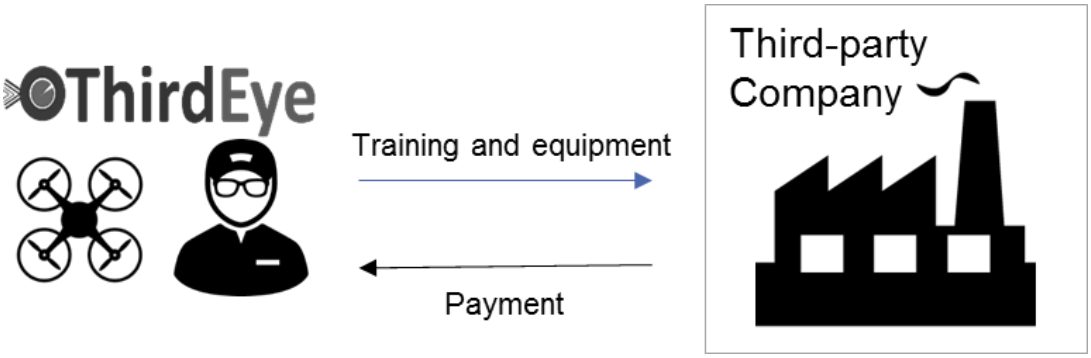
	Internal		
Positive	**Strengths** • FutureWater/HiView expert staff. • Low extra labour required	**Weakness** • Data is not yet stored in order to support this model • Property rights of aerial photos not defined	negative
	Opportunity • Shortage of geospatial data in Mozambique • Shortage of data on smallholder farmers	**Threat** • Vague drone regulations • (international) organisations are withdrawing from Mozambique • Drought • Conflicting interest of smallholder farmers and customers of data	
	External		

SWOT: Business model 10: Data collection.

Business model 11: Enabling others to perform Flying Sensor services.

<table>
<tr>
<td rowspan="2">Key Partners
• INIR
• WE Consult</td>
<td>Key Activities
• Project management
• Flight operations support
• Administration
• New customer acquisition
• Partner & Customer management
• Troubleshooting and complaint handling.
• Training
• Ordering and customizing Flying Sensor equipment</td>
<td rowspan="2">Value Proposition
• ThirdEye staff trains others to use Flying Sensors to support decision making.</td>
<td>Customer Relationships
• Trust
• Formal
• Professional</td>
<td rowspan="2">Customer Segments
• large farmers and agribusiness firm.
• Agribusiness firms
• Universitys
• Anny organization able to make the investment.</td>
</tr>
<tr>
<td>Key Resources
• Local network partners.
• FutureWater/HiView expert staff.</td>
<td>Channels
• Local network</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Expensive travel cost
• Training cost
• Administrative work + PR
• Supplies delivered to customer; Hardware, software
• Overhead
• $25.875,00 USD for 3 trainings and 2 Flying Sensor packages.</td>
<td colspan="2">Revenue Streams
• Customer is charged for training
• Customer is charged for Flying Sensor equipment
• Quick large amount of revenue</td>
</tr>
</table>

Business model 11. Enabling others to perform Flying Sensor services.



In this business model ThirdEye staff trains others to use Flying Sensors to support decision making. At the moment the ThirdEye management has proposed a Training of 4 technicians of Tongaat Hulett sugar cane plantation in order to operate Flying Sensors independently, delivery of Flying Sensor gps equipment. ($25.875,00 USD for 3 trainings and 2 Flying Sensor packages.)Training includes Orthomosaic for overall visual view on weak crop areas, NDVI mapping for In detail crop status information, DEM (digital elevation model) of crops at a 10-20 centimetre accuracy (provided ground control points are available),KMZ/KML for projection of orthomosaics and NDVI mapping into Earth Viewer tools (like Google Earth), Tablet mapping for mapping organization and area management. In this model revenue will be gained by providing the equipment and training to organisations enabling them to carry out Flying Sensor activities and services. This model means fast revenue for ThirdEye however it enables others to become competition or to become independent from ThirdEye services. This does not contribute to sustainability of ThirdEye.

	Internal	
Positive	**Strengths** • FutureWater/HiView expert staff. • Willingness to pay • Quick and high revenues	**Weakness** • Local staff not capable of training others • High travel expenses • Not a sustainable model
Positive	**Opportunity** • Drones in agricultural applications are becoming more popular • Companies come up with their own ideas for application of Flying Sensors	**Threat** • complex drone regulations • Drought • Creating competition for ThirdEye
	External	negative

SWOT: Business model 11. Enabling others to perform Flying Sensor services.

Chapter 4
Ranking of business models

Rice threshing, Chókwè May 2016 ©Sam van Til

Chapter 4: Ranking of business models.

The key ingredient of success for ThirdEye is getting the right business model. This business model ranking intends to provide a good basis for further discussions, decision-making, and ultimately establishment of sustainable business models. In this chapter business models are awarded a numerical score for each of the 9 building blocks of a business model combining a SWOT analysis with the Business Model Canvas. Annex: 9. Ranking of business models contains sets of questions and their maximum score which build on the final score used to assess the strengths, weaknesses, opportunities and threats of each of the business models building blocks. Next to this each model is scored on the value it creates for smallholder farmers. The scores are awarded based on the interviews with 28 (potential) stakeholders and observations. First an overview of the scores is provided then the conclusions derived from this.

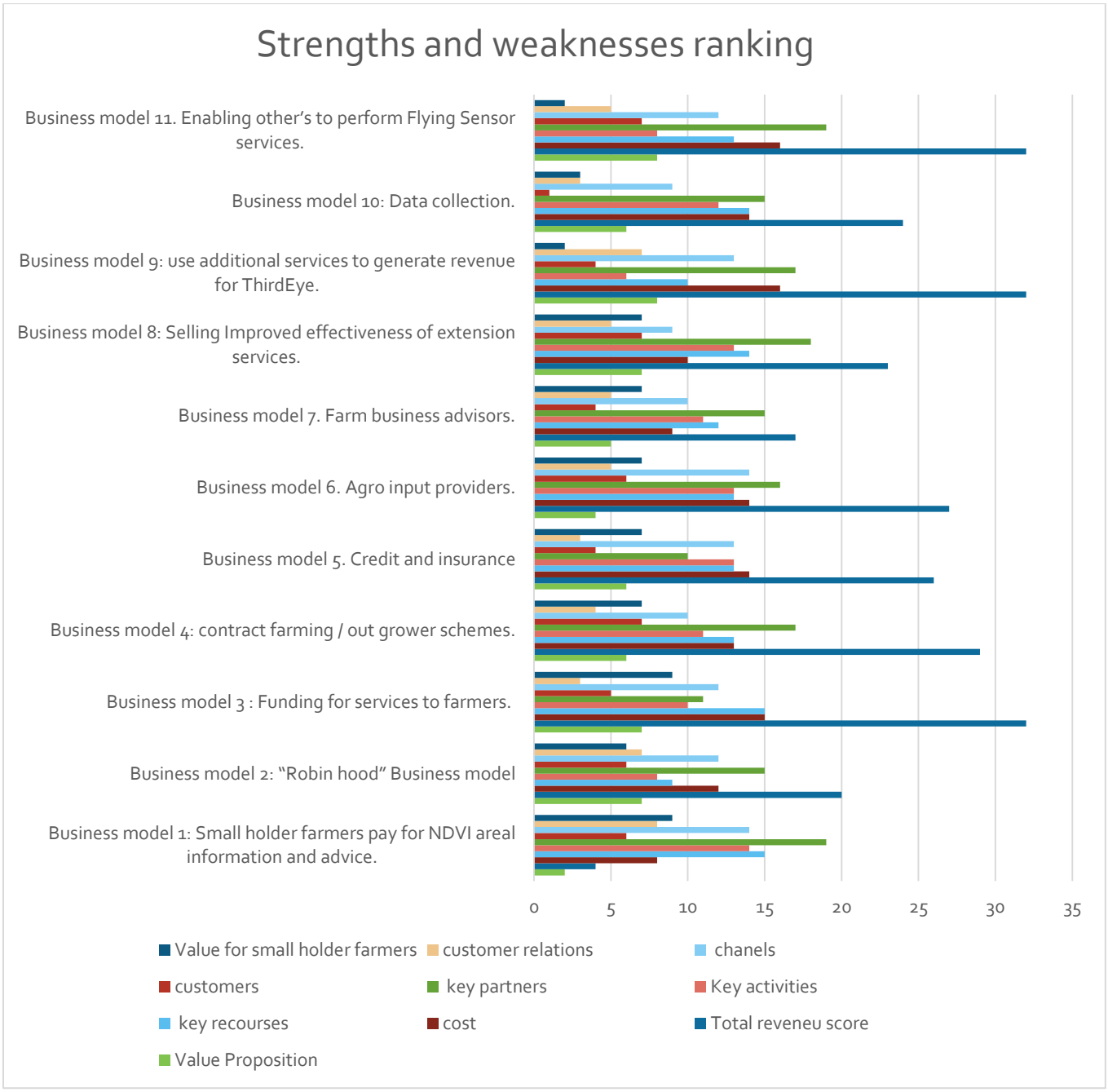


Table 1:Business model ranking: Strengths and weaknesses

The following ranking is based on ability to cope with threats, meaning a high score is low threats.

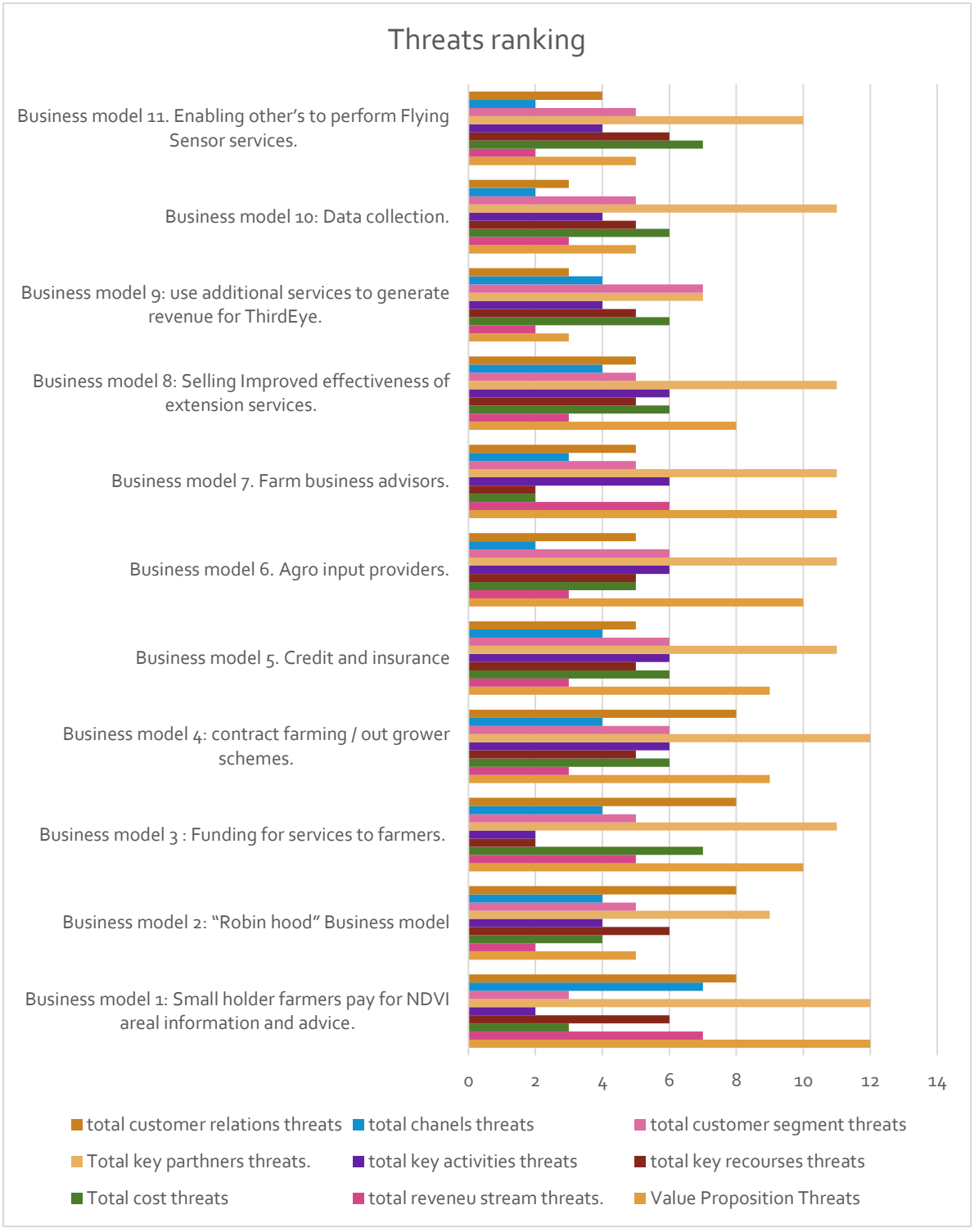


Table 2: Business model ranking: Threats

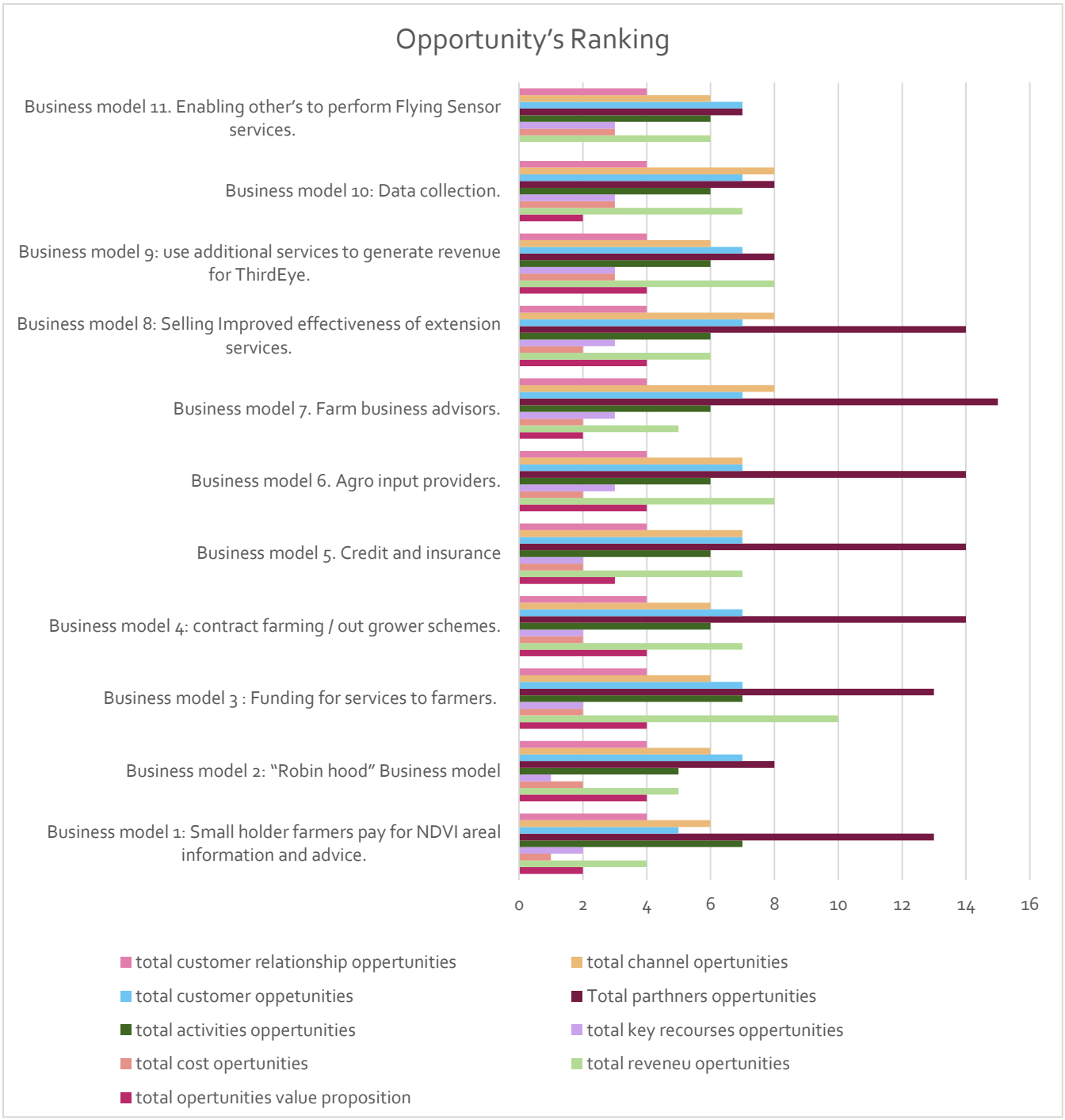
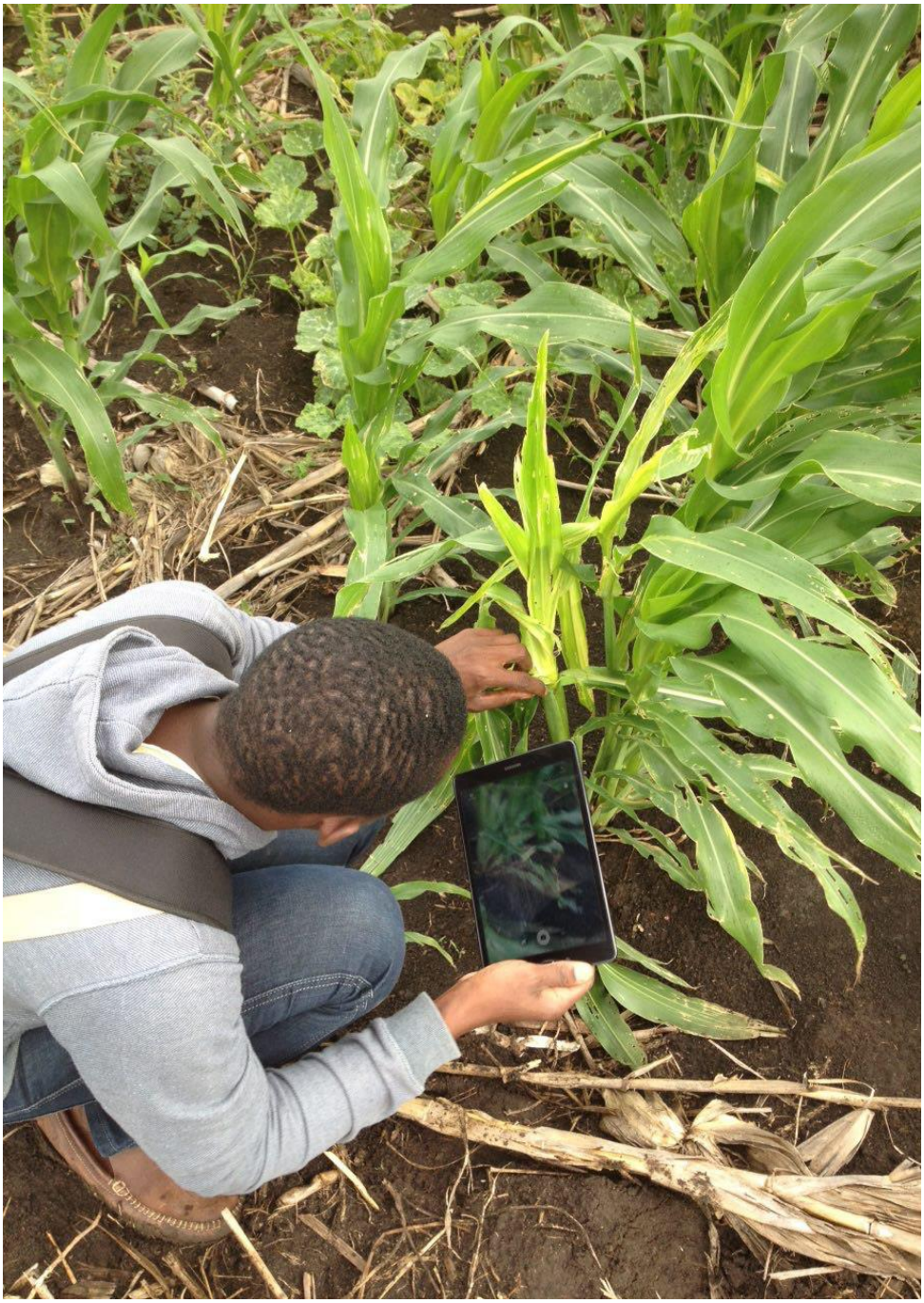


Table 3: Business model ranking: Opertunity

4.1 Conclusions business ranking

Clearly Business model 1 will result in low revenue, whereby business models 3, 9 and 11 rank highest in terms of revenue, however these models rank low on value created for smallholder farmers. When looking at the threats ranking models 9 and 11 have the largest threat of competitors and substitute products, these models are more the commercial approach. There are other parties in the Mozambique market offering drone services. The less commercial (aimed at smallholder farmers) or funded oriented business models require a more long-term mind-set rather than expectation of a quick return. Risk associated with combining profit and a smallholder farmer oriented approach is higher. Business model 10: data collection scores low on the customer segment building block as the discussions with potential customers for this service where very superficial. The same applies to model 5: credit and insurance schemes the potential partners interviewed did not respond very enthusiastic. The other models score better as more customers are identified and a demand is identified. Apart from business model 1 smallholder farmers and 2 robin hood, often a whole new market channel needs to be established and validated to reach the potential customers. Business model 4 credit and out grower scheme scores high on the opportunity ranking. This is due to the unique fact that ThirdEye offers a service which is attractive to multiple customer segments (beneficiaries) within this model ThirdEye has the opportunity to generate revenue in different manners and combine both services delivered to large scale firms and small scale farmers. For business model 1 smallholder farmers, business model 4 contract farming and out grower scheme, business model 5 credit and insurance schemes, business model 7 agro input providers, and business model 8 selling improved effectiveness of extension services. It will be necessary to deliver services to a large number of users with low costs per unit sold to be profitable, charging a fee for a bulk unit purchases, ha, or no. of farmers. When choosing for business model 3: funding for services to smallholder farmers its scale will be limited by funds and donor decisions. When a business model generates profit without high partner dependence, it can grow, evolve, and adapt in new markets. This is reflected in the scores related to partners.

Chapter 5
Conclusion and Recommendations



Flying Sensor operator Dercio inspecting a caterpillar infested maize plant, taking notes in Tablet. Xai-Xai May

Chapter 5: Conclusion and Recommendations

5.1 conclusion

Several Interviews and third parties engagements have been undertaken to identify and design potential business models, some of these interviews have contributed towards concrete agreements and collaboration opportunities for an overview see annex. 7, this research contributed to submitting a proposal to RBL (see annex:11) HICEP and AgriSul. Furthermore an MOU has been signed by ISPG (see annex 12) university. The original business model focused on supporting smallholder farmers, it is clear that this target group is only to a limited extent able or willing to pay. The customer focus should therefore shift towards a system where smallholder farmers will be end user but not the main paying customer. By combining (a part of) the models depicted above there could be a sound business case for securing revenue and delivering services to smallholder farmers. It is believed that ThirdEye should focus on strengthening existing services to smallholder farmers instead of trying to be an individual service. This requires that appropriate business models are applied and that this is done in partnership with producers, the public sector, intermediaries and development agencies. The research shows that a combination of models will be needed. The new business models afford opportunity in terms of smallholder farmer inclusion and do not exclude commercial farmers, or other customers. This will also spread risk. There will always remain a trade-off between financial gain and smallholder inclusion. Any adjustments in pursuit of greater smallholder farmer inclusiveness must not destabilise the most sensitive elements of a model – the cost structure, and the value proposition. This leads to the importance of acknowledging the risks of executing the above business models. It is an open question as to what extend a business model not paid by the main beneficiary will ever be sustainable. Majority of the business models rely on a strong supportive environment with the shared goal to support smallholder farmers. Over reliance on this misses the point of sustainability. However, generating commercial return from activities that engage smallholder farmers is believed to be possible with a combination of above business models. Each identified business model can be regarded as a series of interlocking, sometimes changing, pieces of a jigsaw puzzle. This research has provided the start of the puzzle. To fit the pieces together more market research, a design for an operational plan and validation is needed. This will be done by SNV Mozambique (Netherlands Development Organization). This thesis study functions as the basis for SNV (see annex. 10 for their scope of work).

5.2 Recommendations

1. In the future a renewed market research regarding willingness to pay of farmers is advised; accurately gauge potential demand: not what we think smallholder farmers need, but what they actually want and will save and pay for.
2. Business models vary according different business contexts and may vary per region. Different business models/revenue streams should be combined.
3. Depending on the model Flying Sensor operators need to be trained to execute additional services, manage their own business.
4. A more precise calculation of the integral costs needs to be performed within the coming months.
5. At the moment there is a lack of a clear vision, not clear how FutureWater/HiView wants to be involved with ThirdEye on the long term. Brainstorming about a long-term strategic vision provides firm foundations for deciding on a business model and operational structure.
6. Business models with an inclusive smallholder focus are (potentially) rather complex. When establishing the identified models ThirdEye should guard not to oversimplify the model. It is believed that any model involving smallholder farmers should aim at also linking the farmer to other services such as agronomic advice, inputs, finance, knowledge and markets. The company lacks the reach to engage directly in all these activities. If ThirdEye wants to boost smallholder farmers' quality and supply, it should focus on using Flying Sensors to complement existing extension efforts and not reinvent the wheel.
7. Partnerships are critical and need to be well-managed
8. ThirdEye needs an innovative and creative business approach a good (fulltime) business / sales manager is needed as soon as possible.
9. It is expected that ensuring that each component of the business models fits together coherently will take time and often multiple tests. Prepare for a long term process.
10. Expansion of the flying license issued by INIR is crucial for the success of ThirdEye.
11. The quality of advice needs to be improved, Flying Sensor operators need more agronomic knowledge. It is worthwhile to consider working with a partner whom has a tested and proven extension system in place. Personal of these partners can be trained to be FlyingSensor operators. It is expected that private companies or NGO's have better trained staff and extension programs then public companies.
12. A pilot that 'fails' – but shows you what to do better – is a 'success' It is worth considering if ThirdEye wants to stay put in Chókwé and Xai-Xai or shift to areas with better business and partner potential.

Please see annex: 8 for general recommendations for ThirdEye.

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Flying sensor and 2 operators in training, Xai-Xai March 2016 ©Sam van Til

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Version	Date	Author(s)
1	16/01/2016	Sam van Til, Jan van Til, Martijn de Klerk & Jelle van den Akker

Annex 1. Starting point for business development.

ThirdEye The Business Model Canvas

Key Partners

- Greenbelt
- Regadios
- World Hope
- WE Consult
- USAid
- SNV
- Smops
- Plantations
- AFAP
- IFDC
- Co-operatives
- Government
- Universitys
- Agro-input suppliers
- Marromeu SDPI
- Marromeu SDAE
- A.C.D.I. Voca

Key Activities

- Training FSO operators.
- Business plan development
- Project management
- Flight operations support
- Administration
- New customer acquisition
- Partner & Customer management
- Troubleshooting and complaint handling.

Key Resources

- Local network partners.
- FutureWater/HiView expert staff.
- New innovation "pioneer"

Value Proposition

- In field expertise
- Land use surveying
- Innovation
- Canal monitoring
- Customized information and advice
- Dike monitoring
- Team of operators.
- Innovation / knowledge
- In field expertise
- Land use surveying
- Land leveling
- Improving livelihood of small farmers
- Historical data collection
- Actual data gathering.
- Improved crop quality / yield.
- Cost effective service for farmers
- New way of solving crop issues
- Results monitoring per farmer basis.
- Water saving.
- Increase of water use efficiency

Customer Relationships

- Trust, reliable, useful, impactful.
- Tailor made packages.
- Training.
- Guard for conflicting interests of different customers.

Channels

- End users(farmers) need to pay(USAid) However not the only paying target group.
- How to reach farmers? (Local partners/ngo)
- How to reach other customer segments? (RVO Dutch embassy, partner network)

Customer Segments

- Farmers
- Extension (bureau) workers
- Ngo's
- Government's
- (crop)Insurance company's/banks
- Plantations
- Rejardios
- ARA-CENTRO
- Tongaat Hulett Limited
- ARA-SUL
- ECO sugarcane plantation.
- Water governing body's
- facilitators (e.g. AFAP)
- agro-firms (e.g. fertilizers)
- infra organizations (e.g. regadios)
- donors
- authorities (e.g. Cenacarta, embassy)
- out grower schemes
- Entrepreneurs

Cost Structure

- Manpower and staff
- Sensy
- Software management
- Travel expenses

Revenue Streams

- Farmers subscription.
- Funding or subscription(per farmer) by NGO
- Subscription(per farmer/hectare) by farmer organization
- royalty fee for FSO and/or companies
- % fee on the success (water saving, yield)
- Combination of value propositions "packages"

Annex 2. Description of ThirdEye.

Background ThirdEye

The ThirdEye project is undertaken by FutureWater and HiView (Annex 1). Appropriate information at the right location and timing is essential for farmers to take decisions regarding application of their limited resources such as water, seeds, fertilizer and labor. Our innovation is that we provide this essential information: (i) at an ultra-high spatial resolution (NDVI), (ii) at an unprecedentedly flexibility in location and timing, (iii) at a spectrum outside the human eye, and (iv) at an in-country business oriented approach. For this we use low-cost high-resolution Flying Sensors in a development context to ensure that farmers will get information at their specific level of understanding and simultaneously develop a network of service providers in Mozambique.

Our innovation can be considered as a major transformation in farmers' decision making regarding their agronomic practices. Instead of relying on common-sense management, farmers are now able to take decisions based on facts. The Flying Sensor information helps farmers to see when and where they should apply their limited resources. We are convinced that this innovation is a real game-changing comparable with the introduction of mobile phones that empowered farmers with instantaneous information regarding markets and market prices. With information from Flying Sensors they can manage also their inputs to maximize yields, and simultaneously reduce unnecessary waste of resources. In summary the missing information on markets has been solved by the mobile phone introduction, the Flying Sensors close the missing link to agronomic information on where to do what and when.

Progress (2014 – 2016)

- Farmers estimate a water consumption reduction of 39%.
- More than 15,000 people have access to our services.
- The number of people benefitting from the ThirdEye services is over 12,500.
- Flying Sensor information is currently collected from over 900 ha.
- 14 Flying Sensor Operators have been trained and obtained their license.
- 8 Flying Sensors have been supplied and are all used on a daily basis.

Outlook

- Additional operators will be selected and trained.
- Additional Flying Sensors will be supplied.
- The number of smallholder farmers benefitting from the ThirdEye services will be increased.
- The area where Flying Sensor information is collected will be expanded.
- Focus will be on business development to ensure long term sustainability.
- Exploring new project areas and partnerships.
- Transition to also deliver ThirdEye services to commercial farmers.
- Developing additional Flying Sensor services.
- Extra public relations activities

Flying Sensors

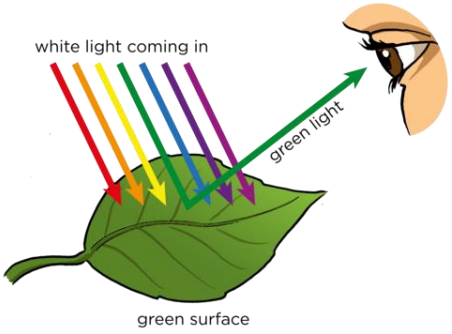
A Flying Sensor is a combination of a flying platform and camera. Reliable Flying Sensors are on the market in a wide-range of categories each with its specific characteristics. Based on the consortiums experiences over the last years low-cost Flying Sensors have been identified that are excellent equipped for our innovation. Typically a Flying Sensor flies at a height of 100 meter and overlapping images are taken about every 5 seconds. This results in individual images covering about 50 x 50 meter and an

overlap of 5 images for each point on earth. So in order to cover 100 ha 500 images are taken during a flight.
The use of Flying Sensor is unique and no comparative techniques exist that provide farmers with real-time high-resolution information. The use of satellites to provide farmers with spatial information has been promoted but has three main limitations: they have fixed overpass times, the spatial resolution is low, and the presence of clouds halters the information. It is unlikely that, within the coming decades, progress in satellites will be real competitors of Flying Sensors. Another category of comparable techniques to provide farmers with information is the use of ground sensors. Typical examples of these sensors are soil moisture devices, soil sampling and laboratory analysis, crop sampling and laboratory analysis. However, all those sensor techniques have the common limitation that information is only local point representative, while the main question farmers have is regarding to spatial differences. Moreover, these ground sensors are in all cases too expensive to be used by small-scale farmers.

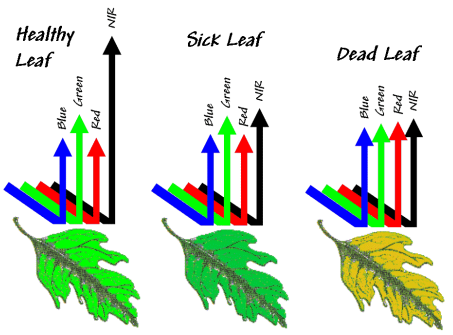
We trained several Flying Sensor operators, who are going to the fields on a daily basis to gather information with their Flying Sensors and advice farmers on potential interventions they could take. These operators are able to support over 400 small-scale farmers, by collecting information and sharing it with farmers on weekly basis. Based on the information, farmers take decisions on where to do what in terms of irrigation, fertilizer application and pesticides.

NDVI technology

When light falls on a leaf, reflection occurs. The amount of reflection of green light (0.54 µm) is very high, making plants green to the human eye. Healthy vegetation does not reflect much red light (0.7 µm), since it is absorbed by chlorophyll abundant in leafs. In the near-infrared spectrum (0,8 µm) the amount of reflection increases rapidly to 80% of the incoming light. This increase is caused by the transition of air between cell kernels. This is characteristic for healthy vegetation.

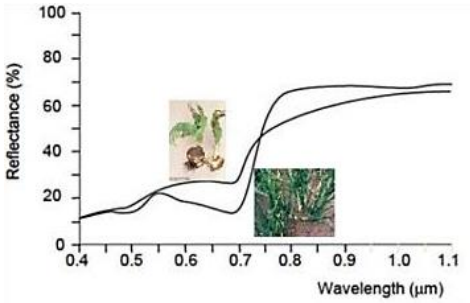


Damaged plant material does not show this increase in reflected near-infrared light. Moreover, the reflection of red light is much higher than in healthy plant material. By measuring the reflection in these spectra, damaged plant material can be distinguished from healthy plant material (Schans et al., 2011).



Our Flying Sensors have cameras which can measure the reflection of near-infrared light, as well as visible blue light. These two parameters are combined with a formula, giving the Normalized Difference Vegetation Index (NDVI). This information is delivered at a resolution of 2x2 cm in the infra-red spectrum. Infra-red is not visible to the human eye, but provides information on the status of the crop about two weeks earlier than what can be seen by the red-green-blue spectrum that is visible to the human eye.

NDVI is the most important ratio vegetation index and says something about the photosynthesis activity of the vegetation. Moreover, NDVI is an indicator for the amount of leaf mass, and therefore, ultimately biomass. In general, open fields have a NDVI value of around 0.2 and healthy vegetation of around 0.8. NDVI values give an indication of crop stress. This can be caused by a lack of water, lack of fertilizer, pests or abundancy of weeds.



Annex 3. Corporate Information commissioner.

FutureWater

FutureWater is a research and consulting organization that works throughout the world to combine scientific research with practical solutions for water management. FutureWater works at both global, national and local levels with partners on projects addressing water for food, irrigation, water excess, water shortage, climate change, and river basin management.

FutureWater's key expertise is in the field of quantitative methods, based on simulation models, geographic information systems and satellite observations. Important clients and collaborators are: World Bank, Asian Development Bank, National and Local Governments, River Basin Organizations, Science Foundations, Universities, and Research Organizations.

In addition to carrying out research and providing advice on request to clients FutureWater frequently initiates state-of-the-art scientific and applied research projects. FutureWater has a pro-active approach to research where we use models to investigate a variety of problems and challenges in water management and emphasize possibilities for the future.

FutureWater has offices in Wageningen (Netherlands) and in Cartagena (Spain). Details can be found at: http://www.futurewater.eu.

HiView

HiView supports professionals by providing data, information and services based on ultra-high resolution imageries obtained by Flying Sensors. HiView deploys a range of platforms on which various sensors (both in the visible and non-visible parts of the spectrum) can be mounted. Raw data is converted to information using various state-of-the-art software packages. Information is transferred to knowledge by our highly qualified scientific staff.

HiView has a broad range of projects in various countries. Typical examples include:

- Moorland restoration monitoring (UK)
- Glacial movement detection in Himalayas (Nepal)
- Vegetation classification in nature reserves (Netherlands)
- Small-holder farmers support in water-agro decisions (Mozambique)
- Large-scale farmer support in farm management (Netherlands)
- Drought detection in nature reserves (Netherlands)

HiView is based in Wageningen (Netherlands) and is accredited by the Civil Aviation Authority of the Netherlands and fully certified by EuroUSC. Details can be found at: http://www.hiview.nl.

Annex 4. Additional Flying Sensor services.

Orthomosaic

An orthomosaic is a geo-rectified stitch of a series of aerial images.

Figure 1. Orthomosaic of sugar cane field. Orthomosaic was made from the images of 1 flight with our Flying Sensor Sensy_gps+

Details sugar cane field

Our orthomosaics contain ultra-high detail. The Flying Sensors of HiView can reach a resolution of up to 2 cm/pixel.

Figure 2. Detail sugar cane field 6 x 6m (derived from orthomosaic)

Figure 3. Detail sugar cane field 3 x 3m (derived from orthomosaic)

DEM

A DEM (digital elevation model) can show the elevation of the terrain and the height of the crops. Depending on ground measuring of control points HiView can generate DEMs with an accuracy of up to 5-10 cm.

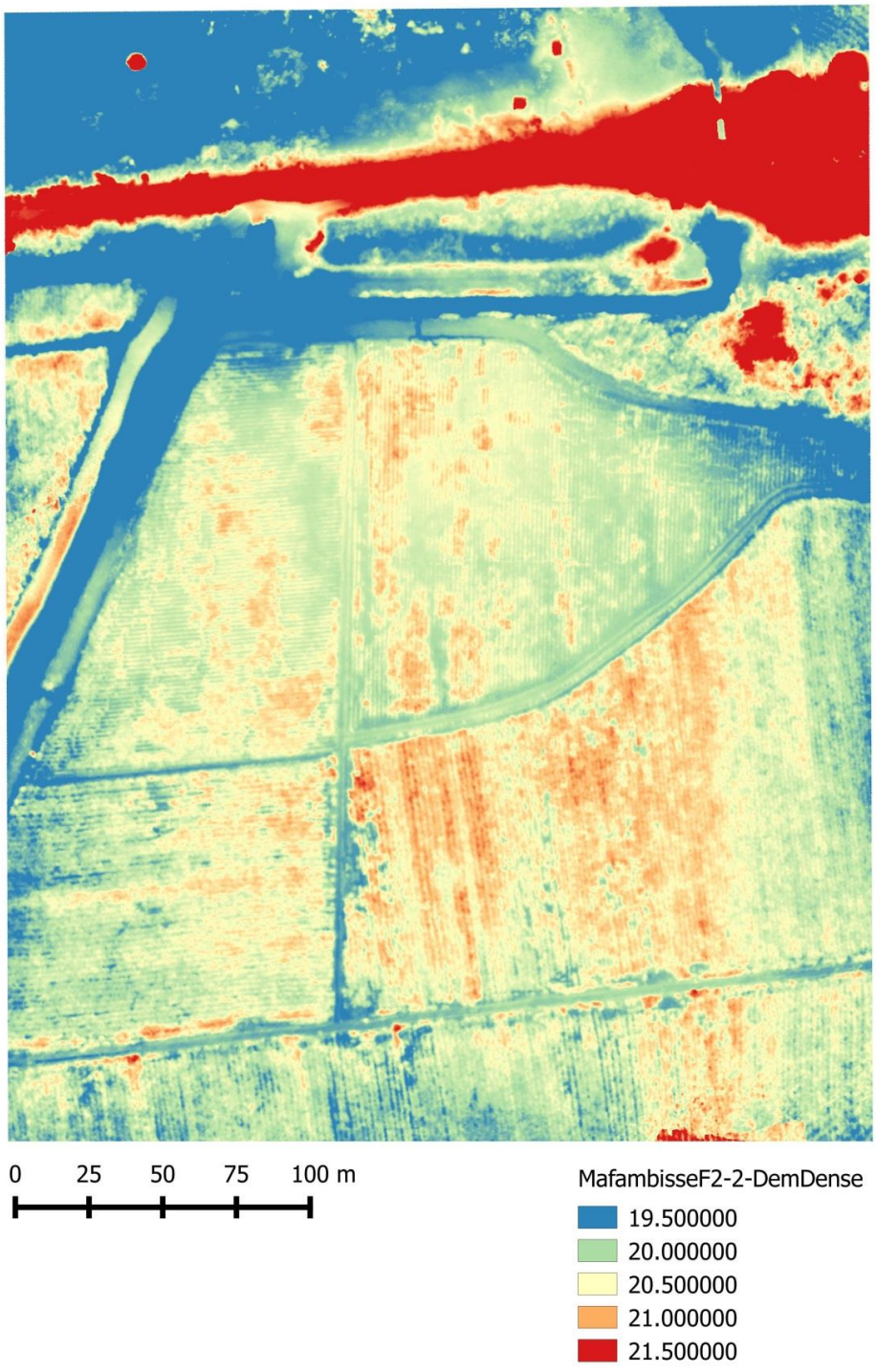


Figure 4. DEM of sugar cane field showing the height of sugar cane

KMZ/KML

A KMZ (a zipped KML) helps to find the location on Google Earth in a twinkle. A KMZ delivered by HiView loads itself automatically into a satellite viewer like Google Earth.

Figure 5. Insert in Google Earth of orthomosaic of sugar cane field

Analysing crops with NDVI & Anomaly

NDVI (normalized difference vegetation index) and Anomaly (further processed NDVI) show the condition of the crops. HiView produces NDVI and Anomaly with a resolution of up to 2 cm/px. The NDVI is derived from the NIR (near infrared) image source.

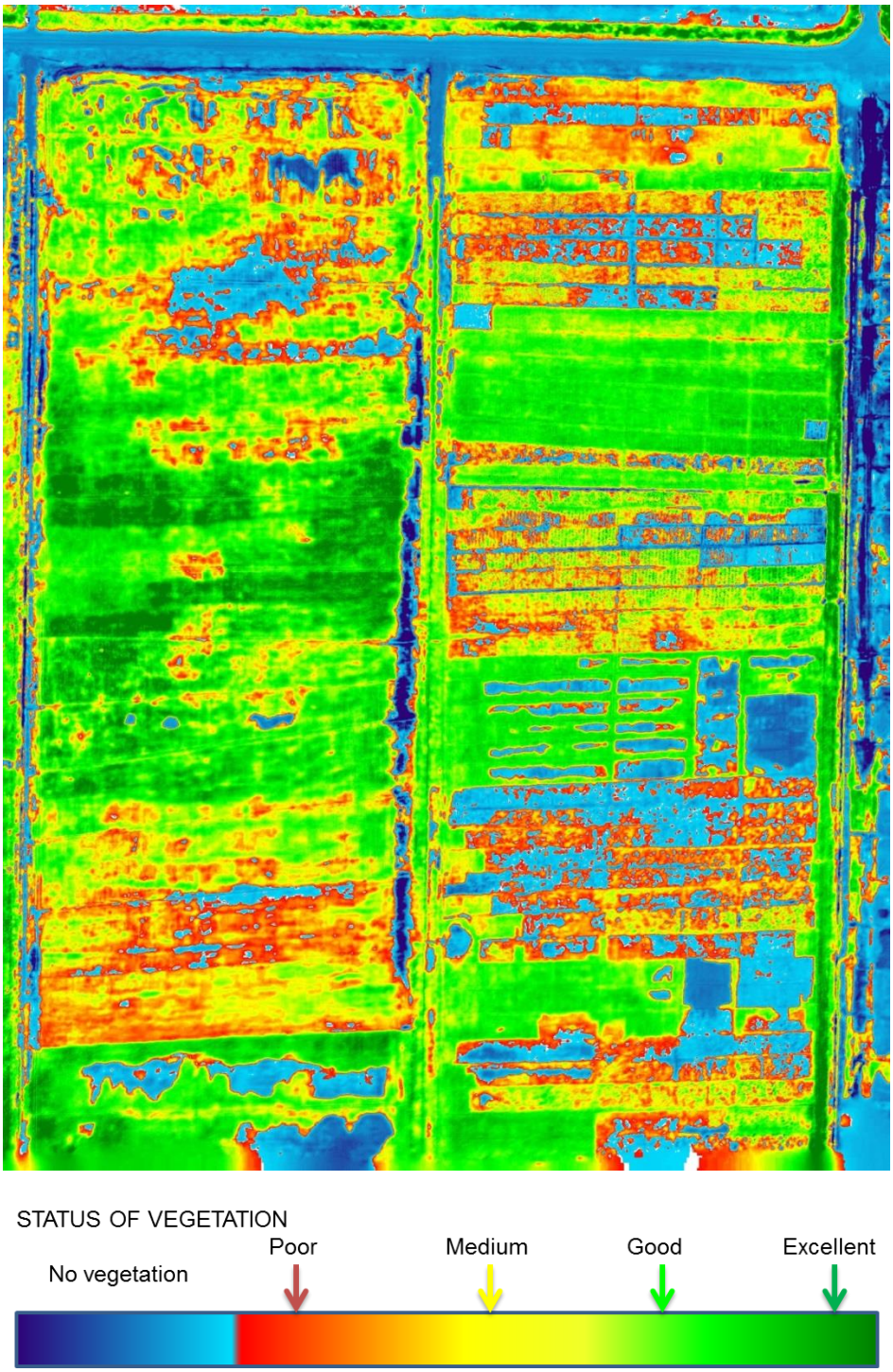


Figure 6. NDVI of small farmer crop fields in the regadio of Chókwè

Details of NIR and NDVI

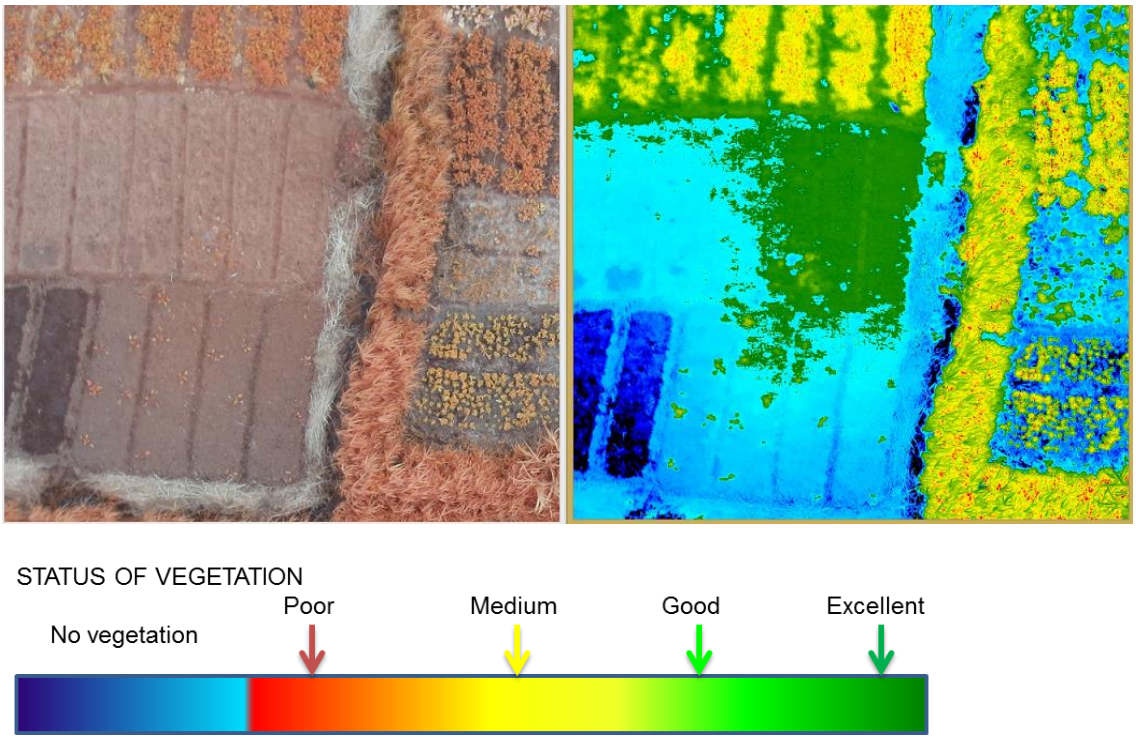


Figure 7. Details of NIR image source (left) and the processed NDVI (right).

Tablet mapping

Tablet mapping is a very handy tool making it possible for Flying Sensor operators to localize special attention areas, add location specific information (categories per colour/ text/ coordinates) and store as customized maps.

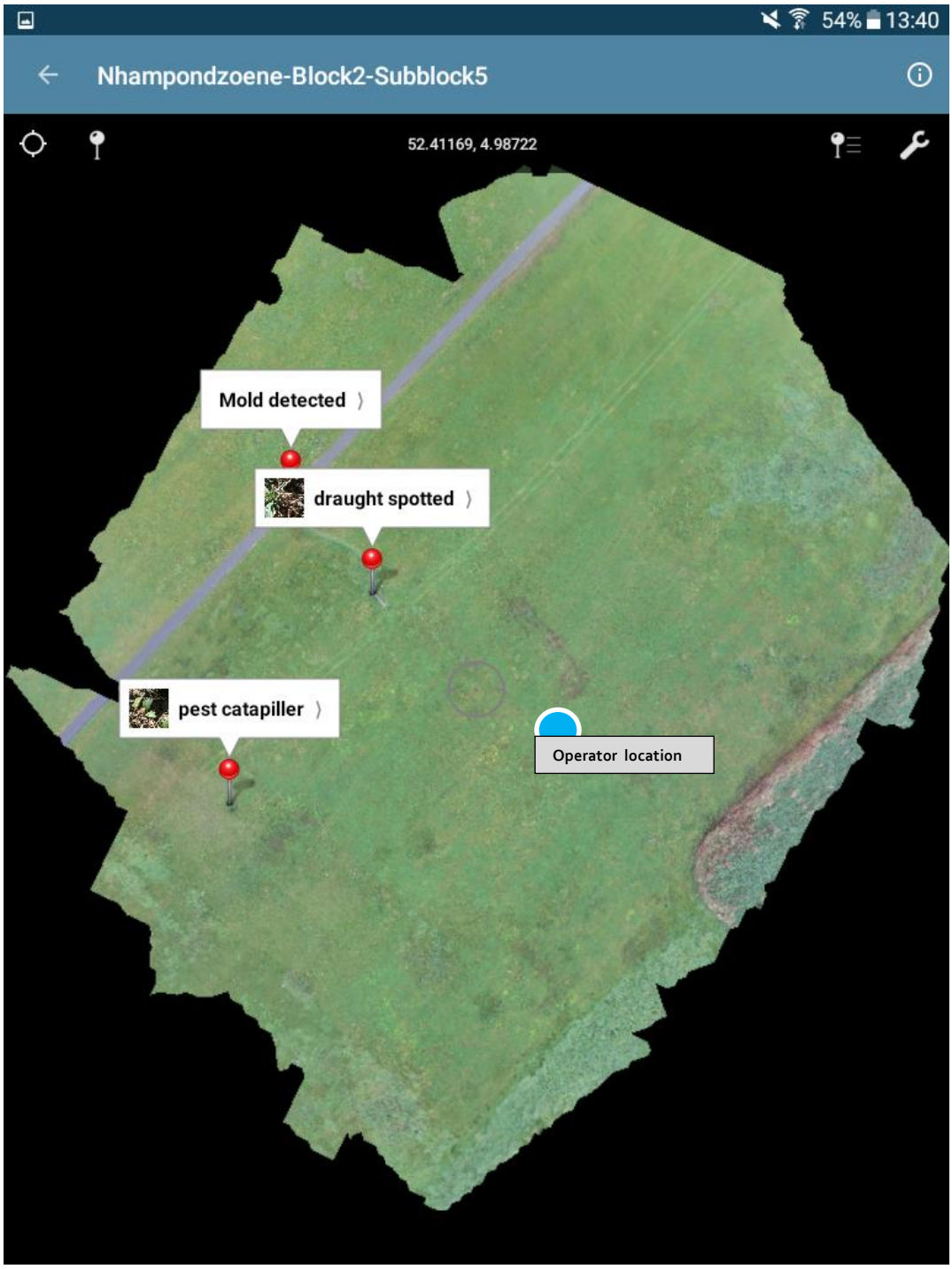


Figure 8. Example of tablet mapping (RGB, visual light image).

Figure 9. Example of tablet mapping (NDVI image).

Annex 5. Secondary data regarding willingness to pay.

An earlier conducted survey by the ThirdEye team and the information collected by SNV Mozambique showed low willingness to pay for the ThirdEye service.

Survey by ThirdEye team:

- 148 questionnaires conducted in Xai-Xai
- Average willingness to pay is 25MT

Name	City	Block	Q1. Job position	Q2. Gender	Q2. Age	Q2. Experience in years	Q3. Nr. hectares total	Q4. Nr. hectares ThirdEye	Q4. Main crop	Q5. Nr. kg./ha harvest	Q6. Method of irrig
	Chokwe		President, Canal Esquerdo	Female	57	10	2	2		1000	secondary channel
	Chokwe		Farmer	Female	52	3	0,5	0,5		100	secondary channel
	Chokwe		Farmer, member of ass.	Female	57	32	0,5	0,5			secondary channel
Floriage Megoer	Chokwe		Farmer	Female		30	0,5	0,5		24 sacos	tertiary channel
	Chokwe	D5B	Chief of the team	Female	60	30	1	1		50 sacos	tertiary channel
Jeremas Sitoe	Chokwe	D5B	President water user ass.	Male	60	18	2	2		30 sacos	tertiary channel
	Chokwe		Farmer	Female	57	10	0,5	0,5		4 sacos	tertiary channel
	Chokwe	D5B, rega2	Farmer	Female		10	1	1			tertiary channel
	Chokwe		Farmer	Female	69	30	1	1			tertiary channel
	Chokwe	D5B, rega5	Farmer	Female	52	10	0,5	0,5			tertiary channel
Romera Samuel Ngoverne	Chokwe		Farmer	Female	50	18	0,5	0,5		40 sacos	
	Chokwe	D5B, rega3	Farmer	Female	58		0,5	0,5			tertiary channel
	Chokwe	D5B, rega3	Chief	Female		32	1	1			
Lezan Sumbane	Chokwe	D5B, rega3	Farmer	Male	52	1	0,5	0,5			
Fernando Mojule	Chokwe	D5A, rega2	Farmer	Male	58	29	0,5	0,5	rice	65	tertiary channel
	Chokwe	D5A, rega2	Farmer	Female	56	14	0,5	0,5	rice	50	
	Chokwe	rega8	Farmer	Female	70	32	0,8	0,8	rice		
	Chokwe	rega2		Female	57	32	0,5	0,5	rice	45	
	Chokwe	D5A, rega3	Farmer	Male		5	0,5	0,5	rice	10	
Jaquelina Valante	Xai-Xai		Farmer	Female	36	1	0,125	0,25		200	secondary channel
Alzira Jaime	Xai-Xai		Farmer	Female	50	32	0,5	0,5		200	secondary channel
Victoria Macavel	Xai-Xai		Farmer	Female	52	32	0,25	0,25		500	secondary channel
Maria de Fefiang	Xai-Xai		Farmer	Female	44	30	0,5	0,5		500	secondary channel
Salmine Monodlane	Xai-Xai		Farmer	Female	34	5	0,25	0,25		200	
Maria de Leirdes	Xai-Xai		Farmer	Female	39	5	0,25	0,25		500	secondary channel
Rita Mario	Xai-Xai		Farmer	Female	20	2	0,25	0,25		200	buckets/ channel
Trango Jose Manjate	Xai-Xai		President	Male	50	2	0,5	0,5		3000	secondary channel
Sandra Maviande	Xai-Xai		Farmer	Female	34	3	0,25	0,25		2000	buckets/ secondayr
Augentina Paulo Lauga	Xai-Xai		Farmer	Female	56	5	0,25	0,25		500	buckets
Margarida Tsambe	Xai-Xai		Farmer	Female	27	3	0,25			200	secondary channel
Jorge Licerian Manbe	Xai-Xai		Farmer	Male	42	12	0,5			500	secondary channel
Manuel Noesue	Xai-Xai		Farmer	Male	52	14	0,5			3000	buckets/ secondayr
Laura Daniel Djedje	Xai-Xai		Farmer	Female	62	20	0,5			2000	buckets/ secondayr
Feljumaia Bila	Xai-Xai		Farmer	Female	45	10	0,25			500	secondary channel
Argentinea Vembe	Xai-Xai		Farmer	Female		4	0,25			200	
Clara Ngovene	Xai-Xai		Farmer	Female	53	6	0,75			500	
Francios Nomusse	Xai-Xai		Block Chief	Male	60	16	0,25			500	
Duzenta Pedro Mauaeu	Xai-Xai		Subblock Chief		46		0,5		maize		main channel
Paulo Abrao Clauke	Xai-Xai		Subblock Chief		33		0,5		maize		main channel
Isac Anoinio Bila	Xai-Xai		Farmer		62		0,5		maize		buckets
Maria Lina Chachuio	Xai-Xai		Farmer		62		1		maize		buckets
Dalila Carhos Modlane	Xai-Xai		Farmer		35		0,5		maize		buckets
Somia Gumayo	Xai-Xai		Farmer		36		0,5		maize		buckets

Survey by SNV.

Deducted from inception report august 2015 "REPORT OF A THIRD EYE TECHNOLOGU DEMONSTRATION AND MEETINGS WITH POTENTIAL USERS"

WILLINGNESS TO PAY

A preliminary discussion with the group of about 20 farmers indicated that there is a willingness to pay up to 20 MT/ha per month for the service. At 1 MT/ha, 100% of farmers was willing to pay. At 10 MT/ha most farmers were willing to pay. At 40 MT/ha farmers expressively showed impossibility to pay at current productivity levels.

Most farmers expressively stated that will only invest in services after RBL invests in purchasing crops and providing inputs for farmers. The same happened when discussing integration ot ThirdEye value proposal in RBL irrigation fees.

Annex 6. SWFF USAID site visit group meeting.

Location name: Chockwe D5A Block Group Interview	**Location type:** Farm **Farm Size** FutureWater operates in 338 ha total	**GPS Coordinates:** -24.5442393139929, 33.015813678503
Date: 3/08/2016		

D5A Block

Interview with Farmer Association President and a group of farmers

Number of farmers: 75 farmers in total. 65 women; 10 men.

Irrigation(s) used: Flood/Channels

Crops grown: Rice, Maize, and Tomatoes

How long has the group received Future Water Data for?

Farmers have been using the reports for 9 months (Approx. since June 2015). The association received reports on Maize last season and is currently receiving reports on Rice. They have received 3 reports on rice so far.

When Farmers receive reports with stressed areas (depicted in red), what is done differently to improve the area?

Farmers selectively apply fertilizer to stressed areas, add more water, add pesticides, and/or control the weeds.

Compared to the previous year, before farmers received FutureWater reports, was there a change in yield?

Farmers noted that yields were getting a lot better (increasing). The farmers did not specify the percentage of increase.

Is there a difference on how men and women are farming?

There is no difference in the methods of farming across gender. For the most part, all famers in the area use the same farming methods.

How much yield is expected of rice/farmer this season?

Farmers are expecting 6 tons of rice per ha for this season.

What evidence of increased yield is there currently on the farm?

Farmers are currently in the mid season of growing rice and the yield expectations are higher.

How were farmers convinced to try the FutureWater service?

Farmers saw that the images would give them a full and clear view of what is going on with their crops. With the service, farmers are now able to pay attention to specific areas in their plot and follow recommendations to increase their yields.

How much are farmers willing to pay?

Farmers said they need the help from the reports but do not want to pay for the service. As of now, farmers were given the service for free. Farmers would like for the farmers association to pay on their behalf.

Are farmers willing to use cell phone credits/SMS to pay for the service?

The farmers interviewed stated that they would not be willing to pay with sms credits because only after they pay for inputs and sell their produce can they afford to buy phone credits.

Outside of increasing crop yield, has there been any other benefit from the information?

According to farmers the report has been really valuable in helping them know what steps to take to improve their crops.

Are farmers using less water, more water, or about the same?

Compared to last years maize harvest, farmers used about the same amount of water with the new service. However, they are getting higher yield than previous years.

D5B Block

Group Interview with 23 women and 1 man

Irrigation(s) used: Flood/Channel

How long has the group been using the FutureWater Service? Farmers in D5B have been receiving FutureWater reports for 11 months (approx. since April 2015).

Is the service helping produce more food? If so, how much more food is being produced?

The reports are helping to increase yields. They are expecting 5 tons per ha expected from this seasons rice harvest.

Location name: Xai Xai; RBL regadio	**Location type:** Farm **Farm Size** 912 ha total area; FutureWater operates in 338 ha total	**GPS Coordinates:** -25.0073177865927, 33.7174044549465
Date: 3/09/2016		

Size of block: 912 ha; FutureWater operates in 338 ha total

Crops grown: maize, rice, cabbage, onions, potatoes, and cassava.

Irrigation(s) used: Flood/channels

Number of farmers: In the Xai Xai farm area visited there are about 1800 farmers. Big/larger farmers have 10 ha plots, medium farmers have 5 ha plots, small farmers have 1 ha. 70% of small-scale farmers are women. However, none of the big farmers are women.

In Mozambique all land belongs to the government. Farmers have user rights to the land.

How long have farmers been using the FutureWater service?
5 months (Approx. since October 2015).

What has the yields been for small farmers crops recently?
1 ton per ha for small crops. For larger farmers, the yields recently have been 3 tons per ha for rice and 1 ½-2 tons per ha for maize.

How were farmers convinced to try the FutureWater service?
Farmers were experiencing difficulties with their cultivation. Farmers thought the service would greatly help with

spotting and removing weeds on time. The images help identify where there is natural vegetation versus crops.

The reports also help with identifying where tertiary channels are clogged and need to be cleaned. Farmers are responsible for maintaining the tertiary channels and the regadio (RBL) is responsible for maintaining the primary and secondary channels.

How do farmers receive the information from FutureWater?
Operators meet with the block chiefs and discuss the reports and then block chiefs share the information to each of the farmers.

What changes do farmers make when they receive the information from the reports?
The reports let farmers know what areas are stressed but do not inform on what changes need to be made. At this time it is also difficult because it is the dry season to tell if the issue is from the water or the soil.

How many of the farmers have used the reports?
Farmers have not received reports in the last 3-4 months due to the loss of the two operators.

How many of the farmers have cell phones? Are farmers willing to pay with credits for the service if it wasn't given for free?
All farmers present had cellphones. However, farmers do not want to pay for the service directly. They would like for the regadios to pay on their behalf.

Has using the service allowed farmers to use more/less or same amount of water?
Due to the drought, farmers are in need of more water.

Annex 7. List of interviewees

1. **AFAP**
   African Feriliser and Agribusiness Partnership. African coalition promoting fertilizer use in Africa. System with local retailers. Very intrested in a collaboration, potential proposals in the pipeline, combining Flying Sensors and soil laboratorys, using Flying Sensors to identify areas with an demand for fertiliser, usinf Flyingsesnsis within Zambezi vally improvement project and a potential agri business parthnership
2. **African business group**
   Facilitates private investments, Organisd GeoSmart Africa – GeoAgri conference last April in Cape Town. Interested to explore opportunities, firm can be of assistance from the Private sector standpoint strategic partnerships from the business development aspect
3. **Agrisul.**
   agricultural holding company 300ha of sugar cane and 60ha of bananas. ThirdEye submitted a proposal to survey the entire farm on monthly basis. No response.
4. **Aproma Casa Agraia**
   large scale farmers organisation xai xai. High profile members, often politically active. A higher willingness to pay is expected.
5. **CAIC Complexo Agro-Industrial De Chókwè**
   $60milion processing plant, out grower scheme, developing new extension service. Interested to explore collaboration, especially on how to improve effectiveness of their extension service to farmers. Did a presentation. Meeting with management scheduled due to a donor visit and my illness meeting cancelled. A follow up is required.
6. **Cepagri (Centro de Promoção da Agricultura)**
   Agribusiness promotion centre. Executing partner for Prosul project interested to incorporate ThirdEye services requested a test flight above one of the project cassava area. Active in both Xai-Xai and Chókwè.
7. **Comercial farmers Chókwè**
   Group interview and demonstration of service with 3 comercial sugarcane and tomato farmers +/- 200ha. Farmers expressed willingness to pay of approx. 15$ per year per hectar.
8. **DATCO**
   social enterprise managing an out grower scheme with Casava farmers.Has experimented with drones aswell, did not get the right certification. Is Interested to do a pilot with ThirdEye, situated north of Xai-Xai close to Inhanbane. (interview conducted by supervisor illness)
9. **ESNEC: Escola Superior de negócios e Empreendedorismo de Chibuto**
   University with around 1000 students enrolled . Courses: Commercial Management, Corporate Enterprise Management, Agro-business, Commercial agriculture. Part of universidade eduardo mondlane Started with a business plan development workshop and project for students, in wich they developed their own business models however due to low involvement and lectures stopped with this. However some important feedback was given by lecturers and students.
10. **HICEP Public Hydraulic Company of Chókwè (Empresa Pública Hidráulica deChókwè)**
    Responsible for the management of water and land in the Chókwè area. The water provided for the irrigation scheme is licensed by ARA-Sul and is coming from the masir dam. Multiple meetings with different staff members on how to improve current services. Furthermore submitted and presented a proposal for payment on behalf of farmers to the board of HICEP. HICEP has expressed interest in additional services an a combination with financial institutes.
11. **IDE Mozambique (International Development Enterprises)**
    Training of agro advisers(FBAs) to support cultivation and link farmers to markets.

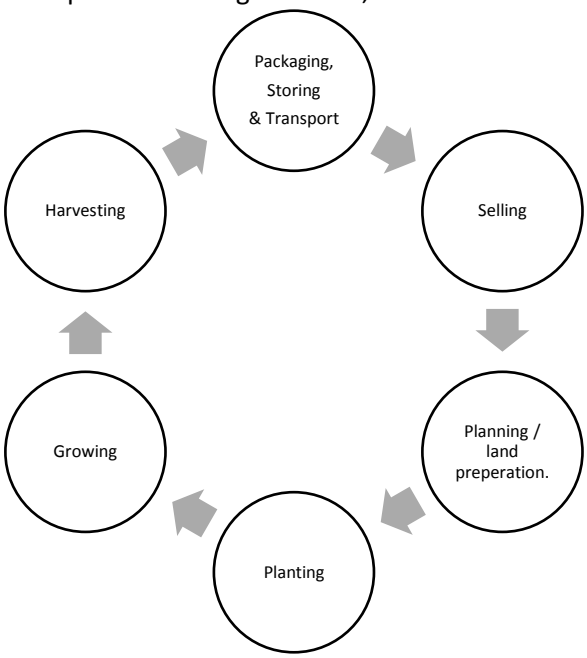
Discussed combining ThirdEye project and Cava(support units) / FBAs, this offers various benefits, to mention a few: nstrengthening the income flow of the operator-FBA. improving the extension service with the help of diverse aerial information, better selling opportunity for both the TE service and the farmer inputs. Other potential ways of collaborating are; Combining the ThirdEye project and with Ide Agri-Hubs these could serve as a link between our network of Flying Sensor operators and farmers. Furthermore combining ThirdEye and existing iDE projects and partners e.g. Kiva large non-profit credit scheme, lusosem, hubmoz. iDE offered to link ThirdEye to private partners

12. **IFAD, International fund for agricultural development.**
    3 big ongoing projects in Mozambique concerning climate resilience and value chain development for smallholder farmers. Large funds available funds available. IFAD has shown intrest however directed me to their local parthner Cepagri.
13. **Impaktful**
    Impaktful is a collective of organizations and independent consultants based in Tanzania, Mozambique and the Netherlands who collaborate to co-build social impact business. Submitted a proposal to ThirdEye for business development. Similar to the work SNV will carry out.
14. **ISPG: Polytechnic Superior Institute of Gaza (Instituto Superior Politécnico de Gaza)**
    local public high educational institute courses: Zootechnical Engineering, Agricultural Engineering and Accounting. Singed and MOU for internship assignments, potential on doing projects together: NUFIC call, surveying of an area for establishment of a Dam
15. **Moz-India agro.**
    5 indian familys owning +/- 800Ha and cultivating Aromatic/medicinal plants rice, maiz and legumes. Land is provided by RBL. Located in Xai-Xai. Very interested however investors are pulling out of Mozambique. requested to come back in 1 year.
16. **RBL Regadio do Baixo Limpopo (Xai-Xai)**
    responsible for water management and is delivering farmers advisory and infrastructure services. Water is retrieved/received from hills and main activity in the irrigation scheme of Xai-Xai is drainage of access water into the Limpopo. Paying on behalf of farmers, request to survey (entire) larger part of the irrigation scheme to support board decision making.
17. **Sammartini**
    Large scale (Italian) farmer based in Xai-Xai cultivating vegetables. Discussed over phone interested in NDVI monitoring.
18. **Saval**
    Agro input supplier chokwe. Only quick 'pitch' no real structured meeting due to limited time. Follow up needed.
19. **UX innovations**
    Successful social company, offering business development support.
20. **WAADL: Wanbao Africa agriculture development, LDA.**
    Waadl is located in the RBL area and cultivates 8000ha of rice. At the moment they are reducing their operations due to landgrabing allegations and financial collapse of company.
21. **WE Consult**
    focuses on ground water modelling and geophysical surveys. Interested in DEM (height maps) services on project base.
22. **IFC (International finance Corporation)**
    IFC blends investment with advice and resource mobilization to help the private sector advance development. Cam potentially be to business training and investments/loans. Very enthusiastic reaction on ThirdEye

23. **TCO Agriculture.**
    TCO Agriculture is an Portuguese company starting an agriculture branch with an plantation in Chókwè and is interested in NDVI information. (interview conducted by college due to illness)
24. **CPL**
    Is a local bank in Chókwè and is actively Setting up a credit scheme with HICEP, interested to incorporate ThirdEye service(Only for farmers who use mechanic harvest services offered by HICEP in this way they can easily collect a part of harvest to cover cost.
25. **SNV Netherlands Development Organisation**
    specialist expertise in Agriculture, Energy and Water, Sanitation & Hygiene, will validate business models in this report.
26. **Nampoenzene agrarian house**
    Farmer Association in Xai-Xai, interviewed individual farmers in the field about how they perceive ThirdEye services. (shangani translation by Flying Sensor operators)
27. **Farmer Associations Chókwè**
    Meeting the presidents drom D5A (Don Chauque) and D5B, Dona Palmira from the Women Farmer association, interviewed about ThirdEye services. (Portuguese by thesis supervisor)

Annex 8. General recommendations

Information Needs During the Agricultural Cycle.
ThirdEye should consider to adjust its information to benefit more stages of the Agricultural cycle for example: NDVI is an indicator for the amount of leaf mass, and therefore, ultimately biomass, in this way it can be used by organisations to plan harvesting activities, a DEM can be used for land reparation.



Example of activities in the Agricultural cycle

Furthermore each crop has its own growth stage for example: germination, vegetation & flowering each stage reacquires a different type of action and input, for example during the first grain/fruit development insecticides are needed. A partnership model could result in complimentary benefits, a Farmer knows where to apply his insecticides, an input supplier knows how much insecticides are needed and a bank knows when and how much money needs to be made available. ThirdEye should focus its activities according to plant stage.

Key activities:
Getting the advice to (all) farmers has proven to be a problem, the TE management should consider how much energy and effort they want operators to invest in reaching each farmer every month. Or if this can be outsourced. There are different methods to reach farmers, Individual, group and mass method. The problems and advantages need to be weighed up with a critical eye.

The following recommended approach is a combination of an individual and group method, leaving time for ground checking NDVI maps as well:

Day 1: Flights and processing of maps. (1day)

Day 2: Field diagnosis.

- Going in the field with the sub chief to make a diagnosis of problems.
- Make notes/pictures in tablet.
- Use the NDVI maps to identify/focus on areas which need most immediate action.
- Find solutions and management approach for problems identified.
- Prepare farmer meeting.
- Fill in form no.1 from annex. 5 The goal of this form is to "force" operators to think about and prepare the advice they are going to deliver to the farmers. Next tot that it is a tool to have an overview of problems spotted by operators.
- Next to that Monitoring on implementation of earlier recommended production practices. Speak to farmers which are in field

By first diagnosing/mapping the problems before giving the advice operators have time to conduct research on the solutions and think about how the farmers are helped best.

Day 3: Farmer meeting.

- Organise the meeting.
- During meeting operator gives general technical advice for al farmers (during this general meeting attention can be given on making decisions as a group e.g to buy pesticides in bulk or on water levels)
- Point out / show which areas of the block are performing the best and which areas are facing problems. (to get knowledge exchange/ discussion going)
- After meeting operator and sub chief visit farmers which require attention.
- After meeting Operators need to fill in field visit report and meeting report (annex5) report findings to head of Flying Sensor operators.

Operational structure and background of management team:

This is not yet established, at the moment there are Flying Sensor operators who are being paid per "round" flight, processed map and advice delivered to farmers. This is documented and approved by staff in Netherlands, payment is made by partner organisation WE Consult. Support and training is delivered by FutureWater staff making trips to Mozambique. Goal is that by end 2017 There will be an operational structure for ThirdEye. This can be one company or individuals paying a service centre. Franchising, or Leasing are options as well.

Business model 7 is the only model conform the initial proposal in which ThirdEye operators are to act like entrepreneurs in future and have their own businesses. For such businesses to succeed it is required to set up a support unit that facilitates the work of the operator in supplying assistance in administration, sales & marketing, technics & logistics. A support unit must be taken into account in the assessment of the costs.

Co-creative Approach to service design.

Understanding all the needs and requirements of customers and designing tailor-made service packages is essential for the success of ThirdEye. Therefore it is vital to incorporate the customer in the process.

This includes prototyping of additional services(as being done with RBL) Additionally, for future services it is important to include an on-going, feedback loop to ensure the changing needs of farmers and other customers are taken into account in the revised service design and future product development.

Diversification of service and business model.
Every region has its own languages, value chain actors, agro-climatic zone thus different crops, social organisation of farmer groups, and partners. There is not one solution to fit all needs of all clients. It is advisable to select several target groups and design services according to their specific needs.

Cost

A more precise calculation of the integral costs need to be performed within the coming months.

For each business model the cost should be calculated. Every business model has a different cost structure. What are the most important costs inherent in our business model? What are the cost per service: DEM, NDVI with or without advice etc. Which Key Activities are most expensive?

After calculating the cost it should be determined if customers are really willing to pay? For what value are our customers really willing to pay? For what substitute do they currently pay?(eg. measurements with Dgps) How much does each Revenue Stream contribute to overall revenues?

Then it should be determined wat revenue model or business model is worthwhile developing, and with what operational model, with or without FutureWater?

Costs are at the moment covered by SWFF grant. However after 2017 and for upscaling and expanding new investments need to be made.

Start-up cost.

Elements of start-up cost:

Flying Sensor package:

- Sensy_gps+ Flying Sensor
- ground control station
- transmitter
- camera
- RGB sensor
- NIR sensor
- Laptop
- Tablet
- ground station software
- image analysis software

Physical Space.

- Furniture.

- Workstations.
- Flying sensy Service Platform.

Transport

Training.

Activity	Days Trainer
Training flight	1
Training undertaking flights	4
Training image processing & interpretation	4
Tota	**9**

Minimising start- up cost.

Some elements can be eliminated or minimised by establishing partnerships or in-kind contributions. Software companies or the manufacture of the sensy (phantom dji) might be willing to offer free or highly subsidised software licenses and hardware to ThirdEye. Partnering with organisations that possess a high level of facilities such as an office and vehicles available can also help lower the costs of expenses.

Operational cost.
Operational cost should be offset by revenue. It is important to anticipate how operating expenses will increase with new customers and operations. This must be included into the services price.

Typical Operational cost include:

- Staff.
- Agriculture specialists.
- Marketing and sales staff.
- Technical staff content management, sensy maintenance, and quality assurance.
- Administrative staff.
- Flying Sensor operators
- System Maintenance.
- New sensy kits
- Trouble shooting e.g Crashes
- Software updates
- Marketing and Sales.
- Accusation cost.
- Market Research.
- Training.
- internet and phone cost.
- Transport.

- General and Administrative management.
- Advice Content generating
- Aerial footage database.
- Analytsing and reporting.
- Reviewing aerial images

Minimising operational cost.

Depending on the business model working with partners who possess existing resources, and infrastructure is possible to reduce or eliminate the need to spend several operational cost

Agricultural organisations may already have a network of field extension workers who could be supplied with Flying Sensor information or be trained to fly as well.

Extra cost.
When deciding on the business model, the financial risks involved in the launch of new services should be considered as these are often not yet tested and proven. For example crop stage monitoring has not been executed yet. Similarly, cost of marketing, revenue collection from farmers or the set-up of a service point should be taken into account.

Yearly data collection.

Additional to the normal tasks it is advisable to add that each operator is required to collect information about the farmers in his/her. When conducting the questionnaire this year it is advisable to design it in such a way that the forms can be understood by operators and that they are able collect the info next years as well. Each farmer is questioned about contact details, yield, the service etc. (any information that is required by the management).

Measures to ensure farmer involvenment.

ThirdEye delivers a great service it shouldn't be a problem to reach farmers, they should be running to the operators. we have to ask our self why this is not the case at the moment? in namponzwene the reasons are clear. Other reasons could be: Farmers don't see a need for the advice or farmers are not aware of the service. Especially the last reason can be tackled options could be:

Spread the word:

Except from the operators clothes ThirdEye is not very visible, an approach could be placing sings at each block/area receiving the service. This will be a daily reminder for the farmers. Furthermore it creates exposure to anyone who visits the field.

It could be an option to make a sing on which notes can be posted. When operator and field chief have set a date, location, time for a meeting. The sub block chief can write this on the sing for all passing farmers to see.

Example of a project description sing by RBL.

Flyer for technical assistance:

At an a farmer meeting Operators will hand out an flyer/voucher. This flyer/voucher shall indicate the number of hours/visits etc. the farmer is entitled to. The voucher will provide the cell number of head of Flying Sensor operators which can be contacted if the farmer does not receive the assistance promised to him/her. The voucher mechanism will guarantee the empowerment of the farmer who in effect is the customer of ThirdEye and who thus has the right to demand it.

Group SMS.

For each meeting the operator or sub-bloc chief sends a group sms to all farmers to remind them about the time/and location of meeting. This is not complicated to do and price are low as a sms cost 1.967MT the message could also entail the subject of the meeting e.g. a large disease spotted during diagnosis.

The most critical factor for the success of the ThirdEye extension are the operator who will make it happen. We need people who are competent and committed, and who can take and handle responsibilities. Furthermore they should be flexible as ThirdEye is developing it is possible the job in future comes with a whole set of extra tasks.

Staff development.

Recruiting field staff
Next to handling drones, field staff needs to be able to interact with the farmers, to understand their problems and have the agricultural knowledge to support farmers in finding solutions. Thisjob requires practical people, ideally with an agricultural background. On the other hand the field staff needs to be good at working with computers, understand maps and be able to report via email. The ideal extension staff member also a dedicated person who stimulates farmers to try out new things and who creates linkages to service providers.

ThirdEye is a challenging project and good field staff is key to its success. However there are few people to choose from, most capable people take jobs that are fulltime, easier, provide them with a car and better paid.

Recruitment channels: ISPG University provides a platform to find graduates with an agricultural background. Another option is emprego.mz vacancy website 20.000visitors daily

Training of Flying Sensor operators.
In future the training should not be limited to flying the drones, processing and delivering advice. It should cover training on understanding the entire farm which needs to be advised. In order to organise this an agronomist could be hired, or in combination with one of the partners, who provide training or already have trained staff.

Side note: For the development of ThirdEye it is important not to remain dependent on Jan or Sam for training, train the trainers. Possible additional rol for head of Flying Sensor operators, training others.

Motivating Flying Sensor Operators to stay.
A challenge is to motivate staff to stay with ThirdEye as it is a par time job it is expected there eye will be out for a full time job somewhere else or motivation/priorities can lie more with other employer e.g. RBL/HICEP**.** It can be a disaster for ThirdEye if team members leave.

It is believed that it will pay off to start thinking about how we can provide staff with motivation to stay(next to the good salaries that are already are being offered), ways to motivate staff to stay: Provide opportunities for training, Involve staff in decision making and business development, Provide opportunities to grow and develop within the business, and let the staff participate in the success of ThirdEye (via shares, or a bonus system)

Some challenges regarding key activities have been identified
Extension challenges:

- How to control on quality of advice given to farmers. -> the tablet notes and photos + field visit forms will cover this to a large extend.
- Smallholder farmers don't have means to buy inputs / and take action. No equipment.
- Hard to derive conclusions from NDVI map green not always good, red not always bad.
- NDVI values between different crops not clear.
- NDVI values matching crop stage not clear.
- Farmers can't interpretate maps themselves.
- (not all) Operators are agronomist, technical advice is limited.
- Operators are not trained in extension methodology, how to organise a meeting, how to transfer knowledge
- Operators don't have direct link for technical questions both agronomical and regarding sensy's
- For large farmers NDVI is a good tool to quickly detect inconsistencies and then go to the spot to make a decision. In case of subsistence farmers each ha is different and this approach does not work you have to go to the field anyhow.
- Not possible to make recommendations based on just the NDVI data.
- Limited training or knowledge exchange in the area

Involving sub block chiefs.

It is obvious that top-down, class-room type meetings is not a very suitable approach to advice farmers using NDVI maps. Attendance to meetings is expected to be low and every map should be ground checked. Therefore ThirdEye should focus on practical, interactive advise.

In order to transfer this advice it is proposed to involve sub block chiefs, as much as possible. These are group leaders or farmers who are already organising meetings and having contact with Flying Sensor operators. It is presumed that sub-block chiefs are ready to support their fellow farmers by providing advice or assistance in interpretation of the NDVI maps. The service of the sub-block chiefs to fellow farmers can either be delivered on a voluntary basis or for a small payment.

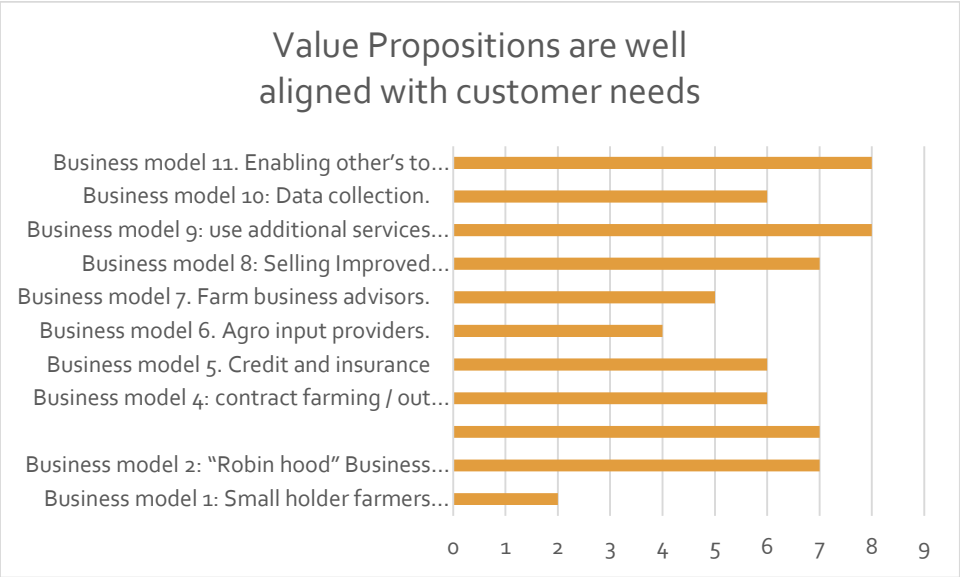
These sub-block chiefs farmers should be trained, supervised and supported by the Flying Sensor operators. The main role of sub-block chiefs will be organising meetings as holding the meeting may be regarded as an complicated objective itself. Sub-block chiefs can also motivate farmers to follow the advice, come to meetings, explain the situation and history of a field to the operator and can transfer advice to farmers not present during time of advice.

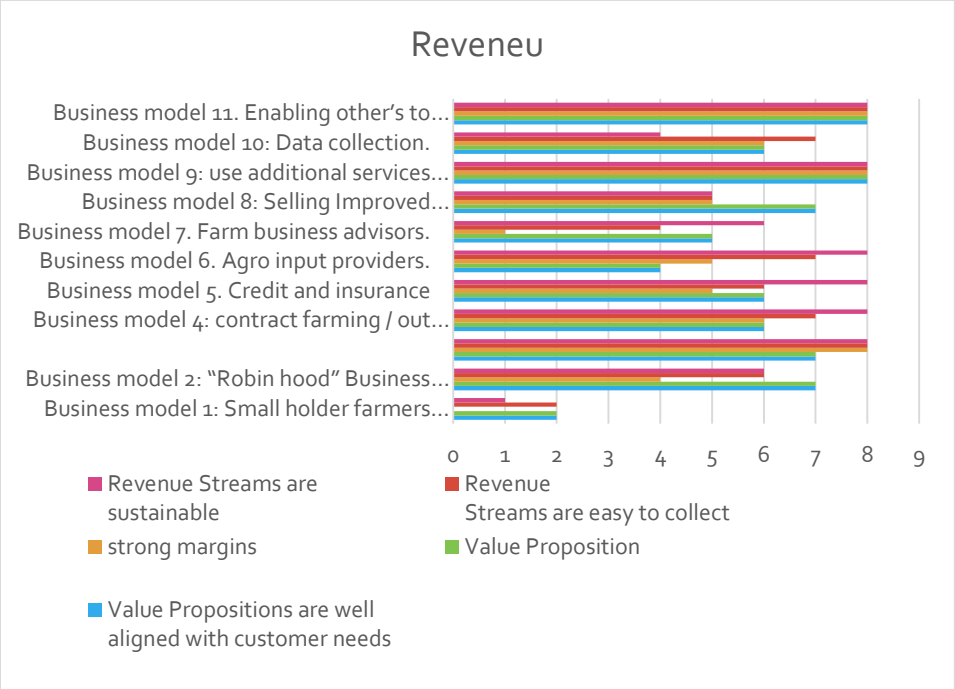
If a sub-block chief is not pro-active a lead farmer(farmer who shows good cultivation practises) can be appointed to fulfil this role. Maybe RBL/HICEP have ideas on this as well.

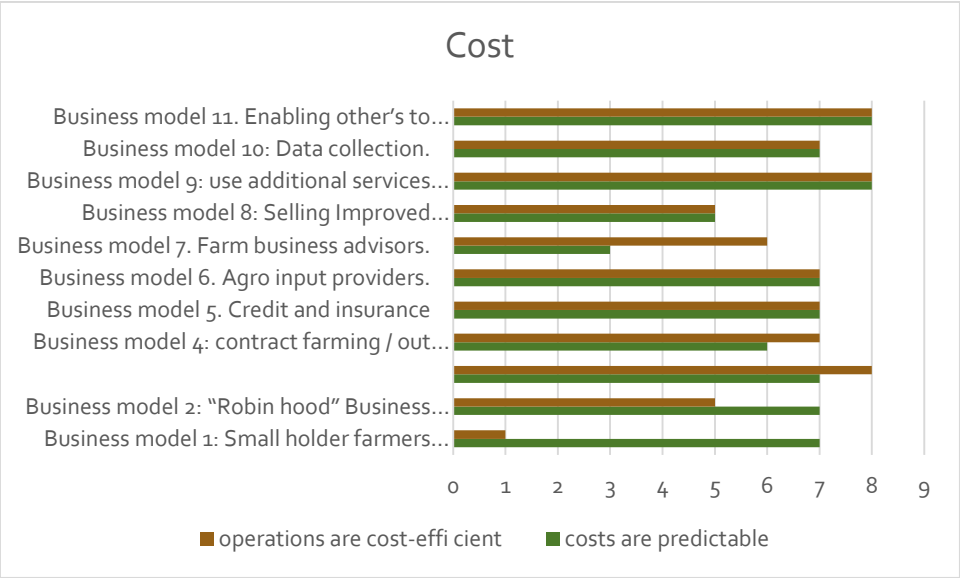
Points of consideration: Sub chiefs don’t get to pay to advice farmers so we can expect little, with doing everything through the chiefs, there is a risk that the leaders become too influential, or start to pursue their own interests. Next to that it is hard to control/influence the quality of advice given.

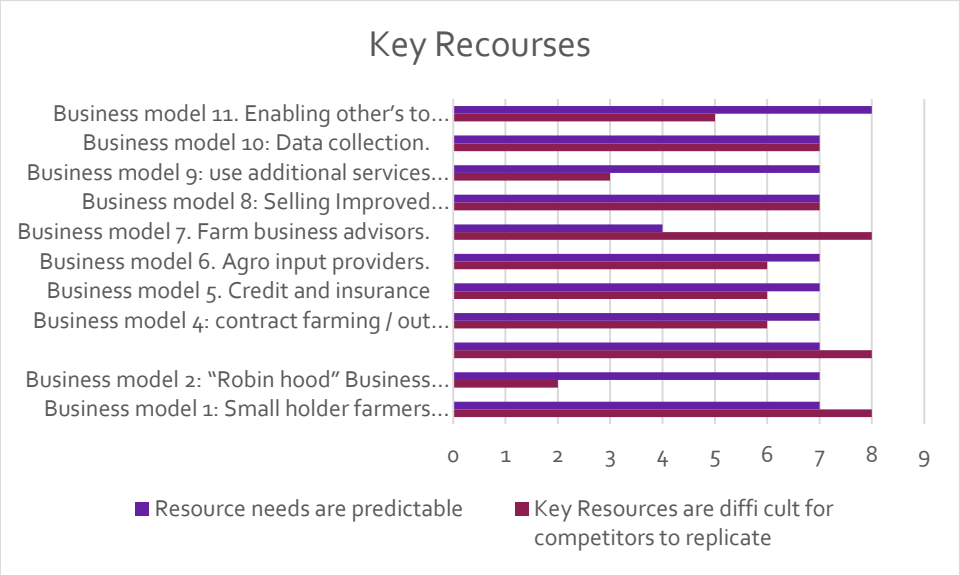
Annex 9. Ranking per business building block.

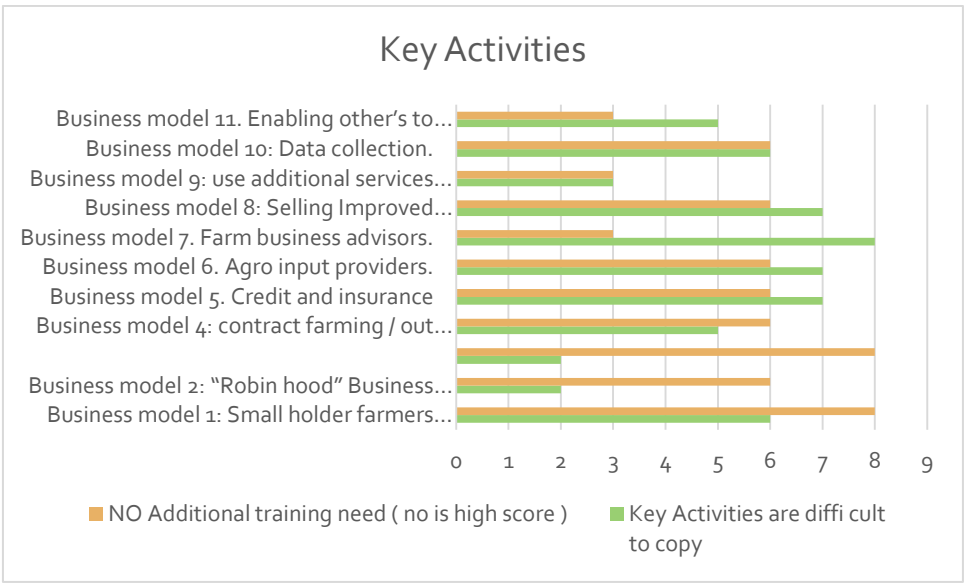
Assessment of strength or weakness per business block, maximum score of 10 points is assigned per assessment point. .

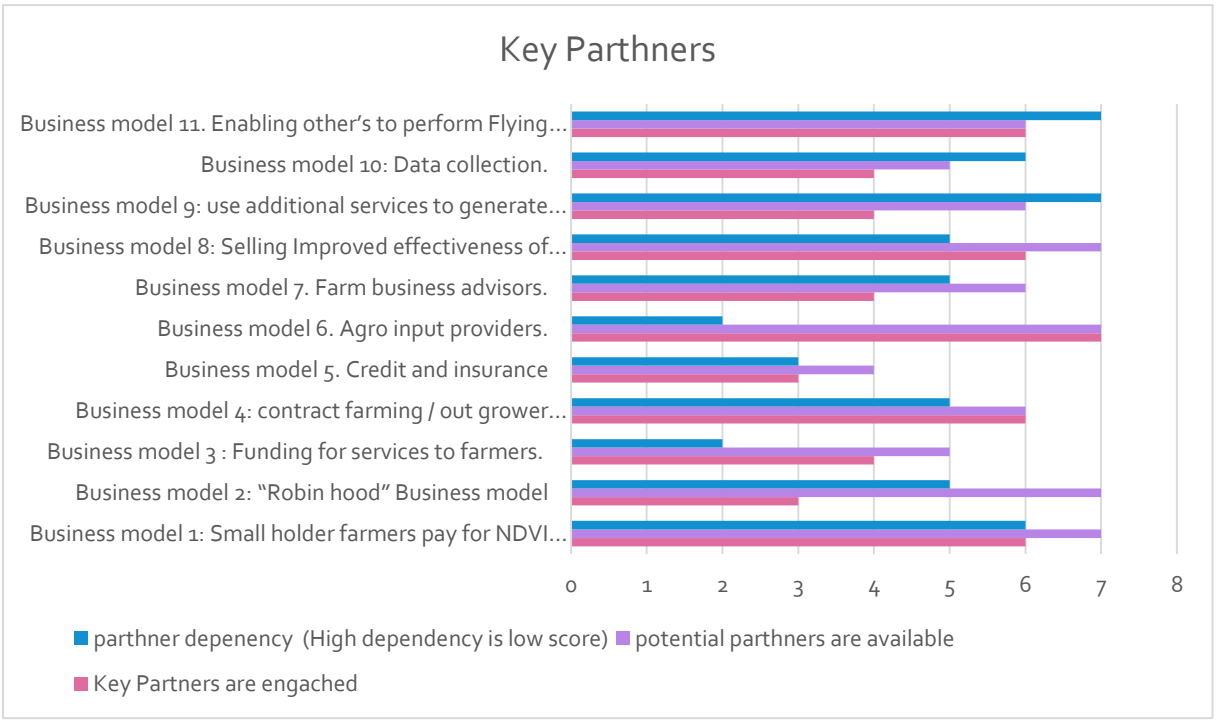


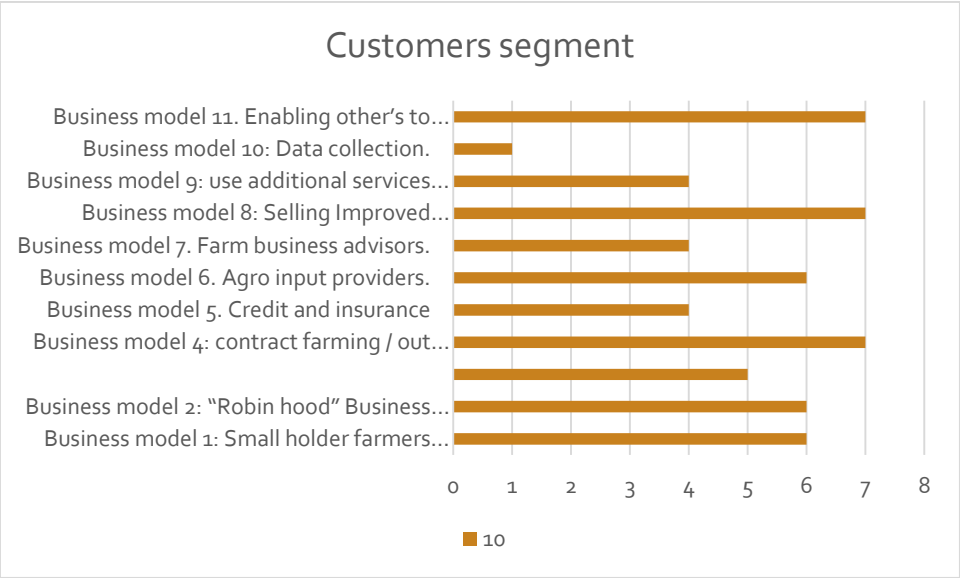


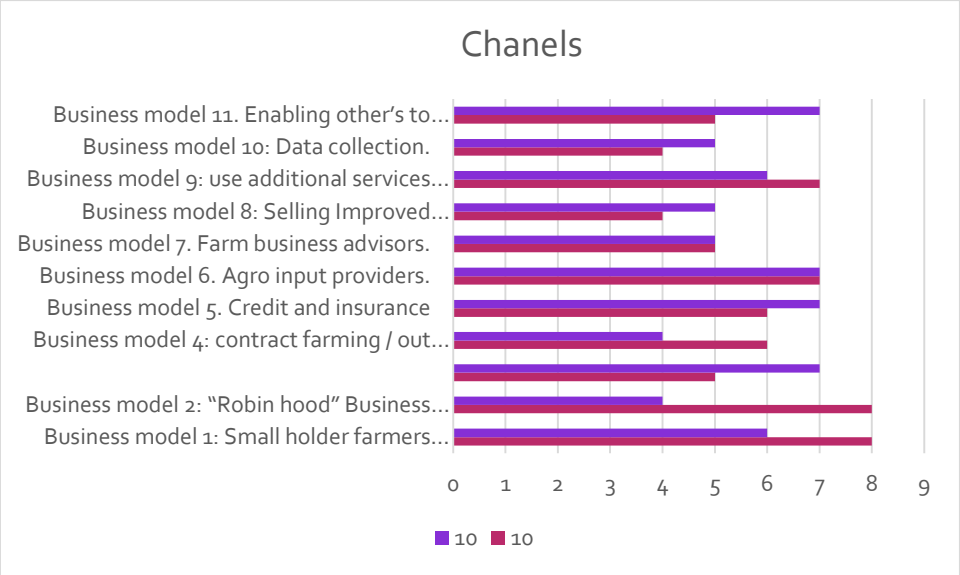

Cost
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
operations are cost-effi cient
costs are predictable

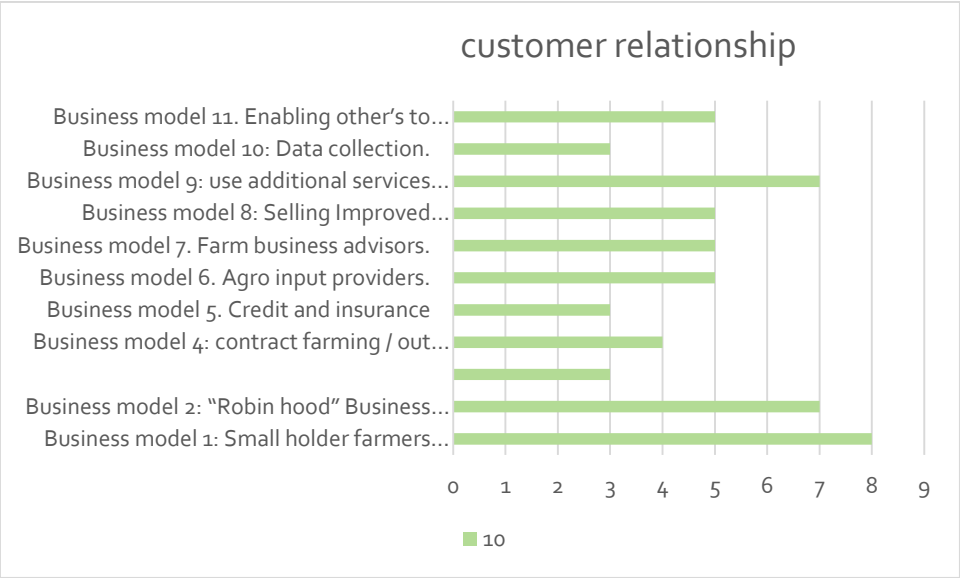

Key Recourses
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
Resource needs are predictable
Key Resources are diffi cult for competitors to replicate


Key Activities
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
NO Additional training need (no is high score)
Key Activities are diffi cult to copy


Key Parthners
Business model 11. Enabling other's to perform Flying...
Business model 10: Data collection.
Business model 9: use additional services to generate...
Business model 8: Selling Improved effectiveness of...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out grower...
Business model 3 : Funding for services to farmers.
Business model 2: "Robin hood" Business model
Business model 1: Small holder farmers pay for NDVI...
0 1 2 3 4 5 6 7 8
parthner depenency (High dependency is low score)
potential parthners are available
Key Partners are engached


Customers segment
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8
10


Chanels
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
10 10


customer relationship
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
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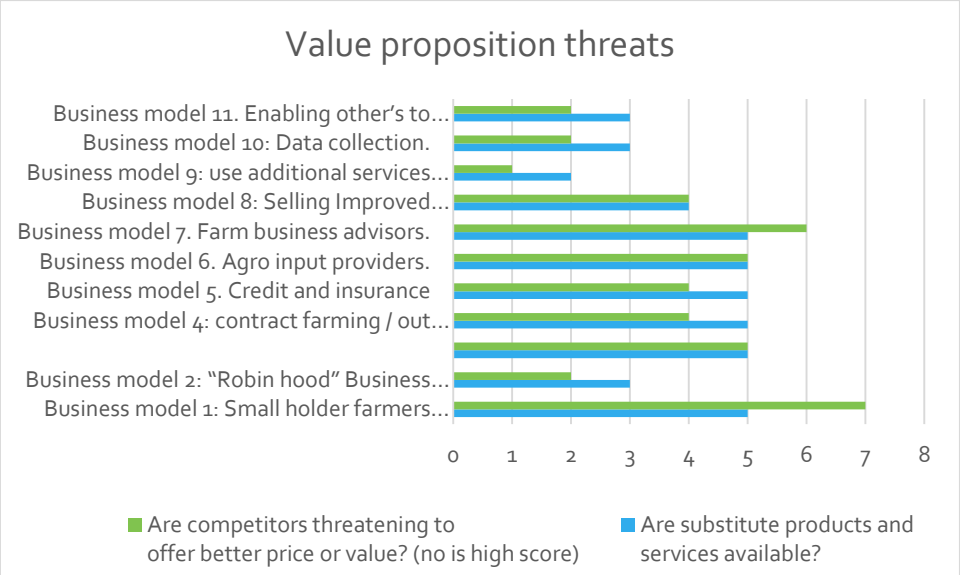
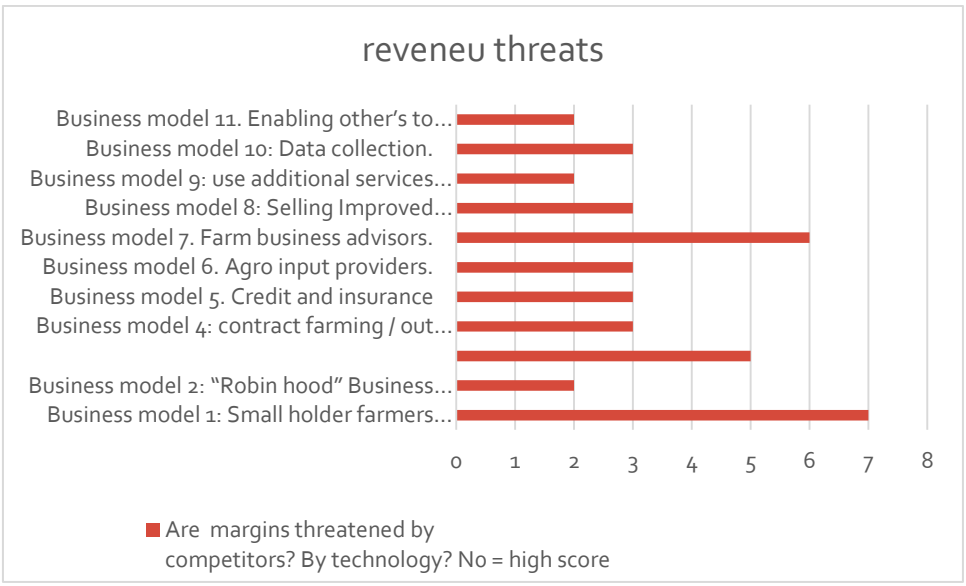
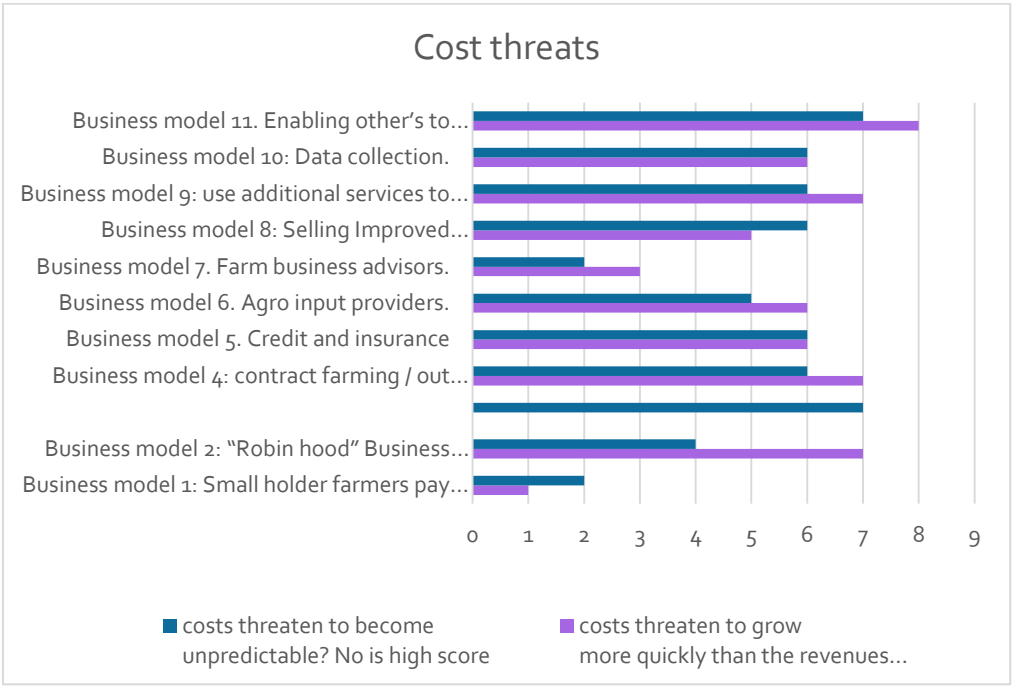
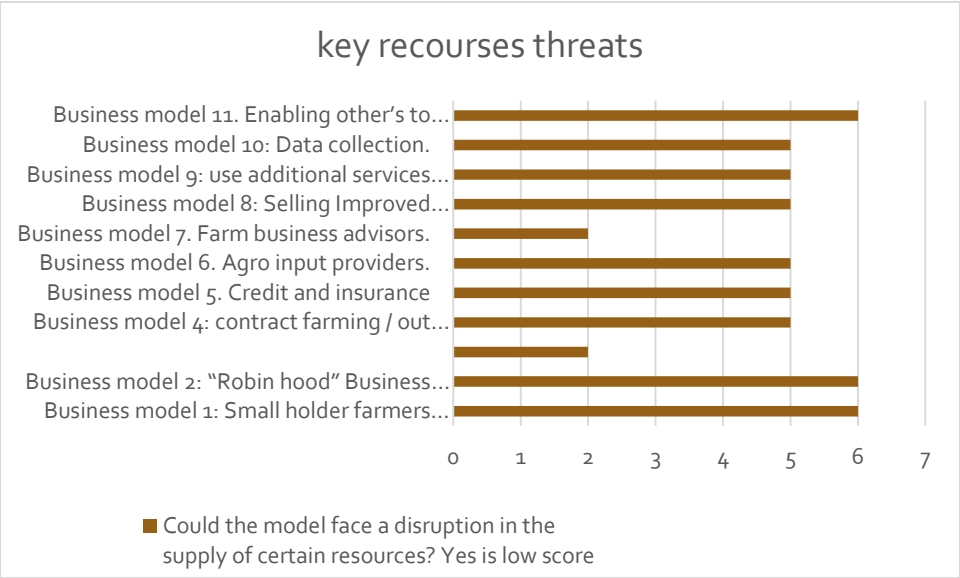
10


Value proposition threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8
Are competitors threatening to offer better price or value? (no is high score)
Are substitute products and services available?


reveneu threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8
Are margins threatened by competitors? By technology? No = high score


Cost threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services to...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers pay...
0 1 2 3 4 5 6 7 8 9
costs threaten to become unpredictable? No is high score
costs threaten to grow more quickly than the revenues...


key recourses threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
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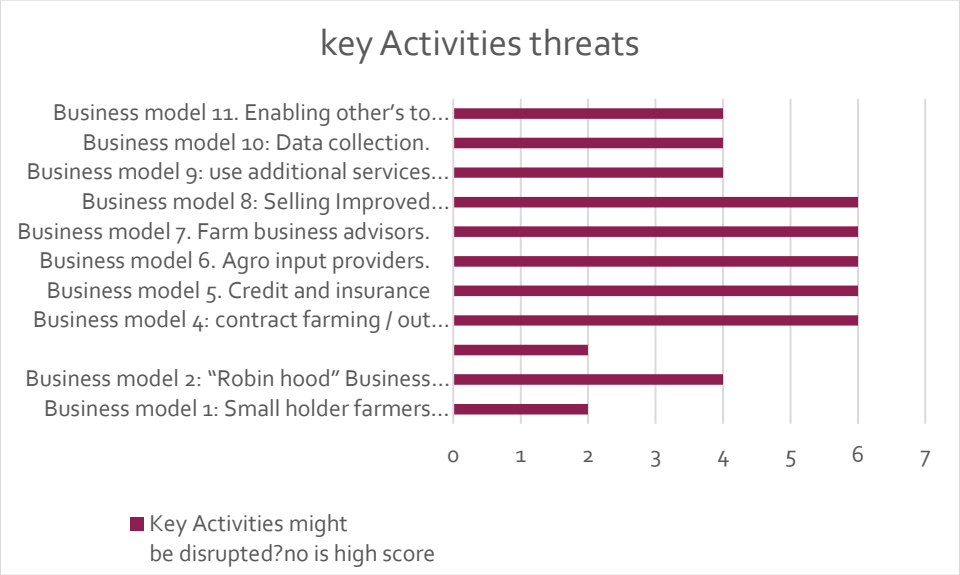
Could the model face a disruption in the supply of certain resources? Yes is low score


key Activities threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
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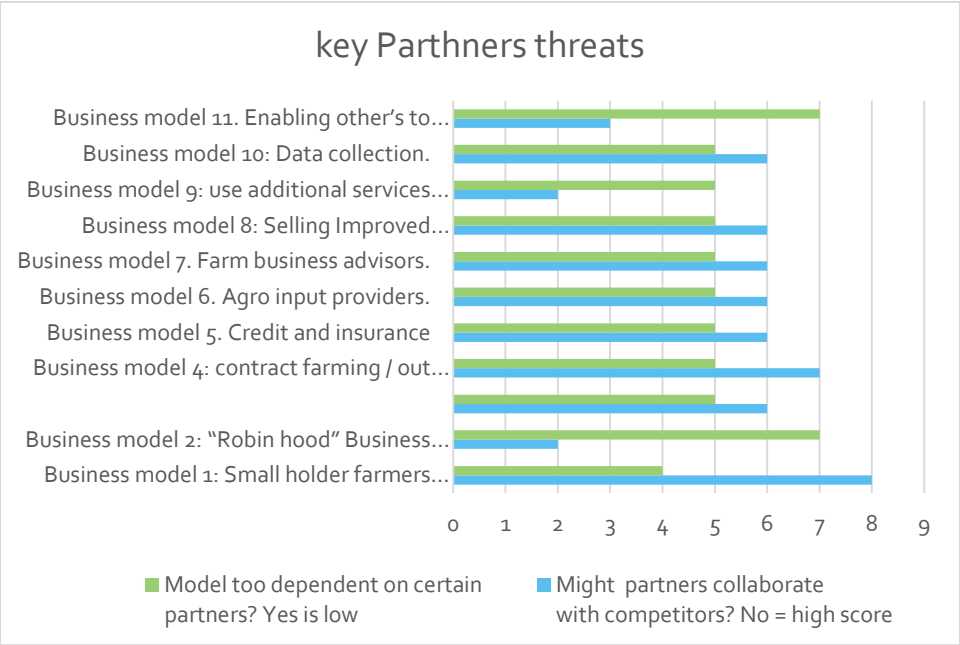
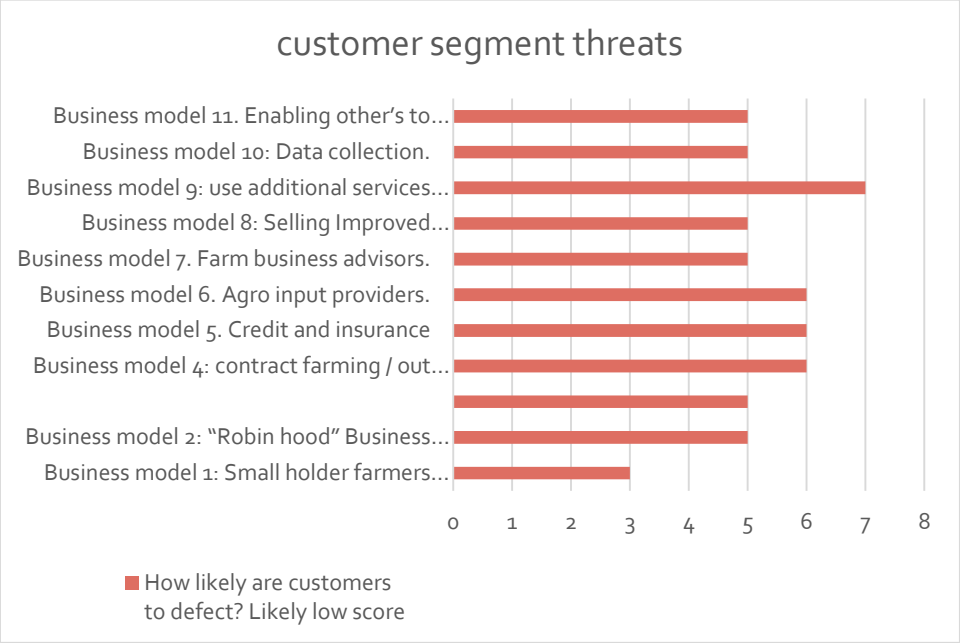
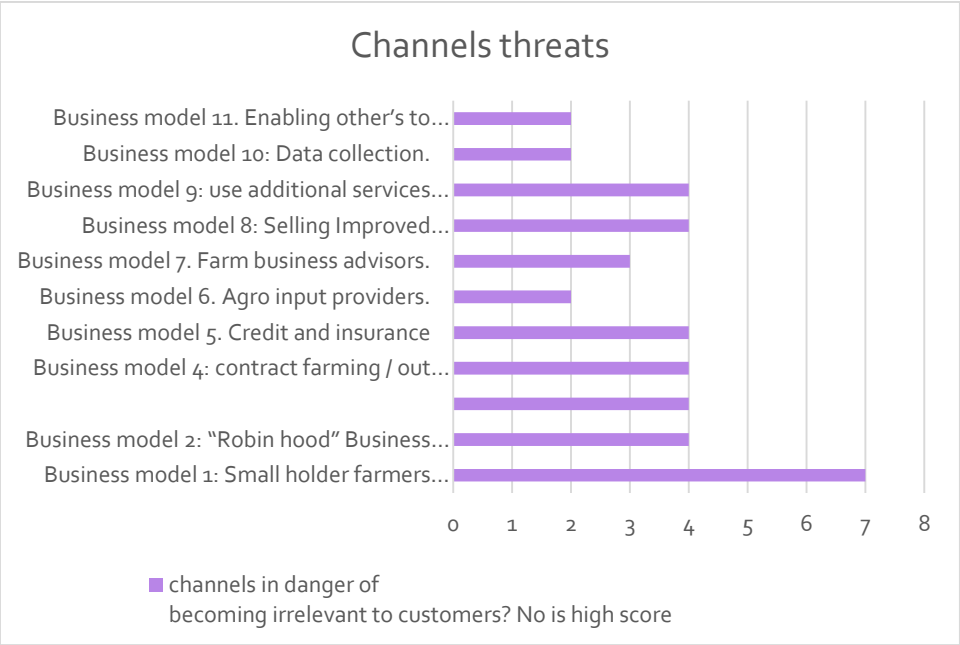
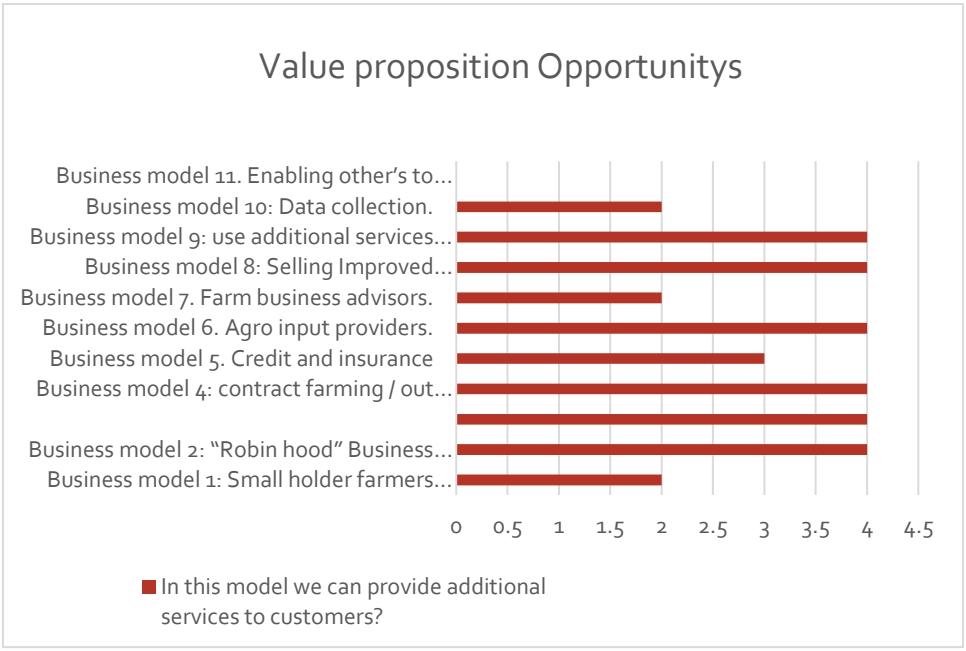
Key Activities might be disrupted?no is high score

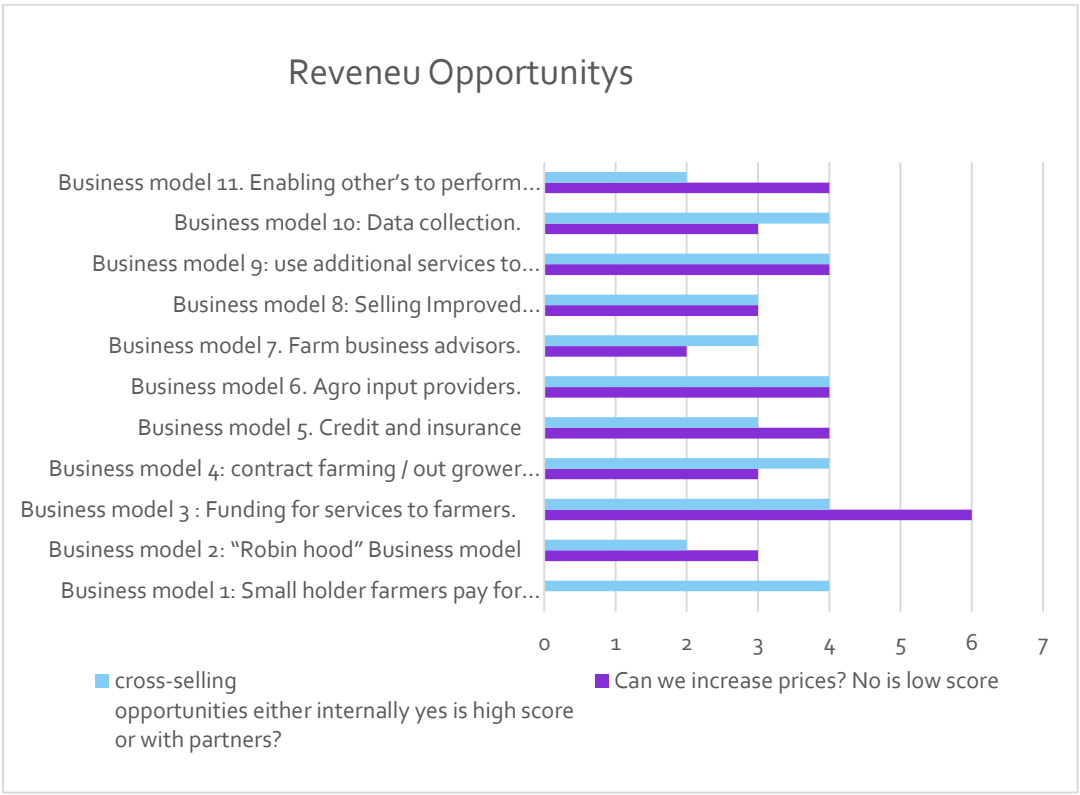

key Parthners threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
Model too dependent on certain partners? Yes is low
Might partners collaborate with competitors? No = high score

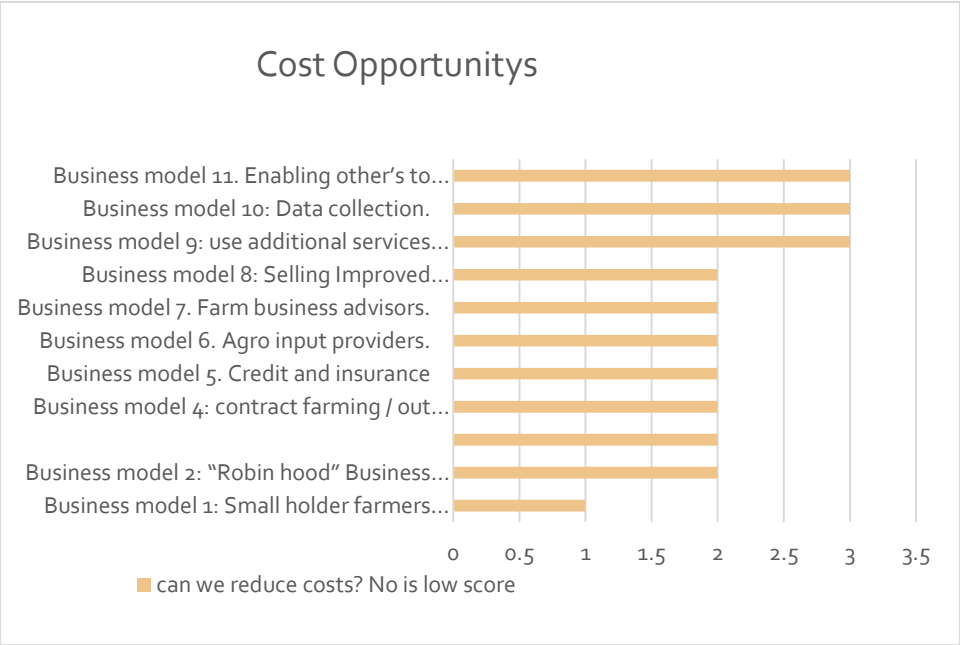

customer segment threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8
How likely are customers to defect? Likely low score


Channels threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8
channels in danger of becoming irrelevant to customers? No is high score


Customer relationships threats
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
Are any of the Customer Relationships in danger of deteriorating? No is high score


Value proposition Opportunitys
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5
In this model we can provide additional services to customers?


Reveneu Opportunitys
Business model 11. Enabling other's to perform...
Business model 10: Data collection.
Business model 9: use additional services to...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out grower...
Business model 3 : Funding for services to farmers.
Business model 2: "Robin hood" Business model
Business model 1: Small holder farmers pay for...
0 1 2 3 4 5 6 7
cross-selling opportunities either internally yes is high score or with partners?
Can we increase prices? No is low score


Cost Opportunitys
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
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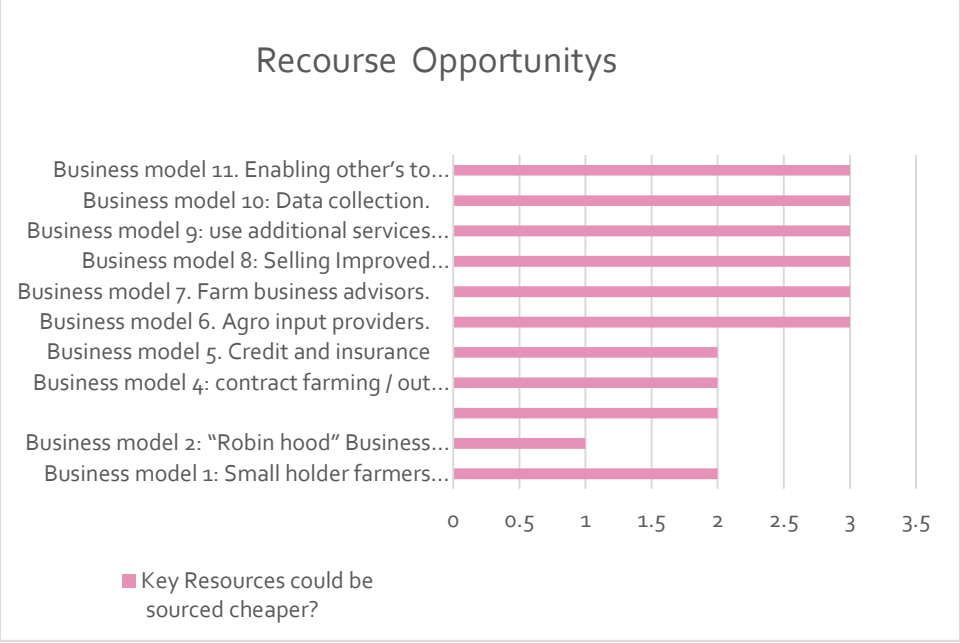
3.5
can we reduce costs? No is low score


Recourse Opportunitys
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0
0.5
1
1.5
2
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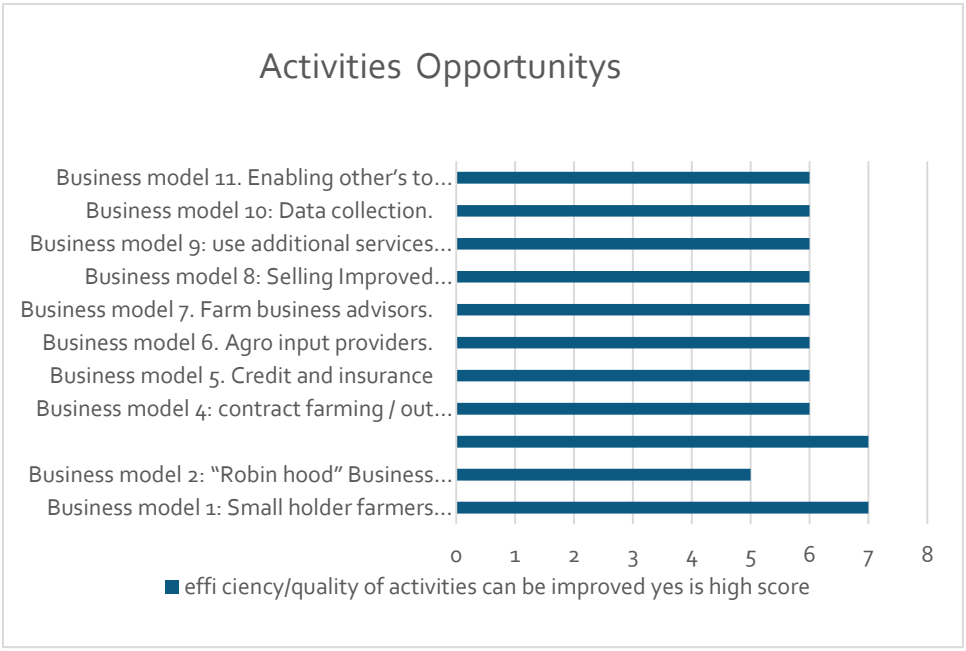
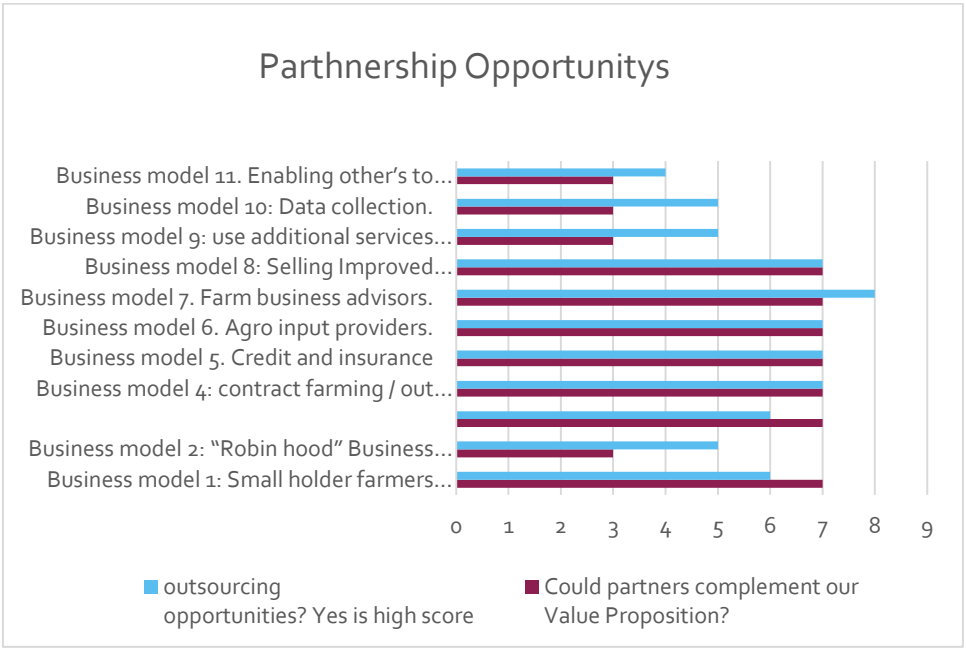
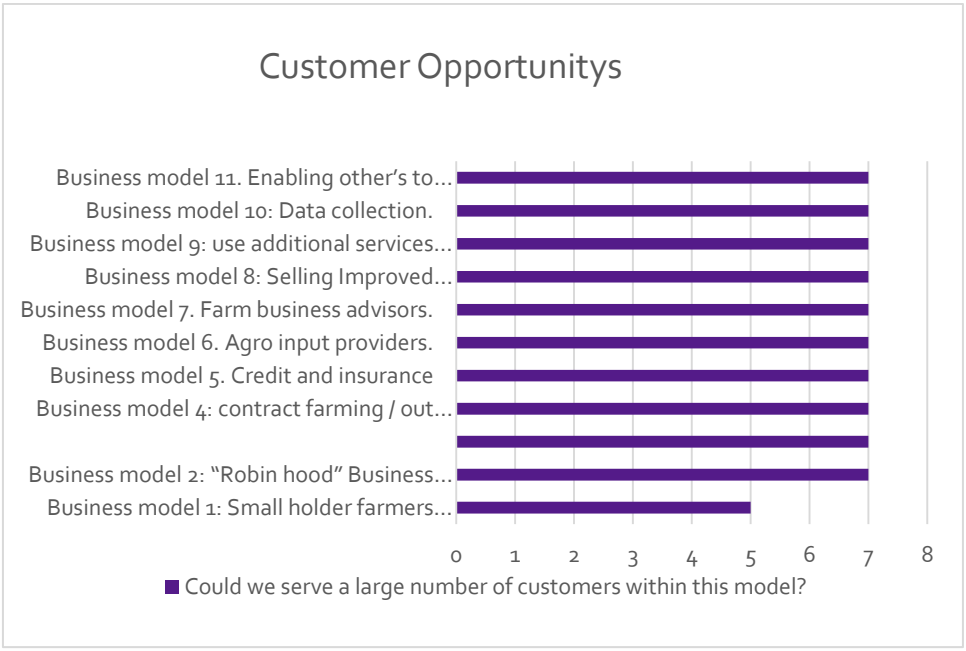
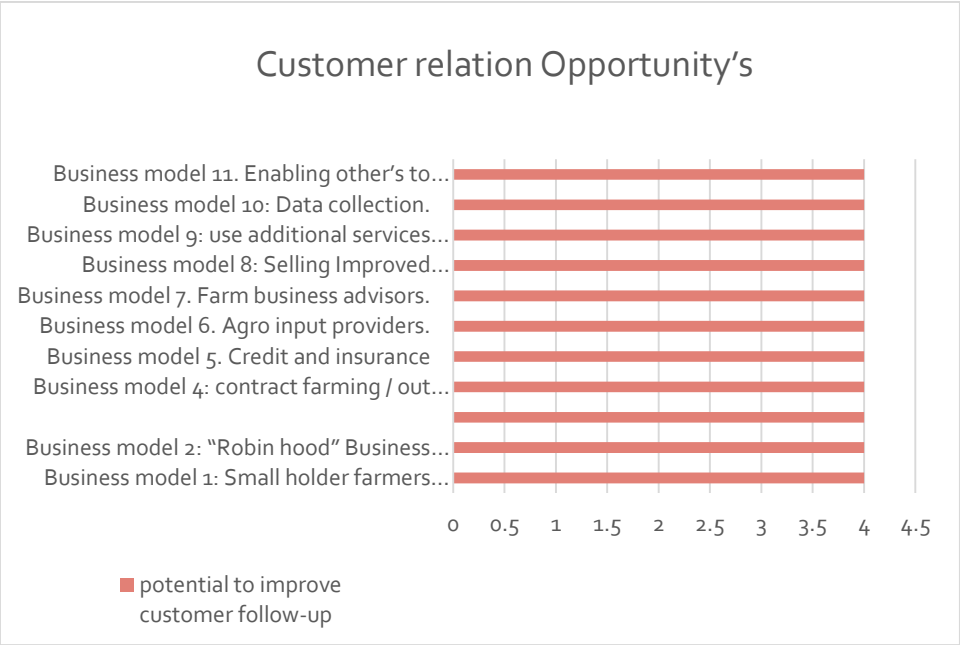
3
3.5
Key Resources could be sourced cheaper?


Activities Opportunitys
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8
effi ciency/quality of activities can be improved yes is high score

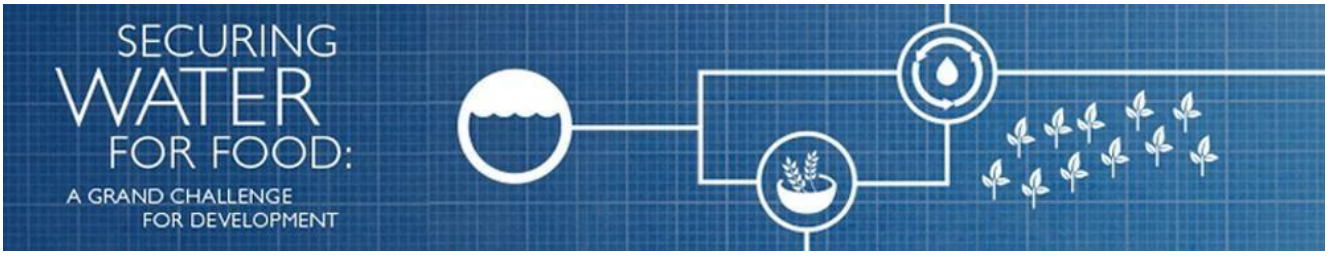

Parthnership Opportunitys
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
outsourcing opportunities? Yes is high score
Could partners complement our Value Proposition?


Customer Opportunitys
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8
Could we serve a large number of customers within this model?


Channel Opportunitys
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0 1 2 3 4 5 6 7 8 9
Could we better align Channels with Customer Segments?


Customer relation Opportunity's
Business model 11. Enabling other's to...
Business model 10: Data collection.
Business model 9: use additional services...
Business model 8: Selling Improved...
Business model 7. Farm business advisors.
Business model 6. Agro input providers.
Business model 5. Credit and insurance
Business model 4: contract farming / out...
Business model 2: "Robin hood" Business...
Business model 1: Small holder farmers...
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
potential to improve customer follow-up

Annex 10. Scope of work SNV



Scope of Work

Project Title: (Completed by the TAF) SWFF Innovator: (Completed by the TAF) Date Submitted:

SECURING WATER FOR FOOD
TECHNICAL ASSISTANCE FACILITY

Scope of Work Overview

The scope of work document has three purposes: 1) to explicitly define the services, deliverables, and outcomes agreed between you the service provider and the innovator; 2) provide a detailed roadmap for service delivery (e.g., may be delivered in phases due to budget and time constraints) and 3) serve as an information source for the SWFF TA Facility as it seeks to better understand the challenges and roadblocks to scale the innovators face and align support opportunities accordingly.

We have provided this template to use when creating the scope of work to save you time, as well as to ensure innovator needs are documented consistently regardless of innovator or service provider.

Our expectation for level of effort to create a comprehensive scope of work is 8 hours, which includes 2 hours to schedule and conduct the scoping conversation with the innovator and up to 6 hours to draft the actual scope of work document.

Background and Context: Securing Water for Food: Grand Challenge for Development

Approximately 2.8 billion people – 40% of the world's population – live in river basins impacted by water scarcity. Of those impacted, 1.2 billion people live in areas of physical water scarcity, where demand is greater than the available supply. Another 1.6 billion people face economic water scarcity, where institutional, financial and human factors limit access to water despite an available natural supply.

Between 2000 and 2050, water demand is projected to increase by 55% globally, meaning that the number of people impacted by water scarcity will continue to rise. Furthermore, 70% of all global water use occurs in the food value chain. By 2050, 45% of total GDP ($63 trillion) will be at risk due to water scarcity. We are at pivotal moment when we face unprecedented challenges to food security and the preservation of our global environment.

Launched at World Water Week in 2013, $32 million Securing Water for Food: Grand Challenge for Development funded by USAID, the Swedish government (Sida), and the Dutch government (MFA-NL). The overarching goal of Securing Water for Food is to enable the production of more food with less water and/or make more water available for food production, processing, and distribution.

The Securing Water for Food Grand Challenge for Development is harnessing the forces of science and technology to develop solutions to water scarcity. At the same time we're harnessing the forces of the market – the businesses that can actually implement these solutions – to make sure the solutions get to the people. This is an enormous challenge, and with this challenge comes an enormous opportunity.

Securing Water for Food is meant to be additive to ongoing global water initiatives efforts by focusing on prototypes, products, and business models that can promote economic growth and community stability. We believe that by investing in water technologies and business models, we can stimulate new innovation, reach untapped markets, and get water technologies into the hands of people that need them most – thus offering a unique value proposition. Securing Water for Food is therefore focused on areas in which science and technology can play a key role and is identifying game-changing solutions that will increase water availability and/or promote efficient use of water in agriculture.

Business Need

ThirdEye is a project by Dutch company FutureWater which has been granted support from the USAID SWFF for piloting the use of so-called Flying Sensors (in the form of drones) to support farmers in Mozambique with their decision making in farm and crop management. FutureWater has expressed a need to be supported by SNV in the area of business development. For effectively tapping into the market opportunity, ThirdEye has been challenged to set up a sustainable business model that creates value to farmers and takes into account willingness to pay for the service. At the same time, FutureWater is looking for a model in which they can provide technical and business support to their operations in a practical, effective and efficient manner.

Background

New technologies are revolutionizing the use of remote sensing in agriculture. The extended availability of drones enables agricultural professionals to cost effectively gather crop health information without waiting for satellite passes or paying the high costs of manned-aircraft flights. Data captured on a frequent basis enables farmers and extension advisers to map the health and vigour of crops today as well as observing how that crop is changing over time. Smallholder farmers, who have limited resources and capacity (such as water, agro-inputs, access to capital etc.) need this type of information to decrease and manage the agricultural production risks.

The use of drones for precision agriculture, farming, and crop management is exploding across the world, although in development countries as Mozambique a large approach is needed especially when it comes to the practical implementation of the models itself (affordability, information delivery).

Several field research and third parties engagements have been undertaken to assess the market potential and validate the price model. RBL is one of the parties that showed interest in paying around USD 6,000 with the purpose of benefitting local farmers. It is yet to be seen if this provides a basis for a commercially sustainable model to be implemented in Mozambique.

The original business model focused on supportting smallholder farmers. However, during the implementation of the first phase it was concluded that this target group is only to a limited extent able or willing to pay. The customer focus should therefore shift towards a system where smallholder farmers will be end user but not the paying customer (e.g. contract farming systems). Alternatively, one could think of creating attractive packages that could combine several products as input supply, irrigation, pulverization, etc.
Next to that, it will be financially attractive to include large-scale commercial farmers in the customer segment. A relative distribution of 60% small-scale farmers and 40% large–scale farmers (as Agro-Industrial of Chókwè, Tongaat Hulett, etc.) is agreed by USAid.

Recently, FutureWater completed a study to identify possible business models. It came up with 11 potential models which now need to be assessed in terms of commercial business potential. By the end of 2016, FutureWater's goal is to benefit around 6250 individuals with focus on the lower income people, while 2000 farmers will be paying for the services. This study will assist FutureWater in business modelling for the ThirdEye concept in Mozambique.

Business Need

The business need for this Scope of Works is defined as follows:

1. Assess which revenue models and distribution channels can be combined to create a value proposition to farmers (attraction and willingness to pay). FutureWater's study will be used as a baseline.
2. Advise in setting up a support unit for supply of administrative, promotional and logistical/technical assistance to ThirdEye business operators

Business Objective

To come up with a financially feasible and commercially viable business model, including advise on the set up of a support unit, which meets the needs of FutureWater and the farmers served by ThirdEye.

Scope Description

The following scope of work is defined to reach conclusion on business modelling:

a) Assess different business models as identified by FutureWater
b) Suggest improvements and/or third models which might be applicable
c) In consultation with FutureWater, decide on pursuing with one of the business models

After having selected the business model with the potential for commercial viability and having a practical chance of being implemented by FutureWater, the SoW continues:

d) Advice on setting up a support unit for supply of administrative, promotional and logistical/technical assistance to ThirdEye business operators, including task division between ThirdEye operators and support unit
e) Advice on setting up a legal and organizational structure for the support unit
f) Analyse the financial revenue and cost structure of the business model through realising P/L and CF projections.

Deliverables

Deliverables include:

1. Recommendation on the most cost effective and sustainable revenue model for FutureWater to benefit operators and farmers in the local context.
2. Recommendation on legal and organisation structure of establishing a support unit as part of the business model, including task division between ThirdEye operators and support unit
3. P/L and CF projections analysing financial feasibility and commercial viability.

Breakdown of Scope into Components

Ad 1: Assessing business models

- Assessment and validation of the business models suggested by FutureWater business developer (see-attached doc.), this includes discussion with FutureWater and evaluation of outcome of the discussions with Third party stakeholders (operators, farmers, potential partners).
- Conduct market intelligence, market validation and assessing organisational and managerial capacity needs.

Ad 2: Advise on legal and organizational set-up

- Evaluate which legal and organisational structure best support the support unit as part of the proposed business model(s).
- Evaluate what the best task division would be between ThirdEye operators and the support unit.
- Advise on which legal and organisation structure to adopt.

Ad 3: Financial projections

- This includes cost and revenue (pricing) validation and analysis. The options for acquiring third party finance will also be assessed.

Expected Start Date and Completion Date

1. Assessing business models: 1 July – 15 July 2016
2. Advise on legal and organizational set-up of support unit: 15 July – 15 Sep 2016
3. Financial projections: 15 Sep – 1 Nov 2016

Upon completion of each of the above steps, FutureWater will receive conclusions/recommendation by SNV in writing.

Assumptions

We assume availability of FutureWater staff during the course of the assignment, and relevant information and documentation to be made available in time to SNV.

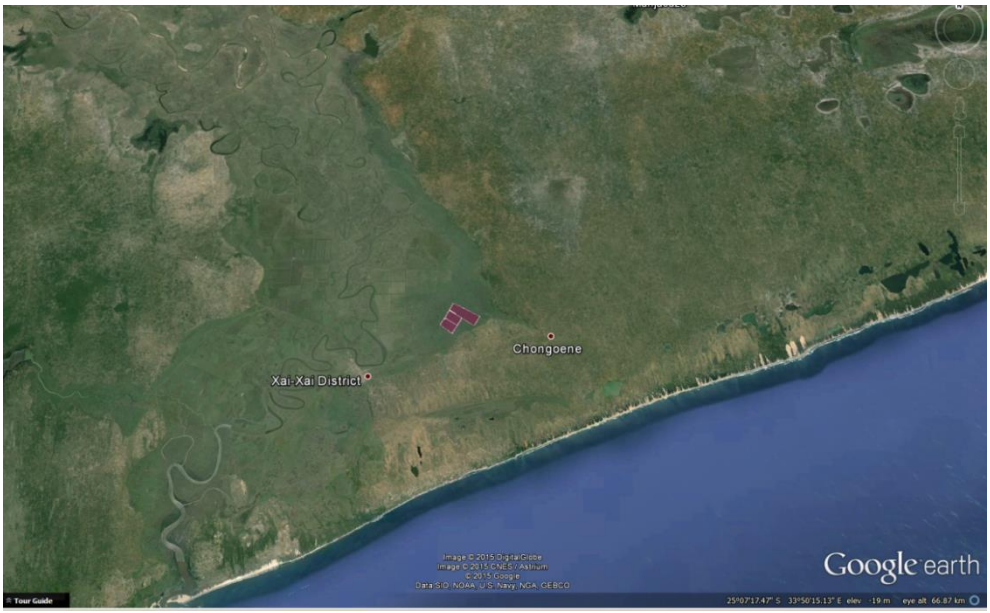
Annex 11. ThirdEye Service Areas

From May 2016

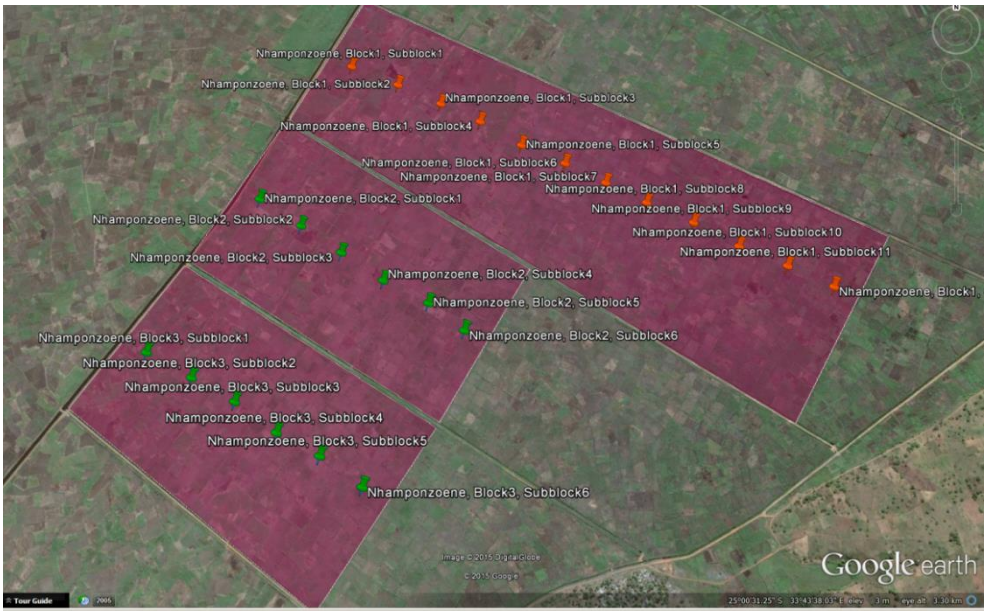
Martijn de klerk

Sam van Til

Xai-Xai: RBL



Location of Xai-Xai service areas.

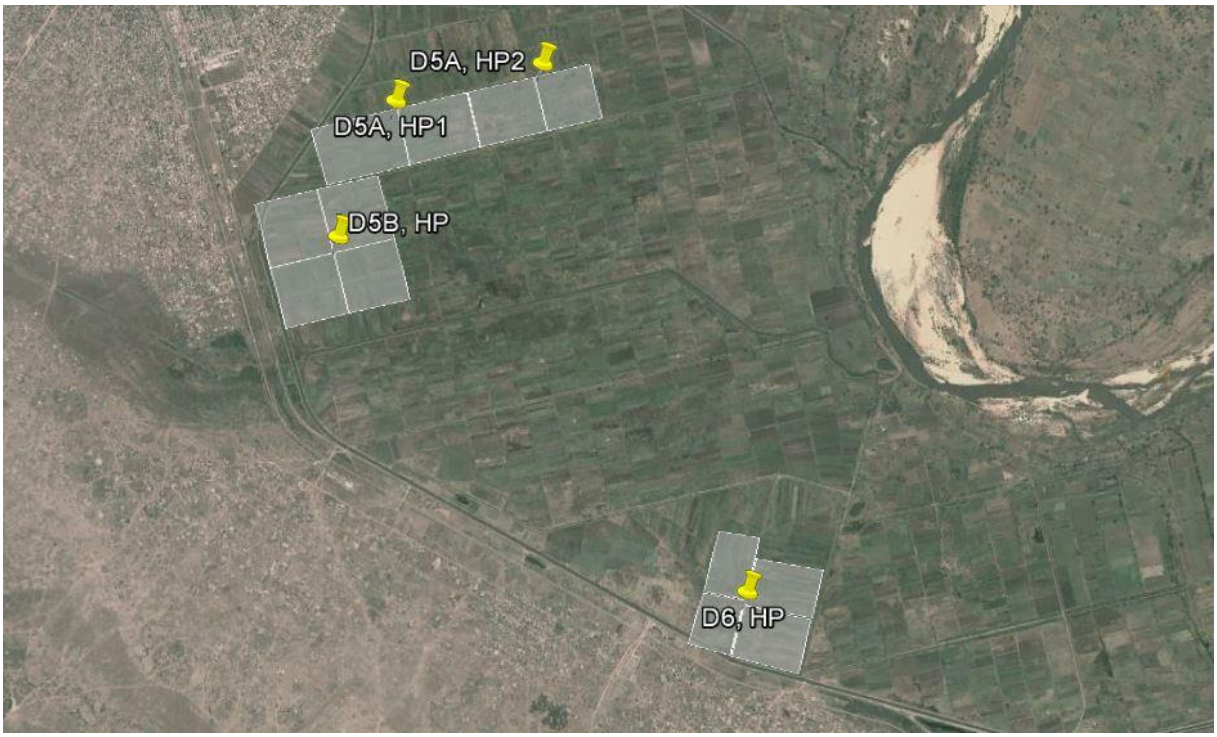


Location of blocks 1, 2 and 3 in Xai-Xai.

Chokwé: HICEP

Location of Chokwé service areas.

D5A, D5B, D6



Location of blocks D5A, D5B and D6 in Chokwé.

D11

Location of block D11 in Chokwé.

D12

Location of block D12 in Chokwé.

Macaretane

Aproxema

Mata Fome

Armalugue

Lhuvuku

Location of Macaretane in Chokwé.