AFRICAN MARKET:

Entry for a Trypanosomiasis Diagnostic Device

AFRICAN MARKET: ENTRY FOR A TRYPANOSOMIASIS DIAGNOSTIC DEVICE

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27th of August 2019
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ACKNOWLEDGEMENTS

I had the opportunity to learn and develop my skills in an exciting project. I had the pleasure of working together with many inspiring and knowledgeable people. Therefore, I would like to thank all of you who helped me along the way.

First of all, I would like to thank my supervisors JC and Willemijn for their time and willingness to think along with me throughout the project. Every meeting resulted in many insights, and the honest and clear guidance steered me in the right the direction whenever I needed it. Also, I would like to thank G-Young and Mirte for their treasured advice and support during the project.

I want to say thank you to the all people who have been contributing to the field trip in Uganda and whom I had the pleasure of speaking. Especially, to Dennis who without him I would not have been able to gather invaluable insights. Also, thanks to Joseph for making sure I didn't get lost in Uganda. Lastly, I want to thank to the laboratory group from Makerere University, which they make me feel as part of their family during my short stay.
I would like to say thank you to my parents for providing me with unfailing support and continuous encouragement throughout my education and preparing me for the future. For always having faith in me.

Some special words of gratitude go to my friends who have always been a major source of support when things would get a bit discouraging. Thank you for all the encouragement through my master.

I would also like to thanks to colleagues and acquaintances who had extend their hand during my journey.

Thank you all, I could not have done it without you!

Enjoy reading,
Paola Montserrat

GLOSSARY

Definitions and Abbreviations

Antigenic variation is a process by which many infectious agents, including some pathogenic viruses, bacteria, fungi, and parasites, evade the defense responses of the vertebrate immune system (Clements & Gdovin, 1998).

Business model hypotheses are the key assumptions that must be true for your business model to work.

Business model prototype can take the form of a simple sketch, a fully thought-through concept described with the Business Model Canvas, or a spreadsheet that simulates the financial workings of a new business (Alexander Osterwalder, 2010).

Cyclical transition: A tsetse fly, when it is born, is free from trypanosomes, until the first infected bloodmeal from a parasitaemic mammalian host. The tsetse fly remains infective for a period of time, infecting other mammals while feeding, turning them into carriers and host to infect other un-infected flies.

Farming system is defined as a group of farms with a similar structure or production functions. (Otte & Chilonda, 2002)

Indirect exporting means selling to an intermediary, who in turn sells your products either directly to customers or to importing wholesalers (Delaney, 2019).

Intermediary is a firm that buys a product and in turn, sells it directly to customers in his or her market (Delaney, 2019).

Tender is a submission made by a prospective supplier in response to an invitation to tender. It makes an offer for the supply of goods or services.

Trypanosomiasis is a vector-borne parasitic disease. It is caused by infection with protozoan parasites belonging to the genus Trypanosoma.

Unsought products typically are products that the consumers are not aware and don't have any knowledge about it.

AAT	African Animal Trypanosomiasis
AGDP	Agricultural Gross Domestic Product Inter-African Bureau for Animal
AU-IBAR	Resources of the African Union
CAHWs	Community Animal Health Workers
CPS	Creative Problem Solving
ECF	East Coast Fever
EL	Entry location
EM	Entry Mode
ET	Entry Timing
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
HAT	Human African Trypanosomiasis
IAEA	International Atomic Energy Agency
NGO's	Non-governmental Organizations
SMEs	Small and Medium Enterprises
SSA	Sub-Saharan African
T	Trypanosomiasis
UMPCU	Uganda Meat Producers Cooperative Union Ltd.
VATs	Variable Antigen Types
VSA	Veterinary Surgeons Act 1958
WHO	World Health Organization

EXECUTIVE SUMMARY

This report is the result of a graduation project in the domain of the Africa Market Entry for a Trypanosomiasis Diagnostic Device. The project aims to find promising ways to bring to the market a portable diagnostic device for Trypanosomiasis, developed by the company Aidx Medical BV.

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The context of T.

African Animal Trypanosomiasis (AAT) is a vector-borne parasitic disease. It is caused by infection with protozoan parasites belonging to the genus Trypanosoma. They are transmitted to animals & humans by tsetse fly bites which have acquired their infection from parasitaemic mammalian host. AAT is a major constraint to socio-economic development in Africa. AAT has significantly reduce productivity in over 150 million cattle and 260 million sheep and goats (Jahnke, Tacher, Kiel, & Rojat, 1988), and it is estimated to cause annual losses of more than US$ 4.5 billion dollars through direct and indirect agricultural production losses (Yaro, Munyard, Stear, & Groth, 2016).

There are many barriers that complicates the access of trypanosomiasis (T) diagnostics and treatment such as lack of confirmatory test, large distances, limited trained staff and lack of laboratories facilities. The diagnosis of T is notoriously difficult, because the clinical signs are similar to other cattle diseases. Likewise, the only way to confirm a diagnosis is to demonstrate and identify parasites in body fluid. The current diagnostic practices require staff with strong proficiency and expertise, which the limits the reliability of the test. In addition, diagnostic technique for routine veterinary purposes is only suitable if it is cost-efficient. Therefore, there is a need for the new diagnostic test requiring minimum training, inexpensive and should provide rapid and reliable results.

Business Modelling

According to the research, the device had a strong value proposition on the market. Several business model prototypes were created and tested in a field trip to Uganda. In the field trip, it was discovered that the current technique of introducing medical devices (ex. microscopes) and drugs was through an intermediary. This intermediary may be a chain of pharmacies or a device seller that needs to be certified by the government to distribute and sell the devices or drugs. The intermediary takes also charge of the promotion and distribution of the product. The business model prototypes were redesigned with the new set of information. After an evaluation with the company, the most promising scenario was selected according to their aim, strengths and weakness.

The main value of the company is to develop and manufacture an automatic diagnostic device for thick bone diseases that an unprofessional person can do a rapid and reliable diagnosis on the field. The customer segment is the government, because they are the largest employer in veterinary services delivery. The distribution channel will be through intermediaries, because they have a deep understand of the local market. As well, the company does not need a large capital investment on developing a distribution channel. The main revenue would be through asset sale of the diagnostic devices.

Market Entry Strategy

The business model helped to outline the important concepts of the company. Thereafter an International Market Entry was planned. This entailed the entry location (EL), entry timing (ET), and entry mode (EM). As it was previously explained, Aidx Medical BV will be the first mover and focused on a niche market on automated diagnostic device for veterinary health. Finally, the entry mode selected was indirect exports, meaning the company will sell the device through an intermediary. The market entry strategy of the company is summarized in Table #01 (Drost, 2017).

Finally, the strategy is described with the concept of 4P Marketing Mix (Mullins & Walker Jr., 2013) which includes product, price, place and promotion in conjunction the international entry market and the business model to ensure that the action plans within all are complimentary and aligned.

Entry Decision	Company Choice
Entry Location	Niche Market
Entry Timing	Early Entrant
Entry Mode	Indirect Export

Table #01: Market Entry

INTRODUCTION

How to read this report

This report presents the results of a graduation project of 20-weeks done at the Faculty of Industrial Design Engineering in collaboration with the company Aidx Medical BV. The report is structured in five chapters which serve as a guideline throughout this report.

In **Chapter I: Design Approach**, the framework followed during this graduation project is introduced, together with the methods and tools used. This chapter entails an overview of the framework, which served as a general guideline of this project, dividing the different activities in three phases: explore the challenge, generate ideas and prepare for action. In addition, this Chapter explains the methods and tools used during each of the phases, and the reasons these methods were selected.

Chapter II: Explore the Challenge is divided in 3 sections. *Section 1* has the aim to introduce the project scope and the projected outcomes. This entails a short description of the device aimed to be validated and brought to the market. *Section 2* explains the disease, Trypanosomiasis, and his complexities. In addition to give a better understanding of the context, current diagnostic practices and challenges are described. In *Section 3* introduces the objective and research questions of this project.

Chapter III: Generate Ideas will focus on finding promising ways to implement the diagnostic device on the market taking into consideration the insights from Chapter II. Therefore, in *Section 4* several scenarios are created which present different customers and value propositions. In addition, hypothesis for the scenarios are created for further validation. In *Section 5*, based on feedback from experts, it is presented the current distribution practice for medical devices and drugs in the market. The scenarios are restructured, according to the new set of insights. The new best scenario is selected, taking into consideration the company's strengths, weaknesses, and the most promising customer. This section will explain the different analyses that motivated said selection.

Chapter IV: Prepare for Action presents the final deliverables. Firstly, *Section 6* is detailed each block of the business model. The business model canvas is very useful to explain the general business in an abstract level. Subsequently, *Section 7* applies the International Market Entry Strategy complemented with description of product, price, place and promotion (4P's Marketing Mix) in Section 8. Furthermore, it is presented a plan of action with a timeline, which gives a deeper level of details in *Section 9*.

Chapter V: Evaluation, *Section 10* aims to evaluate the project to see if the research questions have been answered. Lastly, the limitations and implications of this research are discussed which results in recommendations for future research.

Cattle in Africa
by Irene Becker

TABLE OF CONTENT

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CHAPTER:
DESIGN APPROACH

This chapter builds on that by describing the approach and methods used to the design project.

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DESIGN APPROACH

The Creative Problem Solving (CPS) is the model followed to tackle the challenges of this project. CPS is a structured framework for generating creative and effective solutions in a problem (Boeijen, Daalhuizen, & Schoor, 2017). The key of creativity in this model is by divergent and convergent thinking during the process. Diverging thinking is the process of expanding for potential solutions and possibilities. Converging thinking involves evaluating the options and choosing the most promising one. This model consists of a three-stage process, followed by six explicit steps (Figure #01).

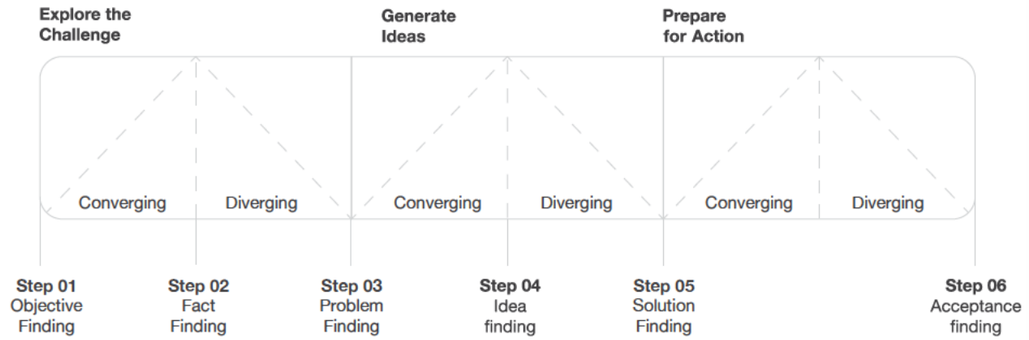


Figure #01: CPS (Boeijen, Daalhuizen, & Schoor, 2017)

First Stage: Explore the Challenge

Step 01 - Objective Finding

The first step is to define the goals and scope of the project. This was defined by a meeting with the client, where it was discussed their needs and expectations for the project.

Step 02 - Fact Finding

This step aim is to dive into the research of the problem gather information and synthetize main insights. The key is to immerse and understand the context of the problematic. The design methods applied were:

- Literature research
- Interview with experts on the field (Appendix A)
- Empathy Map Canvas
- Customer Journeys
- Value Proposition Canvas

Step 03 - Problem Finding

The third step identifies the problem that needs to be solved in order to achieve the goal. In this section, the method of Frame your Design Challenges by IDEO was used to define the research questions.

Second Stage: Generate Ideas

Step 04 - Idea Finding

Generate ideas is a phase for elaboration of solutions or concepts. Solutions are created by evaluating ways and means to solve the core issues you have deduced from your research.

A co-creation session was prepared to create as many ideas possible by a group of creatives. It was used the business model canvas as the method to express the solution.

Step 05 - Solution Finding

The step five is the solution finding, where the best ideas are prototyped, tested and analyzed. This is a process of trial and error that helps to improve the ideas. The idea is iterated as often as necessary. The most promising scenario is selected by the end of this step.

To test and analyze the prototypes from Step 04, a two-week field trip was made to Kampala, Uganda. This country was selected as English is the official language. It is politically stable (compared to some other T. endemic areas) and has governmental organizations dedicated to vector control of T. In addition, this trip was also helpful to validate the information gathered in step 02. During this trip, the next methods were applied:

- Semi-structured Interviews (Appendix B)
- Distribution Channel Framework (Appendix C)
- SWOT Analysis

Third Stage: Prepare for Action

Step 06 - Acceptance Finding

In this step, it is defined the plan to implement the most promising scenario. It was taken as a guideline the phases of the Product Innovation Process by Roozenburg & Eekels (Fig. #02) (Roozenburg & Eekels, 1995). Initially, it is described the new business idea through a Business Model Canvas. This method outlines the most important concepts of the company's business model. Subsequently, it is detailed the marketing plan through International Market Entry (Preece, C. M. M., Saman, & Ibrahim, 2016) complemented with 4P's Marketing Mix (Mullins & Walker Jr., 2013).

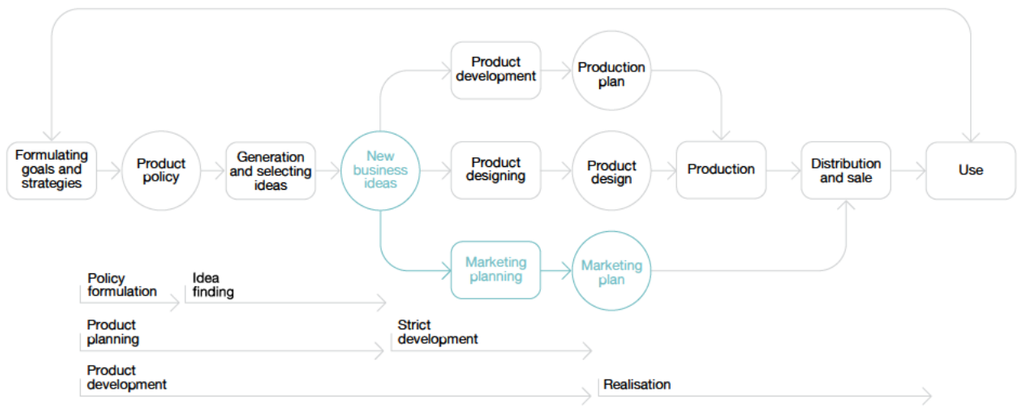


Figure #02: Product Innovation Process by Roozenburg & Eekels

02

CHAPTER:
EXPLORE THE CHALLENGE

Section I: Project Context
Section II: Trypanosomiasis Disease
Section III: Project Focus

This chapter has the goal to introduce the problem, the context, and the objectives of the project. Hence, this section is split up into three sections. The first section explains the project's challenge. The second section presents an understanding of the problem and the context where is developed. The third section describes the research questions to be answered.

Makerere University College of Veterinary Medicine, Animal Resources and Bio-Security, Uganda.

SECTION I: PROJECT CONTEXT

1.1: DESIGN BRIEF

Aidx Medical BV, a social start-up, is currently developing a portable, field compatible, affordable and smart optical diagnostic instrumentation for early detection of AAT infection and other Hemoparasitic infections in animals. An optical smart parasite detection technique using automated smart algorithms integrated into a potentially low-cost imaging platform is being developed by the R&D team. The new prototype is already producing promising results. Its aim is to create a rapid and reliable diagnosis on the field that can be carried out by unskilled personal.

The aim of this project is to define an effective market entry strategy for the diagnostic device that has a positive social impact, yet it is financially sustainable. The strategy will be presented in a detailed business model. This turns a high-level plan into an on-ground implementation solution.

1.2: PRODUCT'S DESCRIPTION

This section describes the diagnostic device developed by Aidx Medical BV.

1.2.1: DIAGNOSTIC DEVICE

It is a portable device that offers an automatic diagnosis of a blood sample for the parasite of T. The diagnostic device can detect light infection, even do the animals does not shown symptoms. The device takes less than 3 minutes to provide a result. The device can record data of the clinical case and geographical information.

1.2.2: BLOOD SAMPLE COLLECTION AND PREPARATION

Blood sample collection and preparation – fixing it to a glass slide and staining the smear – is necessary in order to insert it to the device. The stain makes the parasites visible by the color that it contains.

SECTION II:
TRYPANOSOMIASIS DISEASE

1.1.1 AFRICAN TRYPANOSOMIASIS

African trypanosomiasis is a chronic debilitating disease caused by extra cellular flagellate trypanosome protozoans (Trypanosoma species) and is spread mainly by the bite of the infected Tsetse fly vector (Figure #03) (Yaro, Munyard, Stear, & Groth, 2016). The infectious disease affects wide range of mammalian species including humans.

Animal African Trypanosomiasis (AAT) or nagana disease is caused by T. congolense (Nanomas), T. vivax (Dutonella) and T. brucei (Trypanozoon) (Yaro, Munyard, Stear, & Groth, 2016). It affects wild and domestic animals, like cattle, sheep, goats, pigs, horses, donkeys and camels in similar ways but is less documented (Murray & Gray, 1984). It causes infections and even dead if the disease is left untreated. The symptoms are fever, listlessness, emaciation, hair and weight loss, anemia, discharge from the eyes, oedema, abortion and anemia (Steverding, 2008).

Human African Trypanosomiasis (HAT) or sleeping sickness is caused by two subspecies of T. brucei, T. brucei gambiense and T. brucei rhodesiense, while the third subspecies, T. brucei brucei, is only infectious to animals (Figure #04). HAT currently is under control thanks to successive control programs, although over the last century there have been several epidemics in Africa, the disease was brought under control through successive control programs. Currently, the reported number of new cases of the chronic form of HAT brucei gambiense fell by 95%, from 27,862 to 1,420 cases, between 1999 and 2017. During the same period, the number of new cases of HAT brucei rhodesiense fell by 96% from 619 to 27 cases (WHO, 2019).

On the other hand, AAT is a major constraint to socio-economic development in Africa. AAT has significantly reduce productivity in over 150 million cattle and 260 million sheep and goats (Jahnke, Tacher, Kiel, & Rojat, 1988), and it is estimated to cause annual losses of more than US$ 4.5 billion dollars through direct and indirect agricultural production losses (Yaro, Munyard, Stear, & Groth, 2016). AAT is considered a neglected tropical disease, and it remains endemic in 38 of 54 African countries Tsetse flies infest approximately 10 million km² of the continent affecting 38 countries (Appendix D) (Murray & Gray, 1984).

Trypanosomiasis not only exist in Africa; it has spread to South America (SA). However, this project is going to be focusing in AAT. Primarily, the money loses are greater in SSA countries. It is estimated to be US$ 4.5 billion losses per year in SSA countries compared to US$160 million of the most affected area of SA. Furthermore, the geographical area and countries affected is greater. Finally, the sleeping disease, according to World Health Organizations (WHO) has been controlled and had a descended of 95% of cases. To focus on a specific market to make use of resources and time more effectively and create a better strategic decision. Information about SA T. can be found in Appendix E.

2.1.1: COMPLEXITY OF TRYPANOSOMIASIS

The complexity of the disease is the reason of the difficulty to eradicate the disease. AAT is transmitted cyclically by the different species of Tsetse, and once the Tsetse becomes infected, it stays infectious for a period, and the infected animals become to be carriers and important reservoir of infections.

Antigenic variation is another reason of the persistence of AAT, that enables to evade the immune responses and establish persistent infections (Murray & Gray, 1984). A single infection can express multiple variable antigen types (VATs). There is also an

Figure #03: Tsetse fly

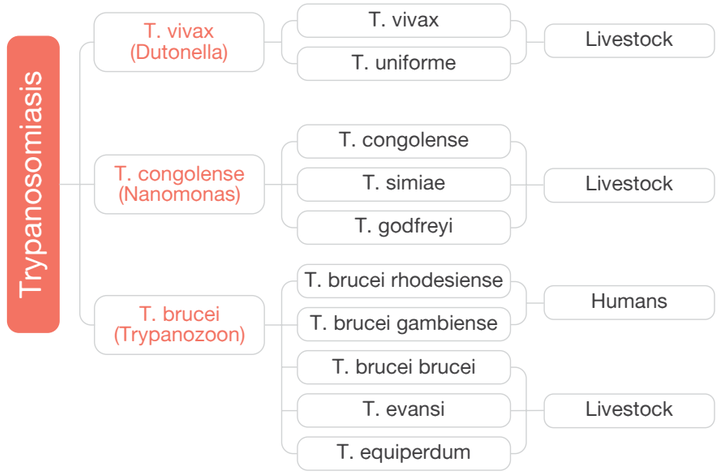


Figure #04: Classification of the pathogenic African trypanosomes.

unknown number of different strains or serodemes of each trypanosome species, each capable of elaborating a different range of VATs (WHO, 1978). For reasons discussed above, no vaccine is currently available.

In 1974, the Food and Agriculture Organization of the United Nations (FAO), Programme for the Control of AAT and Related Development, was inaugurated with the concept of tsetse eradication from the infested areas of SSA countries (Hursey & Slingenberg, 1995). These control methods included; the sterile insect release technique, the destruction of fly habitat, the use of Tsetse traps, the use of insecticide-treated livestock, and coordinated mass spraying of insecticide (Doyle, Moloo, & Borowy, 1984). These control methods had never, reach the level of effective implementation required to rid AAT. Also, the control methods have been associated with negative environmental consequences including pollution of water and deforestation (Holmes, 1997). For these reasons FAO has revised and redirected their aim to develop environmentally acceptable control techniques (Hursey & Slingenberg, 1995).

Another attempt to control this complex disease is the use of anti-AAT drugs, however, the results was drug resistance (Kaufmann, Dwinger, Hallebeek, van Dijk, & Pfister, 1992). From 2008 to 2015 there was a rise from 17 to 21 SSA countries that have reported veterinary trypanocidal drug resistances issues

Cyclical transition: A tsetse fly, when it is born, is free from trypanosomes, until the first infected bloodmeal from a parasitaemic mammalian host. The tsetse fly remains infective for a period of time, infecting other mammals while feeding, turning them into carriers and host to infect other un-infected flies.

(Delespaux, Geysen, van den Bossche, & Geerts, 2008).
Other factors have contributed towards drug resistances includes the high degree of re-infection rates among treated cattle and the misuse of drugs by farmers (Geerts, Holmes, Eisler, & Diall, 2001). If the farmers suspect infection with trypanosomes based on symptoms such as poor weight gain or reduced milk yield, farmers treat the animals with anti-AAT drugs, as they are freely available without regulation. Trypanocides are used either to treat or to prevent trypanosomiasis. However, their use is also determined to some extent by drug resistance (Connor, 1992). Another problematic is the underdosage and incorrect administration.

> **"Antigenic variation** is a process by which many infectious agents, including some pathogenic viruses, bacteria, fungi, and parasites, evade the defense responses of the vertebrate immune system (Clements & Gdovin, 1998)."

Frequently, the farmers are not trained to administrate the medicine. Underdosage occurs when there is an incorrect underestimation of bodyweight, overdiluted solution, incorrect injection technique or even deliberated underdosage to enable treatment of more animals. Trypanocides are supplied in powder form, granular form or as tableted preparation, none in supplied in the African market as solution (Connor, 1992). Therefore, the untrained farmers have to prepare into a solution giving a marge for error. Furthermore, in many countries these drugs are freely available in the market.

An additional factor encouraging the development of resistance of trypanosomes is that the few drugs available to treat AAT have similar chemical composition (Peregrine, Chemotherapy and Delivery Systems: Haemoparasites, 1994). This resistance was due in part by there are the only drugs available for treating AAT in the last 50 years (Peregrine, 1994). In the last 25 years, no new drugs have been developed, and those available are limited to five compounds, diminazene, homidium, isometamidium, quinapyramine and suramin (Peregrine, 1994). In Appendix F, it can find the compound and the trade name. Furthermore, these three AAT drugs have high host toxicity and have shown limited efficacy (Peregrine & Mamman, 1993).

2.1.2: DIAGNOSIS OF TRYPANOSOMIASIS

The diagnosis of trypanosomiasis is notoriously difficult, because the clinical signs are similar to other cattle diseases. Likewise, the only way to confirm a diagnosis is to demonstrate and identify parasites in body fluid (Connor, 1992). There are different diagnostic methods for detecting trypanosomiasis, the next ones are the most used on the field:

DRY BLOOD AND LYMPH

Blood smears are made with fresh blood, then it is stained with Giemsa's stain. Examination is carried out under the microscope, preferably using an oil immersion objective of 40–50x. Specific diagnosis of the trypanosomes is sometimes possible using the 100x oil immersion, but it is usually difficult or impossible.

Pros
- The method is simple and inexpensive.
- It is sometimes (but mostly not) possible to identify the trypanosome species seen.
- It is also used to diagnose anaplasmosis, babesiosis and theileriosis.

Cons
- An immediate diagnosis of T. on the spot is not possible. As the blood films are taken back to the center, for processing and examination at ease.
- The sensitivity of the method remains limited.

Main items of equipment
- Compound Microscope
- Oil immersion
- Phase contrast/bright field light source
- x25/ x40 phase objective lens

Consumables
- Lancets
- Slides
- Coverslips
- Stain
- Ethanol
- Filter paper
- Buffered water
- Immersion oil
- Lens
- Tissue
- Xylene

***Cost**
0.375 USD per test

WET BLOOD

Fresh blood, either from the tail tip of from the ear, is placed between a coverslip and then it is examined with x25 or x40 objective lens. Trypanosomes are seen either directly, moving between the blood cells, or indirectly. The detection depends on the experience of the operator.

Pros
- The method is rapid, simple and inexpensive.
- It is best suited to screening herds in the field. If trypanosomes are found, the disease is diagnosed on the spot.

Cons
- The blood needs to be fresh as the parasites lose their mobility after a limited time.
- Limited sensitivity, the detection limit is usually around 104 trypanosomes per ml of blood.
- The species of trypanosome cannot be identified.

Main items of equipment
- Compound microscope
- Oil immersion

Consumables
- Lancets
- Slides
- Coverslips
- Ethanol
- Filter paper
- Buffered water
- Immersion oil
- Lens
- Tissue
- Xylene

MICRO HEMATOCRIT BUFFY COAT

A blood sample is taken into a glass tube and adds anticoagulant. The glass tube is then situated in a centrifugate at high speed to accelerate the process of sedimentation between the cells and the plasma. After the centrifugation, the tube is then examined for the presence of trypanosomes, either by direct examination of the buffy coat/plasma junction, or after making a smear of this area.

Pros
- The sensitivity is higher than of other methods.

Cons
- The most expensive method.
- Special equipment is needed.
- It is not possible the identification of type of T. Although the type of motility may give some indication.

Main items of equipment
- Microhaematocrit centrifuge
- Electric power source/Generator

Consumables
- Heparinized capillary tubes
- Tube sealant
- Spare rim gaskets racks
- Freezer packs
- Cold box

***Cost**
1.315 USD per test

Centrifugation Machine

***Note #01:** The cost does no includes the estimation of personnel costs or maintenance costs. This cost will vary depending on transportation, liability to duty, and taxation. The cost was calculated in 1990, there will be cost variation depending on the inflation.

***Note #02:** For all the techniques mentioned before, it is necessary either a laboratory technician or a veterinary to have previous knowledge for detecting the shape and form of the parasite.

	Diagnostic Method		
	Wet Blood	**Dry Blood and Lymph**	**Microhematocrit Buffy Coat**
1. Village	+++	+	-
2. Veterinary centre	++	+++	-
3. Commercial farm	+++	+++	+
4. District	+	+++	++
5. Provincial	-	+++	++
6. Surveillance	-	+++	+++
7. Research	(+)	+	+++

+ Suitable method but not likely to be used on grounds of cost or efficiency
++ Suitable method but not the most appropiate
+++ The most suitable test/Resources available at this level to perform the test
(+) Examination of wet films of mouse tail blood
* Suitable in its present form

Table #02: Suitability of diagnostic test at different functional levels

The used diagnostic technique for routine veterinary purposes depends on the suitability in the functional level (Table #02). The suitability of the various tests in veterinary medicine is based cost-efficient and the availability of experts on the field. Although at the village level a veterinary may be competent to make the test and examine the buffy coat, it is prohibitively expensive to provide the necessary equipment widely for use under such conditions (Connor, 1992).

The main challenges for the diagnostic of AAT is that occurs in rural areas, which are difficult to access and are dispersed over areas where poverty, insecurity and lack of animal health staff is predominant. Furthermore, the complexity of current tools to combat the disease require staff with strong proficiency and expertise.

Finally, costs for diagnosis are restrictive for the average income of a farmer. For effective control and surveillance of AAT, new diagnostic tests are still needed. The new test should be inexpensive, and requiring minimum training and equipment, thus easy to execute by any health worker. They should provide rapid and reliable results with optimal sensitivity.

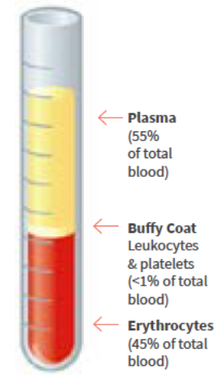


Figure #05: Buffy Coat

2.1.3: TREATMENT

The treatment for T. is the administration of a trypanocidal injection (Connor, 1992). There are five trypanocidal compounds (Appendix F). The speed of an animal's recovery is mainly determined by the nutrition and amount of exercise. Animals that are undernourished and have to trek long distances to pasture and water will take longer to recover.

For a correct trypanocidal injection, it is indispensable to weight the animal to calculate the correct dosage. Sometimes the pack sizes in which these compounds are presented are not enough for one dose. It is required to use a second sachet or tablet to treat an animal requiring only slightly more than the dose contained in one sachet or tablet; this can encourage underdosing (Connor, 1992). Underdosing can incite drug resistance.

It is common to make the next mistakes during the administration of trypanocidals (Connor, 1992):

- **Underdosage or overdosage:** Incorrectly calculated dose volume by wrongly estimate bodyweight
- **Overdiluted solution**
- **Incorrect diluent**
- **Deliberated underdosage to enable treatment of more animals**
- **Incorrect injection technique**
  - Short needles
  - No sterility
  - Early withdrawal of needle

2.1.4: CONCLUSION ABOUT AAT

AAT should not be seen simply as a disease, but it must be recognized with its context of livestock production and rural development. There is probably no other continent dominated to the same extent by one disease as Africa is by T. One quarter of SSA´s population, more than 100 million people, faces food shortage. To overcome these shortages, expanding food production is indispensable (World Bank, 1989). The goal is a 4% growth a year on food production to feed the growing population, improve nutrition, and progressively eliminate food imports. Suitable policies need to be put into practice, improved and appropriate technologies must be adopted to achieve this expansion (World Bank, 1989). Therefore, exploiting other measures such as effective diagnosis in T. is imperative.

2.2: TRYPANOSOMIASIS CONTEXT

In SSA, agriculture is a crucial human activity, as it contributes to food security and economic growth. The agricultural sector is the major source of employment and income. It employs about 67 percent, which was 601 million in 2000, of the total labor force (Otte & Chilonda, 2002). In the rural areas, most people are engaged in agriculture or related activities, and it is an important component of the livelihoods.

From SSA countries, Uganda was the selected country to make a field trip to have a deeper understanding of the context. The reasons that is an AAT endemic country, English is the official language, it is politically stable (compared to some other T. endemic areas) and has governmental organizations and non-governmental organizations (NGO's) dedicated to vector control of T.

2.2.1: UGANDA AGRICULTURAL CONTEXT

Uganda has a total land area of 241,548 km2, which 25% constitute lakes, swamps and protected areas (Nakayima, Nerima, Sebikali, & W. Magona, 2016). The rest of the country (over 18 million hectares) is available for both cultivation and pasture. Agriculture contributes over 40% to the gross domestic product (GDP). It also contributes over 60% of total Government revenue. In addition, agriculture provides more than 80% of the total labor force and gives over half of the total income for the bottom three-quarters of the population (Nakayima, Nerima, Sebikali, & W. Magona, 2016).

Livestock production, a sub-sector of agriculture, contributes about 7.5% to total GDP or 17% to AGDP (Nakayima, Nerima, Sebikali, & W. Magona, 2016). Cattle has a significant important economic contribution to livestock production, compare to goats or sheep. Pig and chicken meat production are also important. Mixed farming small holders and pastoralists own over 90% of the cattle herd; they produce the bulk of domestic milk and meat production (Nakayima, Nerima, Sebikali, & W. Magona, 2016). Although the livestock production sector is a significant contributor of the GDP; it is not given much attention as other professional sectors. As a result, cattle diseases are widely spread and endemic. Currently, the main thick-bone diseases affecting the cattle in Uganda are East Coast Fever (ECF), Anaplasmosis, Babesiosis and T. in that order.

In the late 1980s, the government of Uganda adopted structural adjustments. The results were the liberalized and decentralized of veterinary services. Clinical services, breeding and spraying for tick control were privatized, while vaccination of animals against epidemic diseases, quarantines and tsetse control were retained under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) (Ilukor, Birner, Rwamigisa, & Nantima, 2012). These reforms had the aim to reduce costs in public administration and expenditure. However, this reform did not have the desire impact, because of corruption and financial indiscipline (Nakayima, Nerima, Sebikali, & W. Magona, 2016).

Uganda is divided into 127 districts. Each district is further divided into counties and municipalities, and each county is further divided into sub-counties. Every one of these categories should have a government employ veterinary in charge. However, commonly the districts count only with one veterinarian or two. As well, every district headquarter should count with diagnostic laboratories and laboratory technicians, though diagnostic services in Uganda is still lacking. Many laboratories do not count with laboratory equipment and simple supplies like microscope, centrifugate, freezer, water, electricity, waste disposal, among others (Nakayima, Nerima, Sebikali, & W. Magona, 2016).

2.2.2: FARMING SYSTEM CONTEXT

The main objective of this section is to describe the different farming systems existing in SSA countries. These systems were classified by a number of criteria, the main ones being cattle population, livestock movement, type production, land management, and market integration.

LARGE SCALE & SEDENTARY FARMERS

- Large scale & sedentary farmers are generally commercial enterprises. Herders that look after their cattle are looking after their business.
- Generation of a cash income as the primary function.
- They are specialized in one or more livestock species and producing mainly live animals for slaughter for meat, skins and hides, but also for milk production or wool (Otte & Chilonda, 2002).
- It generally exhibits improved herd, pasture, water management and constant veterinary attention. Herding patterns records are made and kept adapting to the different needs of animal groups such as purchased feed, inputs for animal health, etc.
- Modern systems have large capital requirements and employs substantial amounts of hired labor.
- Land ownership is private.
- The number of cattle varies between 500 to >2,000.
- The farm practice zero grazing or grazing within the fixed boundaries that delimit tenure.
- These herders have the main support of governmental help, because they have economic strength.
- **Pains:** The main pains are the economic loss for medical assistance and medicine for diseases among the cattle. Another pain is the constant stealing of cattle during the night, which provokes economical losses.
- **Gains:** The selling of meat, skins, hides or milk.

Cattle in Africa

Village, Kaduna State, Nigeria

SMALL HOLDERS & SEDENTARY FARMERS

• The type of system will depend from the herder. Small holders & sedentary farmers may be a combination of modern and tradition livestock production system. Modern systems employ hired labor and it is used as a business, while traditional systems mainly rely on family labor, and livestock provides subsistence products.

• In general, traditional livestock systems are far more prevalent in sub-Saharan Africa than modern systems. Smallholder farms constitute approximately 80% of all farms in SSA countries and employ about 175 million people directly (Alliance for a Green Revolution in Africa, 2014).

• Livestock products contribute to subsistence in two ways: directly, via milk and meat for home consumption; and indirectly, via sales to generate cash or exchanges for cereals and other crops.

• Another economical input may be the livestock is reproduction, for the selling of cows and bulls. Other outputs, such as skins and hides, are also of economic importance.

• The number of cattle varies between 5 to 500.

• The animals are grazed on communal pastures.

Generally, several farmers share communal facilities, like crush pens. These facilities are mainly subsidized by the government, yet the maintenance costs, usually, run by the farmers.

• Disease control varies from herder to herder. The herder may use veterinary services or natural remedies to treat the cattle.

• Veterinarian services are limited. Community Animal Health Workers (CAHWs) are the ones in constant contact with these farmers. CAHWs do minor procedures like dehorn, castrate, inject and treat minor diseases.

• **Pains:** The inbreeding is a problem as creates lower quality herds, consequently less economical value. As well, the small farmers diseases, because they may not have the resources to treat their cattle or there is a lack of veterinary services available. Another pain is the constant stealing of cattle during the night, which provokes economical losses.

• **Gains:** The selling of cows or bulls. Also, milk or dairy products can be for sale or home consumption.

TRANSHUMANT FARMER OR SEMI-NOMADIC FARMERS

• Traditional systems mainly rely on family labor. The basic production units are independent nuclear families or groups joined together in camps, whose composition varies seasonally and whose members cooperate to varying degrees in economic.

• Tasks are divided by gender and age among the members of the family. The main work of men is to manage the herd, find grazing sites, build tents and camps, and make security tools such as knives, bow and arrows and guns. Women in the unit take on traditional roles such as sourcing food produce in the market, milking cows, weaving and mat-making. Some women are also involved in farming such as growing vegetables and raising poultry.

• This farming systems are mainly found in the arid and semi-arid zones. These areas receiving less than 400 mm of rainfall per annum (Otte & Chilonda, 2002).

• Transhumant pastoralism, which is based on more or less regular seasonal migrations from a permanent homestead. A primary reason for the migratory nature of the herdsmen is to reach areas with abundant grass and water for the cattle.

• The main functions of livestock production in pastoral households are to provide subsistence products (milk, blood and meat), to meet social obligations (bride price, stock alliances and stock patronages) and to insure against disaster (drought, epidemics, raids) (Otte & Chilonda, 2002).

• The sale of goat, sheep and dairy products such as milk constitute the primary source of income and livelihood for the herdsmen. Their wealth and riches are often measured by the size of the cattle herd.

• Livestock products contribute to subsistence in two ways: directly, via milk and meat for home consumption; and indirectly, via sales to generate cash or exchanges for cereals and other crops.

• The number of cattle varies between 100 to 200.

• Veterinarian services are not available. Commonly, they make use of natural remedies or buy medicine from illegal providers.

• **Pains:** No available veterinarian services.

• **Gains:** The cattle create sustenance. Also, the sale of goats and sheep generate cash or exchange for other goods.

Mundari Man, South Sudan

NOMADIC FARMERS

• It is a traditional farming system that mainly rely on family labor. The man is boss in the family, and he expects total obedience from his wives.

• This farming systems are mainly found in the arid and semi-arid zones. These areas receiving less than 400 mm of rainfall per annum (Otte & Chilonda, 2002). They must always camp within about 10 km of water because their small livestock must be watered every day.

• Cattle are hugely important and symbolic. Their animals mean everything to them, wealth, status, sustenance and dowry, and they guard them with their life. The size of the cow can also be used to ascertain social status.

• The cattle are only killed in special occasions; when visitors come, weddings, and funerals.

• Each bovine is so highly prized that is rarely killed for its meat. Instead, it is a walking larder, a pharmacy, a dowry, even a friend. It is clear that cow is a resource maintaining not just people, but a way of life.

• They do not produce any waste.
  • Cattle dung is collected in the morning and put to good use; once mounds have been formed, the dung is burnt, and the smoke keeps away any insects.
  • Use burnt dung to create talcum-powder like ash which softens their skin and protect their skin from the 115 degree here.
  • Cattle urine is used as an antiseptic and dye hair.

• Livestock products contribute to subsistence. The diet of the nomadic is pretty much milk and yogurt.

• The number of cattle varies between 50 to 200.

• Western veterinarian medicine is not available.

• **Pains:** Severe droughts that may cause the loss of cattle. Productive lands once grazed are becoming degradation. Armed cattle raiders from rival tribes can stole cattle at any time. Cattle illnesses is a major problem, as they do not have availability or knowledge to treat it.

• **Gains:** The cattle create social status and sustenance.

In Uganda, there are only 2 types of farming systems, large scale & sedentary farmers and small holders & sedentary farmers. The project fill focus to target them as the end user. The reasons are that these types of farming systems are the easiest to reach, as they have already access for veterinarian services.

Other important actors influence in the treating of the endemic disease T. in the pastoral system are:

COMMUNITY ANIMAL HEALTH WORKERS (CAHWS)

CAHWs are member of the community and often livestock keepers themselves (VSF International, 2018). They generally receive training in basic animal health care and provide a limited a range of veterinary tasks, for example dehorn, castrate, inject, vaccination, deworming, between other animal health techniques.

CAHWs play a substantial role in providing animal health services at local level due to critical lack of veterinarians. They are members of the community; they speak the same language as the farmers and also can speak English to consult the veterinarians. When the cases that are handled by CAHWs fail to respond, veterinarian are consulted, he gives advice or can visit the site if it is accessible (Ilukor, Birner, Rwamigisa, & Nantima, 2012).

ANIMAL DRUG RETAILERS

Drug shops or retailers are often the first line of health care, especially in rural areas that have very few private or public clinics. Drug shops or retailers do not typically employ a trained pharmacist, however generally drug retailers give advice on drug use for farmers that self-treat his animals. These retailers are legally allowed to sell only nonprescription drugs and prepackaged medicines. The owners of these shops may or may not have some type of retail license.

VETERINARIAN

A veterinarian is a professional who take care of the health of the animals by treating diseases, disorders, and injuries in animals. Makerere University-College of Veterinary Medicine, Animal Resources and Biosecurity was established in 1971, in Kampala, Uganda. The faculty graduates around 30 to 35 veterinary graduates a year (Silkin & Kasirye , 2002). To-date, the faculty has graduated approximately 1200 veterinarians (Interviewee K). From the 1200 veterinarians, around 20% of these veterinarians leave Uganda, to return to their home country. The rest of veterinarian's most of the time hold administrative or governmental positions, and a small percentage are district veterinarians or private veterinarians.

Animal Health Assistant Boru Cherfole (center) injects a cow with diminazen to treat trypanosomiasis (sleeping sickness), while Community Animal Health Workers draw up a multivitamin injection during an eight day Veterinary Civic Action Program August 23, 2011, in Negele Ethiopia. By Capt Jenifer Pearson

2.2.3: JOURNEY IN TREATMENT ENDEMIC DISEASES

Based on the insights gathered and stories heard during the field trip, five different stories were assembled. The goal of these customer journey is several. Firstly, the customer journey helps to understand the current customer journey to control the disease and the barriers the farmers and health services go through. Secondly, it aims to identify the several stakeholders involved and their role in the journey. For example, a stakeholder may be the paying customer, the user or the beneficiary. Thirdly, it helps to calculate an approximate cost that the journey will involve.

From these customer journeys, it became clear that there is a lot of possible variations between the journeys and different stakeholders. Even though every story is different, all farmers or veterinarians face a long journey which involves a lot of barriers to getting access to a diagnostic. The five stories are described and visualized next:

Veterinary in Africa

SCENARIO #01: FARMER

Scenario #01 is the most common situation in Uganda. This scenario is characterized by the farmer taking full action in the control of the disease.

#01 DISTINGUISH SIGNS

The farmers see that the cow has signs of a disease, which may be T.

Disadvantages: The lack of diagnostic. The symptoms of T. are similar to other diseases, this can provoke the selection of the incorrect treatment. As well, the use of medicine without proof of disease can in the future create resistance, and it is toxic for the animal.

6 - 9 Months

#02 GETT MEDICINE

The farmer goes to the nearest veterinary pharmacy to buy medicine.

Disadvantages: Poor regulation. The trypanosomes is medicine type C, in Uganda. Type C medicine are poorly controlled and covers oral solutions and topic application. This are easily available in the counter. Currently, Uganda experiment problems with medicine resistance.

Depends of the economic situation of the farmer

Medicine: 1 to 5 USD

#03 TREATMENT

The farmer administrate the medicine.

Disadvantages: Incorrect administration. The farmers are not trained to administrate the medicine. The wrong administration can be for an overdose or underdose of medicine. The main reason is because the farmers do not count with the equipment to weight the cattle, and the amount of dose depends on the weight. The incorrect administration can also be for the incorrect injection technique, or incorrect use of diluent.

#04 RESULTS

The live or dead of the cattle depends if the disease was correctly treated and if the medicine was correctly administrated.

Disadvantages: The possible losses of cattle. The loss of a cow can be between 120 USD.

Other disadvantages of Scenario #01:

The main livestock systems in SSA are smallholder's livestock, which are characterized by low input and with a considerable level of subsistence production (Yaro, Munyard, Stear, & Groth, 2016). This means, smallholder's livestock farmers livelihoods depend on day-to-day availability of basic needs rather than average income. The lack of money is one of the main reasons farmers do not quest for veterinarian services.

In summary, the main disadvantages of Scenario #01 are:

- **Lack of confirmatory tests:** For most diseases-treatment is based on clinical diagnosis and hence not accurate.
- **Poverty:** The lack of money makes it restrictive look for animal health services.
- **Drug misuse:** Farmers tend to self-treat their animals without a confirmatory test. Most of the farmers with the minimum sign of possible disease treat the animals. This can cause drug resistance.
  - **Poor regulations:** The trypanosomes are poorly controlled medicine, and it is easily available in the counter.
  - **Incorrect administration:** The farmers are not trained to administrate the medicine. The incorrect administration can be for an overdose or underdose of medicine, incorrect injection technique, or incorrect use of diluent.
  - **Drug resistance:** Most of the farmers with the minimum sign of possible disease treat the animals. The constant medication of the cattle can cause drug resistance.

For each scenario, a minimum and maximum costs is counted. It would be taken as a constant number of 100 cows to be treated in each scenario; the purpose is to keep consistent the results.

The approximately costs in are Scenario #01
Farmer approximately costs: 100 ≈ 500 USD

A cow loss would be around 60 to 120 USD in Uganda. The cos t depends on the weight, health and inbreed of the animal.

SCENARIO #02: VETERINARIAN

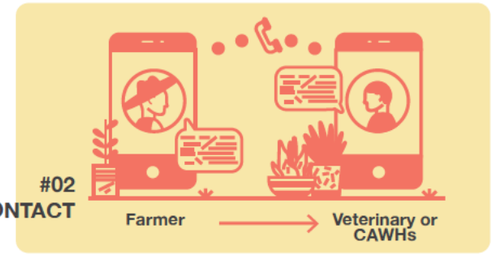
Scenario #02 is about the current struggles with the veterinary health system that experience farmers in Uganda.

#01 DISTINGUISH SIGNS

The farmers see that the cow has signs of a disease, which may be T.

6 - 9 Months

#02 CONTACT

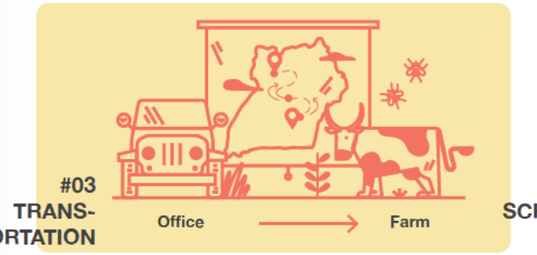


The farmer calls a private veterinary to request an appointment. The appointment can take from days to weeks. Sometimes the veterinary is private or from the government.

Disadvantages: Shortage of veterinary services. In Uganda, there is a scarcity of trained personnel compared to the demand, especially in rural areas, which are difficult to access and are dispersed over areas where poverty and insecurity.

Days or weeks

#03 TRANS-PORTATION



The veterinary travels to the farm.

Disadvatages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 -6 hours

#04 SCREENING

The veterinary checks the symptoms of the cattle, and diagnose only with clinical signs.

Disadvatages: The lack of trustable diagnostic. The symptoms of T. are similar to other diseases, this can provoke the selection of the incorrect treatment.

#05
TREATMENT

The veterinary administrate the medicine to treat the cattle.

#06
PAYMENT

The farmer pays for the services and medicine provided by the veterinary. The fee depends of the location of the farm and the number of animals treated.

Professional fee: 3 to 13 USD
Medicine: 1 to 5 USD

Other disadvantages of Scenario #02:

It is uncommon that a private or the local governmental veterinary perform a diagnostic. The reasons is that clinical veterinary services were privatized by the government in the late 1980's. Almost of all the laboratories in Uganda are owned by the government with the exception of the laboratory from the university of Makerere and two laboratories from the company Uganda Meat Producers Cooperative Union Ltd. The status of laboratories services in Uganda is still lacking. Many districts do not have diagnostic laboratories and laboratory technicians. They depend on clinical signs for diagnosis, or they send samples to regional reference laboratories. However, for the farmer is prohibited expensive to send and analyze blood samples in the main cities of Uganda. These are the main reasons normally governmental or private veterinary can not offer a proper diagnosis.

The second disadvantage is that the government veterinary are not easy to reach. Most of the districts only counts with one veterinarian per districts, that most of the time he is busy with administrative work and delegates his duties to community animal health workers. "Our problem is that we have only one veterinarian in the district and he is busy with administrative work, attending workshops and is always out of station. At times some of us have to consult him on phone". This is the reason, famers generally looks for private veterinarians or CAHWs as they are available.

In summary, the main disadvantages of Scenario #02 are:

- **Limited qualified staff:** There is a scarcity of educated, trained personnel compared to the demand, especially in rural areas, which are difficult to access and are dispersed over areas where poverty and insecurity.
- **Long distances:** Most areas are not easily accessible. It takes time and resources to get to the farms.
- **Lack of confirmatory tests:** For most diseases-treatment is based on clinical diagnosis and hence not accurate.
- **Drug misuse:** Farmers tend to self-treat their animals without a confirmatory test. Most of the farmers with the minimum sign of possible disease treat the animals. This can cause drug resistance.
    - **Drug resistance:** Most of the farmers with the minimum sign of possible disease treat the animals. The constant medication of the cattle can cause drug resistance.

The approximately costs in are Scenario #02
Farmer approximately costs: 103 ≈ 513 USD

SCENARIO #03: GOVERNMENT

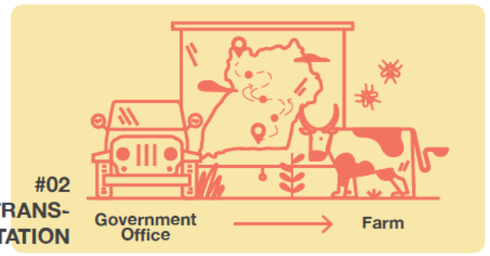
Scenario #03 describes the respond from the government to control the disease of T.

#01
RECEIVE COMPLAINS

The districts send complains to the ministry. The district, depending on the amount and type of complains, sends a veterinary. The veterinary notifies of his visit to the local government, county, and village veterinary. The local veterinaries help to guide the veterinary to the correct area where the farmers with disease problems are located.

Disadvantages: The time of reaction depends of the funds. As result of lack of budget, the government has adopted reactive rather than a proactive approach to service delivery.

3 - 6 Months



#02
TRANS-PORTATION

Generally, the veterinary travels during the afternoon to stay during the night in a guest house. The reason is to start screening as early in the morning possible, because the cattle during the day leaves for grazing.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours (Generally it takes a whole day of work)

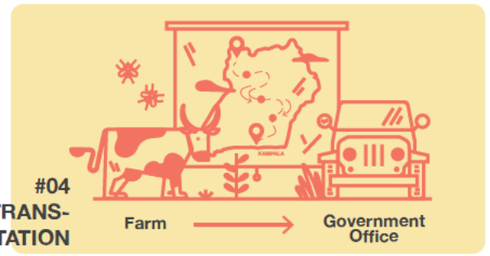
Transport: 50 to 100 USD (if the car is rented)
Gas (Diesel): 1 -30 USD
Professional fee: 25 to 45 USD
Hotel: 5 to 20 USD

#03
SCREENING

The veterinary check up the cattle by looking for signs, epistemology (own criteria) and take blood samples for further test. Generally the veterinary screens the cattle of all the village or region. They may take 100 samples per district.

6 - 8 Hours (1 day work)

Transport: 50 to 100 USD (if the car is rented)
Gas (Diesel): 1 -30 USD
Professional fee: 25 to 45 USD
Hotel: 5 to 20 USD



#04
TRANS-PORTATION

The next day after the screening, the veterinary travels back to the ministry office.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours (1 day work)

Transport: 50 to 80 USDS (if the car is rented)
Gas (Diesel): 1 -30 USD
Professional fee: 25 to 45 USD

#05
LABORATORY

The blood samples arrives to the laboratory the same day of his arrival or the next day of the field trip. The centrifugation and Giemsa test takes approximately 5 and 30 min approximately accordingly. The results delivery time depends on the work load of the laboratory.

Disadvantages: The blood sample is outdated. After 8 hours the parasites may die. In this cases, other factor is taken into consideration other cellular changes, yet the diagnosis is not precise.

1 - 2 Days

2.75 - 5 USD per sample

#06
RESULTS

If the results are positive, the ministry veterinary communicate the results to the district veterinary by a call.

#07
TRANS-PORTATION

The district veterinary travels from the district office to the affected farms.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 6 Hours

Transport: 50 to 100 USD (if the car is rented)
Gas (Diesel): 1 -30 USD
Professional fee: 25 to 45 USD (by the gov.)

#08
TREATMENT

Medicine administration is through injection. The quantity depends of the weight of the animal. It is also recommended to give complex B or appetite stimulants.

2 - 12 hours (1 day of work)

#09
PAYMENT

Even do the district veterinary is employed by the government the farmer pays for his service of administrating the medicine. Rarely, the government gives free medicine. Generally the farmers also pays for the medicine.

Professional Fee: 3 to 13 USD (by the farmer)
Medicine: 1 to 5 USD

#10
TRANS-PORTATION

The district veterinary goes back to his office.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours (Generally it takes a whole day of work)

Other disadvantages of Scenario #03:

The main disadvantage of the scenario #03 is the time loss in transportation. Transportation encompass 4 steps out of the 10 in scenario #03. This is because, firstly, the farms tend to be located in rural areas and not easily accessible. It can take at least one to two days of work to only access this remote areas. Secondly, the samples need to be sent to regional laboratories, because most of the districts do not count with diagnostic laboratories. For this reason, it is needed to go back to the main city to do a proper test of the samples. Subsequently, it is needed another trip to treat the disease if it is necessary. This back and forward to remotes areas provokes a lot of waste of time, money and resources. The veterinary could be better employed to other important task.

The second disadvantage is the delay in treatment of the animal. By the time the government acts on the complains, send a team to make diagnosis, and the animal is attended, the disease is already out of control.

In summary, the main disadvantages of Scenario #03 are:

- **The time of reaction depends of the funds:** As result of lack of budget, the government has adopted reactive rather than a proactive approach to service delivery. By the time, the government takes action the disease may be out of control.
- **The blood sample is outdated:** Most of the current used method are not sensible enough to detect the parasite. Formerly, the timing from the sample is taken to is analyze is important. After 8 hours the parasites may die. In this cases, other factor is taken into consideration other cellular changes, yet the diagnosis is not precise.
- **Lack of diagnostic services:** Generally, it is only possible to realize diagnostic test in the laboratories of the main cities. The laboratories in rural areas have a lack of equipment. This is the reason it is needed to travel long distances to the farm.
    - **Long distances:** Most areas are not easily accessible. It can take a 12 hours to acces a farm from the main city.

The approximately costs in are Scenario #03:

Government approximately costs: 589 ≈ 1,240 USD
Farmer approximately costs: 103 ≈ 513 USD
Total costs approximately: 692 ≈ 1,753 USD

*It is taken as a constant number of 100 cows to be treated in each scenario; the purpose is to keep consistent the results.

SCENARIO #04:
RESEARCH

Scenario #04 explains the journey of a research project about T. where it is needed to take samples on the field and further notify if the samples are positive or negative.

#01 PROJECT

The university or organization funds a new project for a PhD students or researcher to conduct a study about T. The researcher notifies of his visit to the local government veterinary, sub-county veterinary, and finally the village veterinary. The local veterinaries help to guide the researcher to the correct area where the farmers with disease problems are located.

#02 TRANS-PORTATION

Generally, the veterinary and an assistant travels during the afternoon to stay during the night in a guest house. The reason is to start screening as early in the morning possible, because the cattle during the day leaves for grazing.

2 - 12 hours (Generally it takes a whole day of work)

Transport: 50 to 100 dlls (if the car is rented)
Gas (Diesel): 1 -30 dlls
Professional fee: 25 to 45 dlls
Assistant fee: 25 dlls
Hotel: 5 to 20 dlls

#03 SCREENING

The veterinary check up the cattle by looking for signs, epistemology (own criteria) and take blood samples for further test. Generally the veterinary screens the cattle of all the village or region. They may take approximately 100 samples per district.

6 - 12 Hours (1 or 2 days work)

Transport: 50 to 100 dlls (if the car is rented)
Gas (Diesel): 1 -30 dlls
Professional fee: 25 to 45 dlls
Assistant fee: 25 dlls
Hotel: 5 to 20 dlls
Farmers help: 2dlls

#04 TRANS-PORTATION

The next day after the screening, the veterinary travels back to the university, where the laboratory is located.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours (1 day work)

Transport: 50 to 100 dlls (if the car is rented)
Gas (Diesel): 1 -30 dlls
Professional fee: 25 to 45 dlls
Assistant fee: 25 dlls

#05 LABORA-TORY

The blood samples arrives to the laboratory the same day of they arrival or the next day of the field trip. The centrifugation and Giemsa test takes approximately 5 and 30 min approximately accordingly. The results delivery time depends on the work load of the laboratory.

Disadvantages: The blood sample is outdated. After 8 hours the parasites may die. In this cases, other factor are taken into consideration other cellular changes, yet the diagnosis is not precise.

1 - 2 Days

2.75 - 5 dlls per sample

#06 CONTACT

If the results are positive, the researcher communicate the results to the district veterinary.

#07 TRANS-PORTATION

The district veterinary travels from the district office to the affected farms.

Disadvatages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 6 Hours

Transport: 50 to 100 dlls (if the car is rented)
Gas (Diesel): 1 -30 dlls
Professional fee: 25 to 45 dlls (by the gov.)

#08 TREATMENT

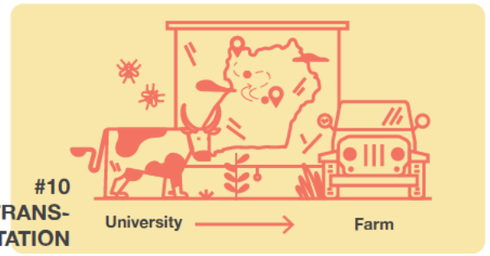
Medicine administration is through injection. The quantity depends of the weight of the animal. It is also recommended to give complex B or appetite stimulants.

2 - 12 hours (1 day of work)

#09
PAYMENT

Even do the district veterinary is employed by the government the farmer pays for his service of administrating the medicine. Rarely, the government gives free medicine. Generally the farmers also pays for the medicine.

Professional Fee: 3 to 13 dlls (by the farmer)
Medicine: 1 to 5 dlls



#10
TRANS-
PORTATION

The district veterinary goes back to his office.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours (Generally it takes a whole day of work)

Other disadvantages of Scenario #04:

The main disadvantages of scenario #04 are the same ones as in scenario #03; their is a lot of time loss in transportation and a delay on taking action to control the disease.

In summary, the main disadvantages of Scenario #04 are:

- **Lack of diagnostic services:** Generally, it is only possible to realize diagnostic test in the laboratories of the main cities. The laboratories in rural areas have a lack of equipment. This is the reason it is needed to travel long distances to the farm.
    - **Long distances:** Most areas are not easily accessible. It can take a 12 hours to acces a farm from the main city.

The approximately costs in are Scenario #04:

Research approximately costs: 489 ≈ 1,142 USD
Government approximately costs: 76 ≈ 175 USD
Farmer approximately costs: 103 ≈ 513 USD
Total costs approximately: 668 ≈ 1,830 USD

* It is taken as a constant number of 100 cows to be treated in each scenario; the purpose is to keep consistent the results.

SCENARIO #05: RESEARCH

Scenario #05 describes the services of the new company Uganda Meat Producers Cooperative Union Ltd. (UMPCU). This company posses the only two private laboratories in the country builted six months ago.

#01
REGISTRA-
TION

A farmer needs to have certain requirements and fill an application form to apply to become a member of UMPCU. Certain requirements are to have a minimum of 5 cows, and his core activity should be livestock, between others.

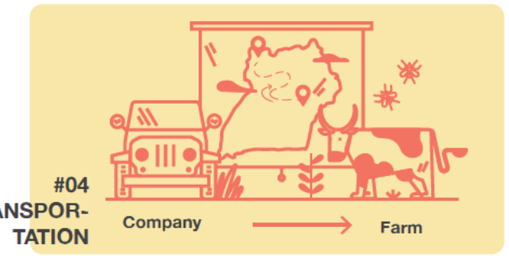
#02
MEMBER-
SHIP

When the farmer is accepted to be a member of the society, he need to pay an annual fee. To be a member includes the services of vaccination, screening two times a year, medicine, and further assistance in the process of producing and selling meat.

Membership: 9 dlls per cow annually. A mimimum 45 dlls per year for five cows.

#03
APP
CONTACT

Once the farmer is a member, a veterinary from the company visits his farm two times the year to do screening of several diseases. The veterinary arrange the visit through an app that the farmer also posses.



#04
TRANSPOR-
TATION

A veterinary, from the region, travels to the farm with his own resources to travel to the farm. The app is helpful to guide him to the farm.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours

Transport: 50 to 80 dlls (if the car is rented)
Professional fee: 25 to 45 dlls per day

#05 SCREENING

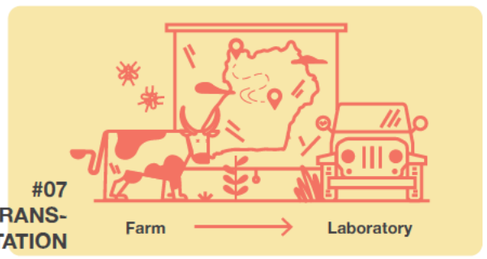
The veterinary check up the cattle by looking for signs, epistemology (own criteria) and take blood samples for further test of different diseases. Also, he does vaccination of the cattle.

1 - 8 hous (depends of the number of cattle)

#06 REGISTER VISIT

The farmer and the veterinary register the visit and actions done in the app. Although in many areas is not possible to reach mobile internet, the app is designed to work offline and upload the data when there is internet.

#07 TRANS-PORTATION



The district veterinary travels from the farm to the nearest laboratory to leave the samples.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 6 Hours

Transport: 50 to 80 dlls (if the car is rented)

#08 LABORA-TORY

The blood samples arrives the same day or next, depending of the location. The centrifugation and Giemsa test takes approximately 5 and 30 min approximately accordingly. The results delivery time depends on the work load of the laboratory.

Disadvantages: The blood sample is outdated. After 8 hours the parasites may die. In this cases, other factor are taken into consideration other cellular changes, yet the diagnosis is not precise.

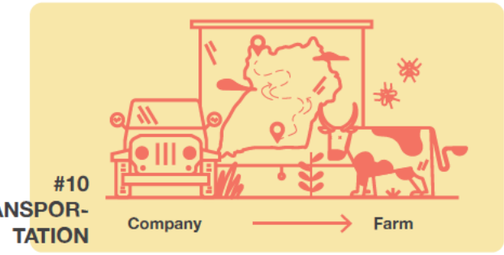
2 - 12 hours (1 day of work, and depends on the amount of samples)

2.75 - 5 dlls per sample

#09 RESULTS

The lab results are uploaded to the app. It notifies the veterinaries that there is an activity

#10 TRANSPOR-TATION



The same veterinary or another veterinary from the company goes to the farm with disease problems.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours

Transport: 50 to 80 dlls (if the car is rented)
Professional fee: 25 to 45 dlls per day

#11 TREATMENT

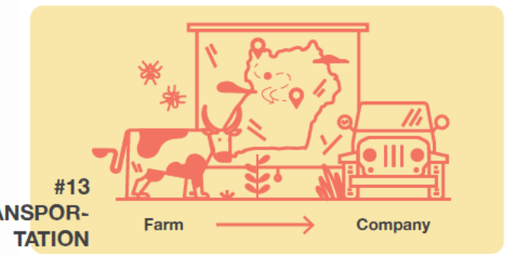
Medicine administration is through injection. The quantity depends of the weight of the animal.

Medicine: 1 to 5 dlls

#12 REGISTER VISIT

The farmer and the veterinary register the visit and actions done in the app.

#13 TRANSPOR-TATION



The veterinary goes to the next farm or to the company, if it is needed.

Other disadvantages of Scenario #05:

In scenario #05, the main disadvantage is the same one as in scenario #04 and #03; their is a major time loss in transportation. However, this scenario does not have the problem of delay in taking action. The company has a proactive approach to do screening two times the year. As well, the company is using technology to diminish the time of respond.

In summary, the main disadvantages of Scenario #05 are:

• **Long distances:** Most areas are not easily accessible. It can take a 12 hours to acces a farm from the main city.

The approximately costs in are Scenario #05:

Company approximately costs: 425 ≈ 1,090USD

Farmer approximately costs: 900 USD

* It is taken as a constant number of 100 cows to be treated in each scenario; the purpose is to keep consistent the results.
* It was not taken in consideration the car as veterinarians count with their own car; they do not rent cars.
* It was not count in the total costs the farmer, as he is paying for a service, not adding to the cost of diagnostic.

2.2.4: CONCLUSIONS OF THE CUSTOMER JOURNEYS

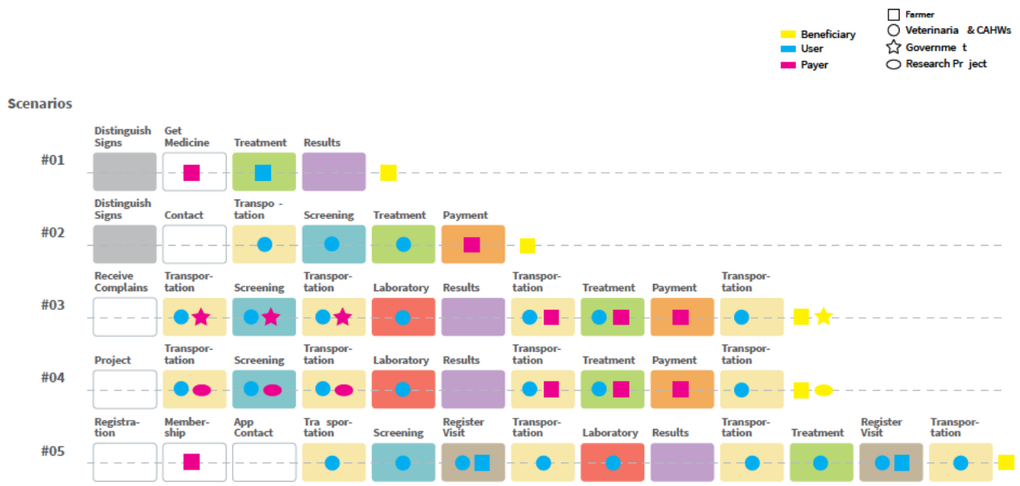


Figure 06: Visual summary of the different customer journeys.

It was made a summary of all the customer journeys and visualized in Figure #06. The first insights possible to noticeable from the chart are:

• Scenario #01 and #02 the journey is shorter. This is because these journeys do not perform a proper diagnostic.

• The color pale yellow (transportation) is the most repetitive color in the chart. Also, is the only color that repeats twice during a journey.

• In scenario #03 and #04 is visible that the first half of the journey, which involves the diagnosis, is pay by an institution. The second half of the journey, which is involves treatment, is pay by the farmer.

• The beneficiary is always the farmer.

• The veterinary or CAHWs is always the actor who performs the screening.

In conclusion, in every customer journey was detected different challenges during the diagnostic practices, such as: limited qualified staff, lack of diagnostic services, long distances, between others. It is possible to help tackle some of these challenges with the diagnostic device of Aidx Medical BV. In addition, it was detected different actors in the customer journey. The farmer will always be the beneficiary, and he pays for the treatment. The government or research institution is the paying customer for the diagnosis. Another actor is the user of the device, this is always by a veterinarian or CAHWs.

Interview Notes

SECTION III:
PROJECT FOCUS

This device has the potential to be used in low or high resource settings. Introducing this device which is suitable for the field is a highly promising alternative to current diagnostic procedures. However, there is a lack of understanding about how the business is going to create and deliver the value to the customers. Therefore, the focus of this project is on getting a more in-depth understanding of the context of T. in SSA countries, which will help to find promising ways to integrate this product into the current market.

3.1.1: Research Problem

The aim of this project is assessed to how to bring a new diagnostic device successfully to the SSA market.

3.1.2: Research Objectives

Four main objectives where defined from the research problem. The objectives are complemented with questions to answer. Answering these questions will give insights to answer the objectives.

***Objective #01**: Identify who would is our customer segment, the user and the beneficiary.*

> ***Q1:** Who is our customer segment?*
> ***Q2:** What is the size of our market?*

To answer this research question, it is essential to understand not only the disease and the processes to attack it but the actors who are involved in the case management of AAT. From there, it is required to make a thoughtful decision about which segment to serve and which segment to ignore. Once this decision is made, a business model can be designed around a strong understanding of a specific customer needs.

***Objective #02:** Understand how to reach our customer segment.*

> ***Q1:** Through which channels do will reach our customer segment?*
> ***Q2:** Which resources do we need to reach our customer segment?*
> ***Q3:** How will we make the customer aware of the new product?*

It is imperative for a successful business to understand the most effective ways of reaching our prospects. Finding the right channel to satisfy how customers want to be reached is crucial in bringing a Value Proposition to market. Channels have five distinct phases: awareness, evaluation, purchase, delivery, and after sales.

***Objective #03:** Understand the budget possibilities of the target market.*

> ***Q1:** What is the budget of the target market?*
> ***Q2:** How will we make money?*

To answer this research question, it is important to understand for what value is our customer segment willing and conceivable to pay? It is possible to use different pricing models depending of the customer segment taking in consideration their low or high resources restrictions.

***Objective #04:** Identify the best strategies to enter to the market.*

> ***Q1:** What are the best strategies to enter an international market?*
> ***Q2:** What is the vision and aim of the company?*
> ***Q3:** What are the strengths and weaknesses of the company?*

To answer this research question, it is essential to understand the most promising strategy for a successful market entry, according to the capabilities and possibilities of the company.

03

CHAPTER:
GENERATE IDEAS

Section 4: Ideation of Scenarios

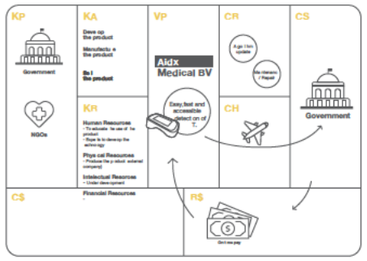
Section 5: New Scenario

This chapter has the function of getting an understanding of the context of the users involved in Animal African Trypanosomiasis in the endemic areas in Sub-Saharan countries.

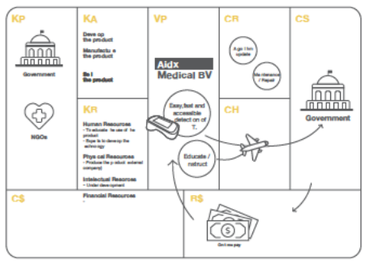
SECTION IV:
IDEATION OF SCENARIO

There are multiple ways to bring to the market the diagnostic device. Therefore, several business model prototypes were created during a 1.5 hours session with the students of IDE.

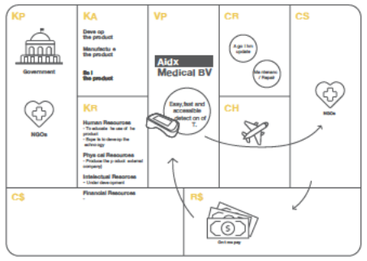
Each scenario represents a unique way of combing the different actors involved in the context of diagnostic of T. It is important to emphasize that the customer is the actor who purchase and pays for the device; it is not necessarily the actor who use the device neither the one who benefits. The second element taken into consideration are the different benefits that the company, Aidx Medical BV, can offer as a value proposition. Next is a short description of the several business model prototypes created:



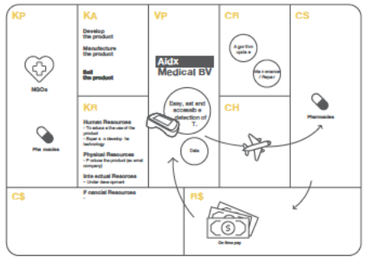
Business Model Prototype #01
The first idea is that the company offers as a value proposition easy and fast diagnostic with a portable device of trypanosomiasis. The target customer segment will be the government, and the revenue would by asset sale.



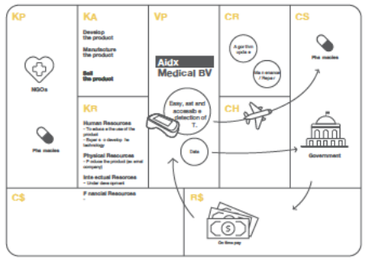
Business Model Prototype #02
The second prototype is similar to the first prototype; the difference is an added value proposition. The company can offer workshops where can educate and instruct about the use of the device.



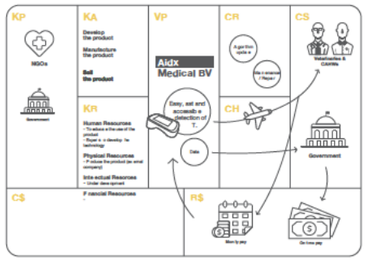
Business Model Prototype #03
The third idea prototyped is that the customer segment are NGO's related to the subject of eradication of Trypanosomiasis. The value proposition is easy, fast and portable diagnostic device of trypanosomiasis.



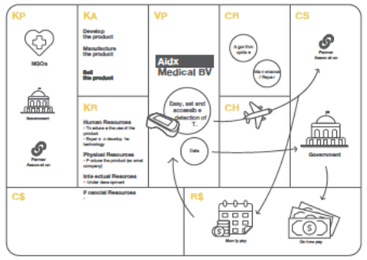
Business Model Prototype #04
The fourth prototype is to sell the diagnostic device to the pharmacies. The reason is that the pharmacies are in constant contact with the actor who benefits and who use it. The pharmacies can benefit by charging for the service of diagnostic and also sell the consumables and medicines. Furthermore, the pharmacies can also sell the data recollected from their service to the government or other NGOs.



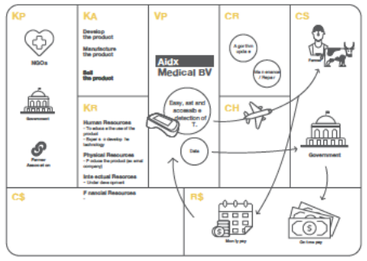
Business Model Prototype #05
The next idea has two different customer segments, acquiring different value propositions. The first customer will be the pharmacies. It is a possibility that the price of the device is higher than the monetary possibilities of the pharmacy. Therefore, the revenue stream may be by the monthly rent of the device to the pharmacies, where the pharmacies can benefit from this device by offering the service of diagnostic of T and selling consumables. The data acquired from the rent later can be sold to the government or ONGs interested.



Business Model Prototype #06
The sixth prototype has two different customer segments, acquiring different value propositions. The customer segment will be veterinarians and CAHWs. The revenue stream will be through the rent of the device, so it is possible to afford it. The data acquired from the rent later can be sold to the government or ONGs interested on the disease.



Business Model Prototype #07
The seventh prototype has two different customer segments, acquiring different value propositions. This prototype comes from the idea to empower the actor who benefits from the device, the farmers. From the interviews, it was discovered that there are several farmers who have basic knowledge on animal health care. The customer segment will be farmers association; therefore, several farmers can afford the device. The revenue stream will be through the rent of the device. The data acquired from the rent later can be sold to the government or ONGs interested on the disease.



Business Model Prototype #08
The last prototype is similar to the seventh, with the different of the customer segment. The target customer segment would be large scale & sedentary farmers, who may afford the rent of the device.

4.1 HYPOTHESIS

Following, business model hypotheses were made. These hypotheses are the assumptions that must be tested and validated.

Business Model Prototype #01

Hypothesis #1.1: Is the government interested in the value proposition?
Hypothesis #1.2: What is an acceptable price? What an expensive price? What is a prohibitive price for this device?
Hypothesis #1.3: Do the government have the budget destinated to buy a new diagnostic device on the market?

Business Model Prototype #02

Hypothesis #2.1: Is the government interested to hire a company to give workshops?

Business Model Prototype #03

Hypothesis #3.1: Is the NGOs interested in the value proposition?
Hypothesis #3.2: What is an acceptable price? What an expensive price? What is a prohibitive price for this device?

Business Model Prototype #04

Hypothesis #4.1: Are the pharmacies interested in the value proposition?
Hypothesis #4.2: Do the pharmacies have the channels to offer the benefits of the value proposition?
Hypothesis #4.3: Does the pharmacies have the possibilities to sell or use the data?
Hypothesis #4.3: Do the pharmacies have the budget to buy a new diagnostic device on the market?

Business Model Prototype #05

Hypothesis #5.1: Are the pharmacies interested in the value proposition?
Hypothesis #5.2: Does the pharmacies have the channels to offer the benefits of the value proposition?
Hypothesis #5.3: Is the pharmacy open to rent the device?
Hypothesis #5.4: What is the payment method that best suits the pharmacies?

Business Model Prototype #06

Hypothesis #6.1: What is the market size of this customer segment?
Hypothesis #6.2: What is an acceptable price? What is an expensive price? What is a prohibitive price for this device?
Hypothesis #6.3: What are the resources needed to create a system for monthly charge?
Hypothesis #6.4: Does the customer count with credit cards?

Business Model Prototype #07

Hypothesis #7.1: What is the market size of this customer segment?
Hypothesis #7.2: What is an acceptable price, and what an expensive price and which a prohibitive price for this device?
Hypothesis #7.3: What are the resources needed to create a system for monthly charge?
Hypothesis #7.4: Does the customer count with credit cards?

Business Model Prototype #08

Hypothesis #8.1: What is the market size of this customer segment?
Hypothesis #8.2: What is an acceptable price? What an expensive price? What is a prohibitive price for this device?
Hypothesis #8.3: What are the resources needed to create a system for monthly charge?
Hypothesis #8.4: Does the customer count with credit cards?

4.2 TEST OF HYPOTHESIS

The next step was to test and validates these hypotheses. A two-week field trip was made to Kampala, Uganda to interview the different actors in the diagnostic of T. The interview was divided in two sections. The first section was the validation of the scenarios presented in section 2.2.3. The second section was to fill a Distribution Channel Framework. This framework asks about past experiences acquiring devices through the five channels phases: awareness, evaluation, purchase, delivery and after sales. According to "The Mom test" by Rob Fitzpatrick is recommendable to ask about specific situations about the past, instead of generics and opinions about the future.

Currently in Uganda, the goods used in animal health services can be divided in two broad categories: drugs (medicine) and devices. These two categories have a different paths during the distribution channel. Next, it is going to be presented the distribution channel for animal drugs; subsequently, it is described the distribution channel of laboratories devices.

4.2.1 DRUG DISTRIBUTION CHANNELS

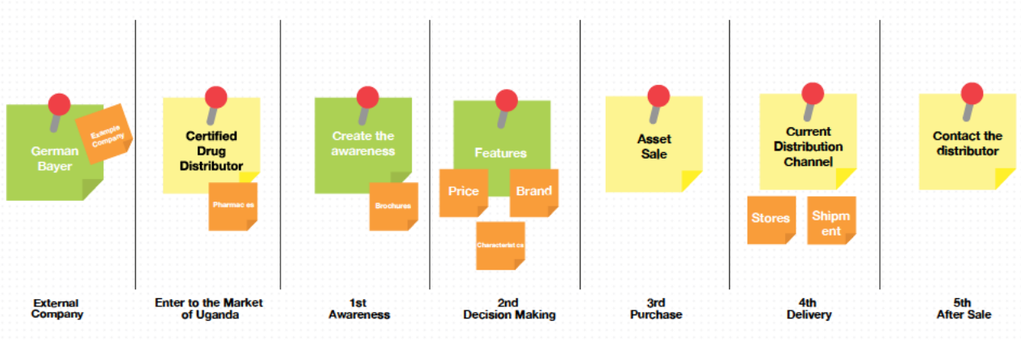


Figure 07: Example Distribution Channel for Drugs

Generally, when an international drug company, for example German Bayer, wants to enter to the market in Uganda, the company gets a certified drug distributor. The certified drug distributor functions as an intermediary. Usually the drugs intermediaries are chain pharmacies already stablished on the market. The intermediary is in charge of the whole distribution process. The intermediary creates awareness through their existing contacts, afterwards the clients will decide to buy conditional of the features. The three more important features for the customer are: first that all needed characteristics are fulfilled. The second most important characteristic is the price, which is accessible or cheaper than competitors. The third characteristic is brand, if the drugs have the same characteristics and price, the customer will buy from the strongest brand. The next channel is purchase, which is always an asset sale. The following channel is delivery of the product; usually the intermediary, pharmacies, have stores distributed through Uganda or some pharmacies also count with rural distributors that move from town to town. The last channel, after sale, the intermediary is responsible for any complain or further clarification.

4.2.2 DEVICE DISTRIBUTION CHANNELS

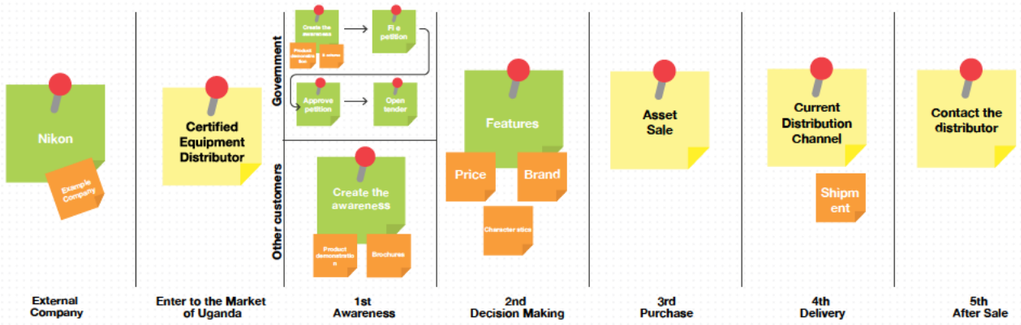


Figure 08: Example Distribution Channel for Medical Devices

The distribution channel of medical or diagnostic devices is comparable to the drug distribution channel, with the main difference of a client, the government. Therefore, when an international company wants to enter to the market, for example Nikon, the company gets a certified equipment distributor. The certified device distributor functions as an intermediary in the foreign country. The intermediary creates awareness through their existing contacts, generally through brochures and product demonstrations. If the customer is the government, it takes months to past from the first distribution channel to the second distribution channel. This is cause, the government has established procedures in the purchase of goods. First, the person in the government, who is presented the product, needs to file a petition. When the petition is approved as the budget for the next quarter, the government opens a tender. Several suppliers respond with to the invitation to tender.

The next channel is decision making, which the government and other customers take into consideration the same features: characteristics, price and brand. The next channel is purchase, which is always an asset sale. The following channel is delivery of the product. Usually, as medical devices are an specialize product there are no stores; the intermediary sends the product to the client. And the last channel, after sale, the intermediary is responsible for any complain or further clarification.

In conclusion, international companies usually enter to the market through intermediaries, who take responsibility of the whole process of distribution of the goods. This method makes it easier for international companies to enter to a new country without the need of a big investment or knowledge on the market.

4.2.3 CUSTOMERS SEGMENT

During the interviews, the experts mention the next possible customer segments that are interested on the device and had previously purchased diagnostic devices. It was taken as an example the microscope, in the questionnaire. The list is in order from the biggest to lesser buyer of microscopes.

Government

As mentioned before, in the late 1980s, the government of Uganda adopted structural adjustments. The results were the privatization of veterinary services, such as clinical services, breeding and spraying for tick control. Since the structural adjustment, the government has been and remains the largest employer in veterinary services delivery although private practice is encouraged (Nicholas, 2019).

Furthermore, according to the Veterinary Surgeons Act 1958 (VSA), private veterinarian practice can only be performed by registered and licensed persons. It will be criminalized practices by unregistered or un-licensed persons. There is one exception to this rule, according to the section 24 of the VSA, nothing in this Act shall be deemed to prohibit or prevent the practice of veterinary surgery by any person in the service of the government (Government Gazette, 1959). This makes the government the main buyer of diagnostic tools.

NGOs

There are several NGOs that had funded the programs for the control and elimination of African T in Uganda. The role of the NGOs in these programs is to sponsor and help by providing training, assistance and tools to control and eliminate the disease (Dargie, 2015). Some of these NGOs are: Food and Agriculture Organization of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the Inter-African Bureau for Animal Resources of the African Union (AU-IBAR), the World Health Organization (WHO), between others. Therefore, NGOs is the second main buyer of tools for the control and elimination of African T.

Private companies

Private laboratories in Uganda are uncommon, however private practice is starting to grow in the country. Last year, UMPCU open the first two private laboratories in Uganda, and it is expected to open more because of the high demand. As well, it is expected in the future to have competitors.

University

Makerere University is the only university in Uganda that offers veterinarians studies. As well, the veterinarian university counts with a laboratory that offers the service of diagnostic to the public. Therefore, the university has previously acquired several microscopes for their laboratory.

Veterinary and CAHWs

There are several veterinarians and CAHWs that offer private services of animal health. However, it is uncommon that the veterinarians or CAHWs buy sophisticated devices. The standard tools for veterinarians on the field are stethoscope, speculums, ear syringes, dehorners, surgical clamps, between other. This equipment designed specifically for animals, and the tools may differ between veterinarians or CAHWs. Normally veterinarians and CAHWs do not buy microscope for their private practice; generally, the animal is diagnosed according to their clinical symptoms.

Farmers associations or large-scale farmers
In Uganda, there are over 90 independent associations of farmers. The aim of farmers associations is to join efforts between several farmers to solve issues in livestock and complementary livelihood resources development. This includes the maintenance or purchase of equipment or facilities like crush pens. It is not possible for small-holders to afford a device, however it would be possible for an association with the join budget of several farmers. It is also possible for large-scale farmers, as they have a greater revenue.

To conclude, there are several possible customer segments that differs in economical possibilities and market size. These elements will be taken into consideration in the selection of a customer segment.

SECTION V:
NEW SCENARIO

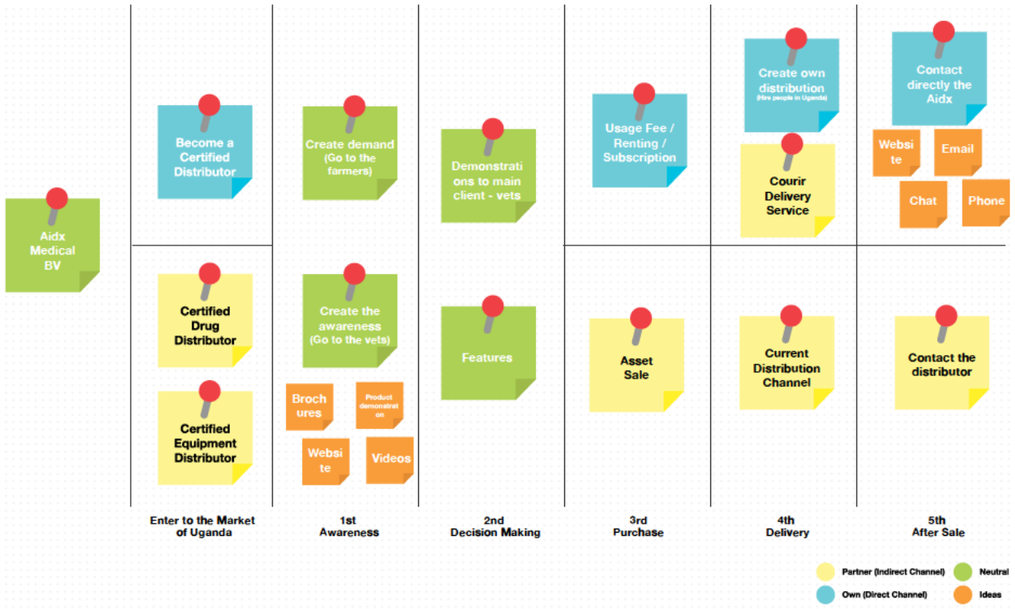


Figure 09: Possibilities of Distribution Channel for Aidx Medical BV

Taking into consideration the information gained during the interviews, it is possible to take two directions when entering to the Uganda market, as in Figure #09. Aidx Medical BV can either decide to create their own distribution channel or get an intermediary. This decision will help to define several elements of the business model.

5.1 COMPANY'S SWOT

To determine the best direction for the company, it was used the SWOT analysis to compare the current situation. Presently, the competition is the current method of screening and diagnosis that it is made through microscope and professionals. The second competition is a company developing a portable and disposable T. test.

The SWOT analysis allows to identify the forces that influence a strategy and is used as support when making business-critical decisions. Next, it is presented the SWOT analysis of Aidx Medical BV.

Veterinary Laboratory at Makerere University

S

• **Innovative:** the startup is creating an innovative product that bring unique value to the customer.

• **Technology:** The start-up has developed a technology for the detection parasites that can be applicable in different market sectors.

• **Agility:** Startups are young and formless for the first couple of years. This agility comes in handy when something disrupts the industry, such as a new technological development or an even newer competitor.

• **Team Chemistry:** In a startup everybody will be working so closely together on work that matters to all of you that you'll have a natural chemistry in your working relationships.

• **Less Bureaucracy:** In large corporations there are rules surrounding everything. In essence, the gears of bureaucracy slow everything to a crawl and formalize processes that never needed formalizing in the first place. Startups can make decisions faster and work more efficiently because of it.

• **Fresh Culture:** Workers at startups often seek a human approach to space, rather than a cold setting.

• **Access to Free Talent:** The start of this company was from a project's university. The company still has a strong bond and support from the university, where many students have developed projects for the company.

• **Partnerships:** Create a parentship with an intermediary who has the contact, knowledge and experience where the company is lacking.

O

• **Learning:** Fail, learn and iterate at the speed of light which gives startups an unfair advantage. The ability to learn fast is an opportunity every startup exploit.

• **Early Entrant:** It is the first one on the market to offer this technology or similar product.

• **Trend:** The global animal health market size was valued at USD 44.74 billion in 2018. The market is largely driven by a significant rise in the zoonotic and food-borne diseases globally (Grand View Research, Inc., 2019).

• **Fragility:** a startup can implode anytime due to lack of funding, a founder dispute, losing interest in the idea or other reasons.

• **Cash Balance:** The lack of financial resources and revenue is one of the most frequent reasons startups fail.

• **Hardship:** startups are hard on everyone given the daily grind and major obstacles that every successful entrepreneur most endure.

W

• **Lack of Reputation:** as the startup they haven't establish themselves as a reputable question quality product provider

• **No Name:** The veterinarian community in Uganda is a closed community, where everybody knows each other already from their studies. As a startup needs to figure out a enter way to open up doors and for some, this can be more challenging than people already in the market.

• **No Structural Organization:** The company doesn't count with department, this means no shipping department, no marketing, sales, human resources, accounting.

• **No Distribution Experience:** a startup does not have previous experience distributing to SSA countries, and the company does not have the knowledge of the implications and costs of delivering the product in distant rural areas.

• **Competition:** There is a company called GALV med, who is developing a disposable field test for animal T.
Current methods: Another competition may be the use of the current methods.

• **Piracy of your products:** A startup may have the problem of an external company plagiarize the idea.

• Customers lack of knowledge about the product

T

In conclusion, the company counts with positive attributes as being dynamic, agile, solid teamwork and a strong innovative product. However, the star-ups also have the difficulties that it doesn't have previous experience in distribution, neither abundant financial resources.

04

CHAPTER:
PREPARE FOR ACTION

Section 6: Business Model Canvas
Section 7: International Market Entry
Section 8: 4Ps Marketing Mix

In this chapter, the selected scenario from the previous chapter is described in detail. Also, it is described the market entry strategy.

The Business Model Canvas

Designed for: Aidx Medical BV

Designed by: PM

On: Day / Month / Year

Iteration: No

Key Partners

Who are our Key Partners?
Who are our key suppliers?
Which Key Resources are we acquiring from partners?
Which Key Activities do partners perform?

MOTIVATIONS FOR PARTNERSHIPS
Optimization and economy
Reduction of risk and uncertainty
Acquisition of particular resources and activities

TU Delft
Goverment
ONG (FAO)
Certified Equipment Distributor
Material Supplier

Key Activities

What Key Activities do our Value Pro
Our Distribution Channels?
Customer Relationships?
Revenue streams?

CATEGORIES
Production
Problem Solving
Platform/Network

Development of Technology
Manufacture of Device
Sales

Key Resources

o our Value Propositions req
mer Relati

Finances Resources
Manufacture Equipment
Technology
R&D Team

Value Propositions

What value do we deliver to the customer?
Which one of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each Customer Segment?
Which customer needs are we satisfying?

CHARACTERISTICS
Newness
Performance
Customization
"Getting the Job Done"
Design
Brand/Status
Price
Cost Reduction
Risk Reduction
Accessibility
Convenience/Usability

For the government who struggle to offer health veterinary services, our product is a diagnostic device for the endemic disease T that an unprofessional person can do a rapid, reliable diagnosis on the field.

Test Reliability
Limited qualified staff
Lack of diagnostic services
Expensive Treatment Journey

Customer Relationships

What type of relationship does each of our Customer Segments expect us to establish and maintain with them?
Which ones have we established?
How are they integrated with the rest of our business model?
How costly are they?

EXAMPLES
Personal assistance
Dedicated Personal Assistance
Self Service
Automated Services
Communities
Co creation

Personal Assistance

Channels

Through which Channels do our Customer Segments want to be reached?
How are we reaching them now?
How are our Channels integrated?
Which ones work best?
Which ones are most cost-efficient?
How are we integrating them with customer routines?

CHANNEL PHASES
1. *Awareness*
2. *Evaluation*
3. *Purchase*
4. *Delivery*
5. *After sales*

Intermediary
Certified Equipment Distributor

Customer Segments

For whom are we creating value?
Who are our most important customers?

Mass Market
Niche Market
Segmented
Diversified
Multi sided Platform

Niche Market
Goverment
ONGs

Cost Structure

What are the most important costs inherent in our business model?
Which Key Resources are most expensive?
Which Key Activities are most expensive?

IS YOUR BUSINESS MORE
Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing)
Value Driven (focused on value creation, premium value proposition)

SAMPLE CHARACTERISTICS
Fixed Costs (salaries, rents, utilities)
Variable costs
Economies of scale
Economies of scope

Revenue Streams

For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each Revenue Stream contribute to overall revenues?

TYPES
Asset sale
Usage fee
Subscription Fees
Lending/Renting/Leasing
Licensing
Brokerage fees
Advertising

FIXED PRICING
List Price
Product feature dependent
Customer segment dependent
Volume dependent

DYNAMIC PRICING
Negotiation (bargaining)
Yield Management
Real time Market

Asset Sale

SECTION 6:
BUSINESS MODEL CANVAS

In this section, it is described in detail the business canvas model of Aidx Medical BV.

6.1 CUSTOMER SEGMENTS

The diagnostic device is in the niche market of veterinarian health services. There are several possible customers, such as: private companies, private veterinarians or CAHWs or NGOs. However, the first customer to target will be the government. The government will be the paying customer, the user will be the governmental veterinaries and the beneficiary will be the farmer.

The main reason is that the government has been and remains the largest employer in veterinary services delivery although private practice is encouraged (Nicholas, 2019).

The second customer segment should be NGOs. As commented before, NGOs are the ones sponsorship tools, training, and assistance. The NGOs are a suitable customer segment, as they count with the financial possibilities and a big market.

6.2 VALUE PROPOSITION

For the government who struggle to offer health veterinary services, our product is a diagnostic device for the endemic disease AAT that an unprofessional person can do a rapid, reliable diagnosis on the field.

The main elements that Aidx Medical BV is offering is:

- **Newness**

The diagnostic device possesses an optical smart parasite detection technique using automated smart algorithms; this technology makes possible to give an automatic diagnosis. There is no similar product in the market. In addition, it offers the possibility to record data about each clinical case and geography.

- **Performance**

According to the test, the device is 30 more sensible and 20 times faster than the current tests.

- **Cost Reduction**

Due to the portability of the device is not necessary to make the transportation of the blood samples to the diagnostic laboratory of the main cities. This eliminates cost and time in transportation. It reduces by approximately 25% of costs of scenario #03. As well, it is possible to hire a less skilled person to perfume the screening of the cattle, as the device offer an automatic diagnosis.

- **Convenience/Usability**

The diagnostic device is a portable size and rechargeable ideal for the field.

6.2.1 SOLUTION TO CUSTOMERS PROBLEMS

The main problems of the customer comprise:

- **Test Reliability**

The diagnostic device offers a higher sensitive compared to the current laboratory tests. In addition, the device eliminates the possibility of human error through an automated smart algorithm.

- **Lack of Diagnostic Services**

The diagnostic device is designed to be portable, thus it is possible to offer the same service of diagnosis of T. as stationary laboratory. Furthermore, it eliminates the need to transport the samples from the farm to the laboratory of the main cities, doing the process more efficient in time and resources.

- **Limited Qualified Staff**

As previously mentioned, the diagnostic device offers a diagnostic through an automated smart algorithm. This eliminates the need of qualified staff, such as laboratory scientist of a veterinary. However, it is required basic knowledge of blood sample collection and preparation, which can be done by CAHWs or trained farmers.

- **Expensive Treatment Journey**

According to the Scenario #03, the government expends approximately between 589 to 1,240 USD every time the government go through the process of diagnose and treat the disease of T. A future scenario was created to count minimum and maximum costs with the advantage of the diagnostic device. The results were around 346 to 1,078 USD; this is approximately 50% to 38.5% cheaper.

FUTURE SCENARIO: GOVERNMENT

Future Scenario describes the respond from the government to control the disease of T. envisioning the use of the diagnostic device of Aidx Medical BV.

#01 RECEIVE COMPLAINS

The districts send complains to the ministry. The district, depending on the amount and type of complains, sends a veterinary. The veterinary notifies of his visit to the local government, county, and village veterinary. The local veterinaries help to guide the veterinary to the correct area where the farmers with disease problems are located.

Disadvantages: The time of reaction depends of the funds. As result of lack of budget the government has adopted reactive rather than a proactive approach to service delivery.

3 - 6 Months

#02 TRANS-PORTATION

Generally, the veterinary travels during the afternoon to stay during the night in a guest house. The reason is to start screening as early in the morning possible, because the cattle during the day leaves for grazing.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours (Generally it takes a whole day of work)

Transport: 50 to 100 USD (if the car is rented)
Gas (Diesel): 1 -30 USD
Professional fee: 25 to 45 USD
Hotel: 5 to 20 USD

#03 SCREENING

The veterinary check up the cattle by looking for signs, epistemology (own criteria) and take blood samples for further test. Generally the veterinary screens the cattle of all the village or region. They may take 100 samples per district.

6 - 8 Hours (1 day work)

Transport: 50 to 100 USD (if the car is rented)
Gas (Diesel): 1 -30 USD
Professional fee: 25 to 45 USD
Hotel: 5 to 20 USD

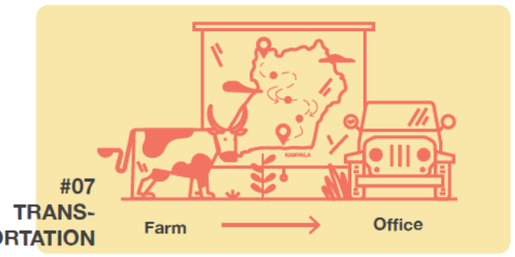
#04 TEST

After the screening, the veterinary can use Aidx Medical BV device to test the blood for T. parasites. If the results are positive, the cattle is treated.

Medicine administration is through injection. The quantity depends of the weight of the animal.

Even do the district veterinary is employed by the government the farmer pays for his service of administrating the medicine. Rarely, the government gives free medicine. Generally the farmers also pays for the medicine.

Professional Fee: 3 to 13 dlls (by the farmer)
Medicine: 1 to 5 dlls



The next day after the screening, the veterinary travels back to the ministry office.

Disadvantages: Long distances. Most areas are not easily accessible. It takes a lot of time and resources.

2 - 12 hours (1 day work)

Transport: 50 to 100 USDS (if the car is rented)
Gas (Diesel): 1 -30 dlls
Professional fee: 25 to 45 USD

The approximately costs on future scenario:

Government approximately costs: 243 ≈ 565 USD
Farmer approximately costs: 103 ≈ 513 USD
Total costs approximately: 346 ≈ 1,078 USD

This costs are around **50% ≈ 38.5% less** than the scenario #03.

Considerations:
• It is taken as a constant number of 100 cows to be treated in each scenario; the purpose is to keep consistent the results.
• It is possible to employ CAHWs or trained farmers to do the screening and medicine administration. This can lower the professional fee.

Channel Types		Channel Phases				
Partner		1. Awareness	2. Evaluation	3. Purchase	4. Delivery	5. After sales
Indirect	Certified Equipment Distributor	Create awareness in the governmental institutions and government veterinaries	Product demonstration Features	Asset sale	Current distribution channel by the certified equipment distributor	Contact directly the company Aidx Medical BV

Figure 10: Proposed Distribution Channel for Aidx Medical BV

6.3 CHANNELS

The company decided to distribute their product through an intermediary, because it is low-cost strategy to expand sales in other countries. In addition, the company has the aim to focus on the development of other medical diagnostic tools.

Generally, distributors have the knowledge, connections and resources needed to access buyers in a specific region. The government is the main target customer; it is more promising to partner with an equipment distributor, as the government is the owner of most of the veterinarian laboratories since the structural adjustment in the late 1980s.

Next, it will be described the channel phases:

6.3.1 Awareness

The device is a new innovation, for this reason is necessary to create awareness to governmental institutions, veterinaries from the government and NGOs. This will be through a demo, where a product is demonstrated to potential customers. It is important that the customer is able to see and test the product to build acceptance and trust. This is important, because during the interviews with expert there was a lot of skepticism about the quality and sensibility of the device. In addition, demos help tackling user problems is easier during a demo and effective problem solving helps in confirming the sale.
The demos would be through two events:

By-appointment: Scheduling a meeting with the government institutions in charge of veterinary health services and trypanosomiasis, like Uganda Veterinary Association (UVA), Coordinating Office for Control of Trypanosomiasis in Uganda (COCTU), and FAO.

Trade Show: There is the 14th Annual National Internal Audit Conference 2019 in Kampala, where is possible to present the diagnostic device.

During the awareness channel, it is necessary to prepare promotional material for the intermediary. This can be a brochure, website, videos of use and presentation cards.

6.3.2 Evaluationd

The main three features that the government evaluates on the purchase of new equipment are:

1. Features: The equipment needs to fulfill all the requirements needed. For example, trypanosome is preferable detected with a microscope of X1000.

2. Price: A range of price which is feasible to buy.

3. Brand: If the device to buy has all the requirements, and similar price, the third feature will be to decided according to a recognizable brand.

6.3.3 Purchase

The only method of purchase from the government is asset purchase.

6.3.4 Delivery

The delivery will be through the existing channels of the intermediary. However, as the government is the main target customer; the intermediary will deliver the product to the government, and the government will be in charge to send it to users, governmental veterinarians.

6.3.4 After Sale

After-sale services such as installation, training, parts and repair access have been recognized as basic requirements for purchasers of industrial equipment (Anell & Wilson, 2002). A company may either supply the services itself, or it can supply them through the

intermediary. Aidx Medical BV wants to manage the after sale in the area of complains or repairs. This is because they have the benefit of having records of their customers and end users complains and opinions about the product. The best way to offer this service would be through email, website chat and even WhatsApp. WhatsApp is a very popular method of contact in Uganda.

6.4 CUSTOMER RELATIONSHIP

The relationship with the customer will be personal. During the sales process, the intermediary will have customer representatives that will provide information and demonstration about the product. The intermediary will take orders, determine charges, and oversee billing or payments and the delivery of the product to the client.

After the purchase is complete, the company, Aidx Medical BV, will handle the complains or solutions as needed. This would be by e-mail or through their website.

6.5 REVENUE STREAMS

The company will earn his revenues from the sale of the diagnostic device to the intermediary. As it is not possible estimate with exactitude future sales. A scenario was created to give broad estimations of the possible revenue.

According to FAO (2018), there is 15,393,187 heads of cattle in Uganda in 2017. About 70% of livestock in Uganda is exposed to the risk of AAT with an average prevalence of 4.5%. Prevalence rates of up to 35% have been recorded in some parts North Eastern Uganda (Nantima, Jolly, Tumusiime, Kauta, & Ademun , 2016). Let's envisage that the government do 5% of screening of all the cattle in Uganda one time the year. It is recommendable to do screening two times the year and a major percentage of cattle screening, however the research has indicated that there is a lack veterinary service in Uganda. This is the reason a low percentage was chosen.

Subsequently, the approximate costs of screening are around 5.89 to 12.40 USD. The mean of the cost of screening is 9.14 USD, which approximately 43% is the costs of the diagnostic test. The costs of screening 5% of the cattle in Uganda, one time the year is approximately 7,404,122.95 USD. The approximate cost of only the diagnostic test of 5% of the cattle in Uganda is around 3,183,772.87 USD. This is a potential estimation the government expends on diagnostics test.

6.6 KEY RESOURCES

The different resources which the company is using to create value proposition are grouped under the following heads:

- **Physical Resources:** In the future the company will need physical resources the next resources: a space for offices and manufacture, machinery for manufacture, warehouse to store the materials and devices.

- **Human Resources:** At the moment, the first employees in the company perform different tasks and positions. Right now, as the company is in their first stage, developing the product most of the human resources are in the research and development department. When the business starts to grow or the work load grows, it will start to demand specialized staffing and departments.

- **Intellectual Resources:** The company has developed an optical smart parasite detection technique using automated smart algorithms. This technology should be patented and is part of the intellectual resources of the company.

- **Financial Resources:** The company was awarded by EIT Health Belgium-Netherlands with €50 000 in funding. This funding has been used mainly to research and develop the product

6.7 KEY ACTIVITIES

The key activities which the company performs include the development and manufacture of diagnostic device. The manufacture of the device involves getting the raw materials, transforming them and then shipping. As well, the sale of this products to intermediaries distributed in different SSA countries.

6.8 KEY PARTNERSHIPS

Aidx Medical would need to partner with quite a few numbers of entities to be able to operate effectively. The general and currently list of partners the food truck would need would include:

University Industry Collaboration

Currently, Aidx Medical BV counts with a strong partnership with TuDelft. Aidx Medical BV was founded thanks to a successful university project. From there, the company has count with the strong support and advice of the university. The university has provided newly minted talent to solve short-term, incremental problems for the company.

Buyer-Supplier Relationships

Find the right material suppliers for the company's needs, as well as desired margins for our business. It would likely do business with these same entities if they have found them to be fair during initial interactions.

Intermediary Partnership

An intermediary partnership can result in additional exposure and revenue, and both parties win with more sales and market expansion. The partnership should be somebody already in the industry distributing similar products in the market of animal health devices.

Approval from Other Organizations

Strong relationships are important to doing business between all cultures. Develop a relationship with NGOs and the government can benefit both parties.

6.9 COST STRUCTURE

The cost structure refers to the types of business cost structure that will impact the business. The major components of such cost structure are variable and fixed costs. Variable costs are costs that change in direct proportion to production/selling activities, some examples include sales commissions, product cost, cost of labor and raw materials used in manufacturing, between others.
Contrariwise, fixed costs are those that occur irrespective of the volume of selling or business activities. They are costs that accrue due to the passage of time such as insurance, salaries, and rent.

Currently, the device is under development. Therefore, it is not possible to make an estimation of the cost structure as there is no information about the product costs or manufacture.

SECTION 7: INTERNATIONAL MARKET ENTRY

Root (1987) stated that a foreign market entry mode is an institutional arrangement that makes possible the entry of a company's products, technology, human skills, management or other resources into a foreign country. There are a variety of ways in which a company can enter a foreign market, because there are a number of factors that can influence the strategy.

Market entry is determined by three components: entry location (EL), entry timing (ET), and entry mode (EM) (Figure #10). This is called the ELETEM decisions (Preece, C. M. M., Saman, & Ibrahim, 2016)Next, it will be presented the key determinants of the market entry strategy.

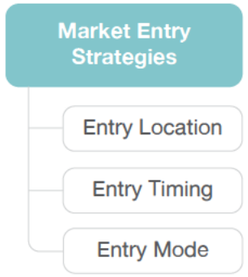


Figure 10: Market Entry Strategy

7.1 ENTRY LOCATION

Toften & Hammervoll (2009)writes in the paper with title "Niche firms and marketing strategy", niche marketing is often understood as focused marketing towards a limited market consisting of a few customers and competitors, where the concept of firm specialization, product differentiation, customer focus and relationship marketing are frequently applied. As a strategy, niche marketing, also called micromarketing, works with the concept of 'Big fish in small pond' (Choudhary, 2014).

Every market can be further refined, or divided, by the particular needs and preferences of its constituents. Next it will be described the several customer characteristics that helped define the niche market.

Demographics

Location: The T disease is a tropical disease. This means that is prevalent in or unique to tropical and subtropical regions. It is present on four different continents (Radwanska, Vereecke, Deleeuw, Pinto, & Magez, 2018). Historically, AAT is a well-known disease that affect sub-Saharan Africa and has developed of vast lands of the African continent into highly productive agricultural areas. The money losses are estimated to be around US$ 4.5 billion per year (Yaro, Munyard, Stear, & Groth, 2016).This is the reason it was targeted the African continent, as it has a major issue.

Occupation: Responsible in provides health care to large animals, such as livestock, horses and sheep and work to improve public health. Generally, this are veterinaries or CAHWs, however it exists other institutions involve in animal public health. Veterinaries have the responsibility to diagnose, treat, and research medical conditions and diseases.

Aidx Medical BV, a social start-up, developing a portable, field compatible, affordable and smart optical diagnostic instrumentation for early detection of AAT infection and other hemoparasitic infections in animals. Therefore, the niche market is the community that provides animal health care in certain countries of Africa.

7.2 ENTRY TIMING

Timing of entry is defined by the decision taken by the company to internationalize or not. Companies can establish themselves in new market as early entrant or late entrant. Both entrances have advantages and disadvantages. The current market is a niche market, as mentioned previously. The niche market is the community that provides animal health care in certain countries of Africa. The competition is the current diagnostic methods and a company that is developing a portable, disposable test. However, there is no similar or comparable product on the market. Therefore, the product is an early entrant.

The advantages of being an early entrant:

• An early entrant wins a competitive edge gained by being the first to introduce the product to the market. In some industries an early entrant acquires a monopoly status.

• Opportunity to build brand loyalty and reputation.

• Scope to create barriers to late entrant.

• The early entrant creates the foundation of expectation which late entrants must follow.

The disadvantages of being an early entrant:

• The cost of pioneering can be high, for example: technology, research and development, marketing, between others.

• Early entrants carry the greatest risk, as an early entrant are the ones testing the market

• Loyalty for unsought products is often weak.

• Late entrants can take advantage of rapid technological changes.

• Early entrants are easily imitated and cheapened.

7.3 ENTRY MODE

According to (Pehrsson, 2008) a market entry mode is a significant method for the delivering of a company's product, technology, and human and financial resources into a foreign market. The selection of an optimal entry mode is considered as one of the most significant issues in international market entry strategy (E.S & J.P, 2007).

Market entry mode is classified on level of control, resource commitment, and risk involvement. The Figure #11 is an overview of the different entry modes, according to the level of risk and control.

Therefore, the most suitable entry mode for Aidx Medical BV is indirect export. Indirect export involves an organization sells to an intermediary in its own country. This intermediary then sells the goods either directly to customers or to importing wholesalers and takes on the responsibility of organizing paperwork and permits, organizing shipping and arranging marketing (Roy, 2017). Generally, start-ups or small and medium enterprises (SMEs) lack adequate financial and managerial resources required for making a successful entry into a foreign market. Indirect exporting is suitable for such companies.

The **advantages** of this entry mode are:

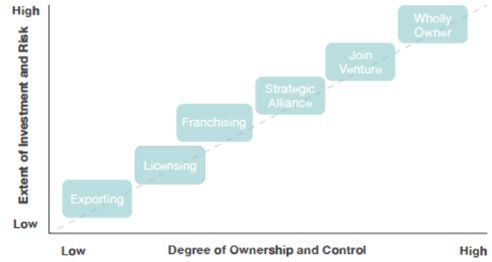


Figure 11: Entry Mode Strategies (Root, 1987).

• **Low-risk market entry:** The intermediary assumes all sales and credit risks.

• **Minimal involvement in the export process:** The intermediary organization handle all the exporting activities, like formalities related to documentation, shipping arrangements, financial, political and credit risks, obtaining licenses from Government departments, between others.

• **Concentration on production:** The company is relieved from exporting formalities. This enables the producers to concentrate on the development and production

• **No local investment:** Indirect exporting involves less financial expense for the manufacturer. The firm does not have to build up an overseas marketing infrastructure. Therefore, the financial resources committed are minimum.

The **disadvantages** of this entry mode are:

• **Profits are lower:** The intermediary involved in export trade may charge a commission for the services offered. It increases the cost of the product to the ultimate users and reduces profitability to the manufacturer.

• **Ignorance of export trade:** The serious limitation of indirect exporting is that the manufacturer of the export product remains ignorant of export market.

• **Dependence on the intermediary**

SECTION 8: 4PS MARKETING MIX

8.1 PRODUCT

A product can be defined as anything that satisfies a want or need through use, consumption, or acquisition (Mullins & Walker Jr., 2013). Aidx Medical BV offers a portable diagnostic device for the endemic disease T, which can be used by unprofessional people. At present, the following are the main characteristics the product should encompass:

Diagnostic tool: a tool used to identify or determine if there are parasites on the blood. This tool is mainly going to be used by veterinarians and CAHWs, and need to have the following features:

- **High sensibility**
- **Minimal training:** easy to use and interpret the results
- **Battery:** for 1 or 2 days of screening (100 to 200 samples)
- **Field resistance:** light weight, temperature resistance, semi-water resistance, movement and hits
- **Work offline:** when online upload the data to a database.
- **Battery:** should last around 100 to 200 test samples, before the recharge of the battery
- **Electrical voltage conversion**, according to the country of shipping.
- **Product size** for portability and shipping.
- *Detect the three main thick-bone disease of the country.

*This feature is a recommendation yet is not a requisite. The main thick-bone diseases affecting the cattle in Uganda are East Coast Fever (ECF), Anaplasmosis, Babesiosis and T.

This feature would make more attractive the device and can also elevate the price. The problematic of detecting one disease firstly is the comparison to the purchase of a microscope which can detect several diseases with a qualified staff. Secondly, if the cattle show symptoms, yet it is negative diagnosed for trypanosomiasis, the device was not useful to provide an answer.

- **World Organization for Animal Health (OIE) certification**

This certification will recognize the status of a kit as valid for the defined fitness for purpose, or purposes, according to the OIE criteria. The OIE standards, guidelines and recommendations applying to diagnostic tests are published in the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. There is also the OIE Quality Standard and Guidelines for Veterinary Laboratories, which provides a specific interpretation of the generally stated requirements of ISO/IEC 17025 for veterinary laboratories, as well as guidelines, which are practical texts that complement these Manuals.

Also, it is recommended to register the diagnostic kit. As this will to be published on a list of diagnostic kits certified by the OIE which is going to be provided to OIE member countries. For more information about the OIE certification, follow the QR Code.

Epidemiological tool: a tool that describes the distribution of disease by case, place and time.The device should record the next information:

- Type of parasite
- Mobility
- Size of parasite
- Concentration of Parasites
- White & red cell count
- Image record

Figure 11: QR Code link for OIE Certification Requirements

8.2 PRICE

Price is the monetary value that has to be paid by a customer to acquire or own the product of a company (Mullins & Walker Jr., 2013). It is the critical revenue-generating component of the firm.

Competition Based Pricing (Comparison of price to a similar product and service)

This pricing strategy is based on the competition in the market. The focus is to match the prices of the competitors, which currently there are two indirect competitors. The first one is the compound microscope, the device currently used for most diagnostic methods of T. In Uganda, a compound microscope price is around 400 to 500 USD. The second indirect competitor is the service of blood test in private laboratories. The cost of a single blood test for T is around 3 USD.

Value-based pricing

During the interview, the different actors involved in the journey in treatment mention their perception of value of the device. The range mentioned was between 120 to 500 USD. Only one actor mentioned a higher price of 700 USD.

Therefore, based on the previous information presented, the price of the diagnostic device should be around 300 to 500 USD. The final price should also take into consideration the manufacture and shipping costs, which the information is currently not available as the product is on development.

Note: The final price should also encompass the manufacture and shipping costs, which the information is currently not available as the product is on development.

8.3 PLACE

The 4P of the Marketing Mix is place. Place includes distribution channels, warehousing facilities, mode of transportation and inventory control management thus it is a mechanism through which goods and services are moved from the service provider and manufacturer to consumer (Mullins & Walker Jr., 2013).

As previously mentioned, the company will distribute their products through a certified intermediary in Uganda. Normally, the intermediaries do not count with stores, as the products tend to be very specialized for a market sector. The intermediaries have an office, but walk-in customers are unusual.

The device will be physically represented by equipment vendors and product demonstrations to the target customer and trade shows.

8.4 PROMOTION

Promotion helps the trader and sales force to represent the product to the consumers in an effective manner and induce them to buy (Singh, 2012). Next, it be described a promotional recommendation. This recommendation has the aims to inform the potential customers about your product and secondly, it persuades them to buy your product.

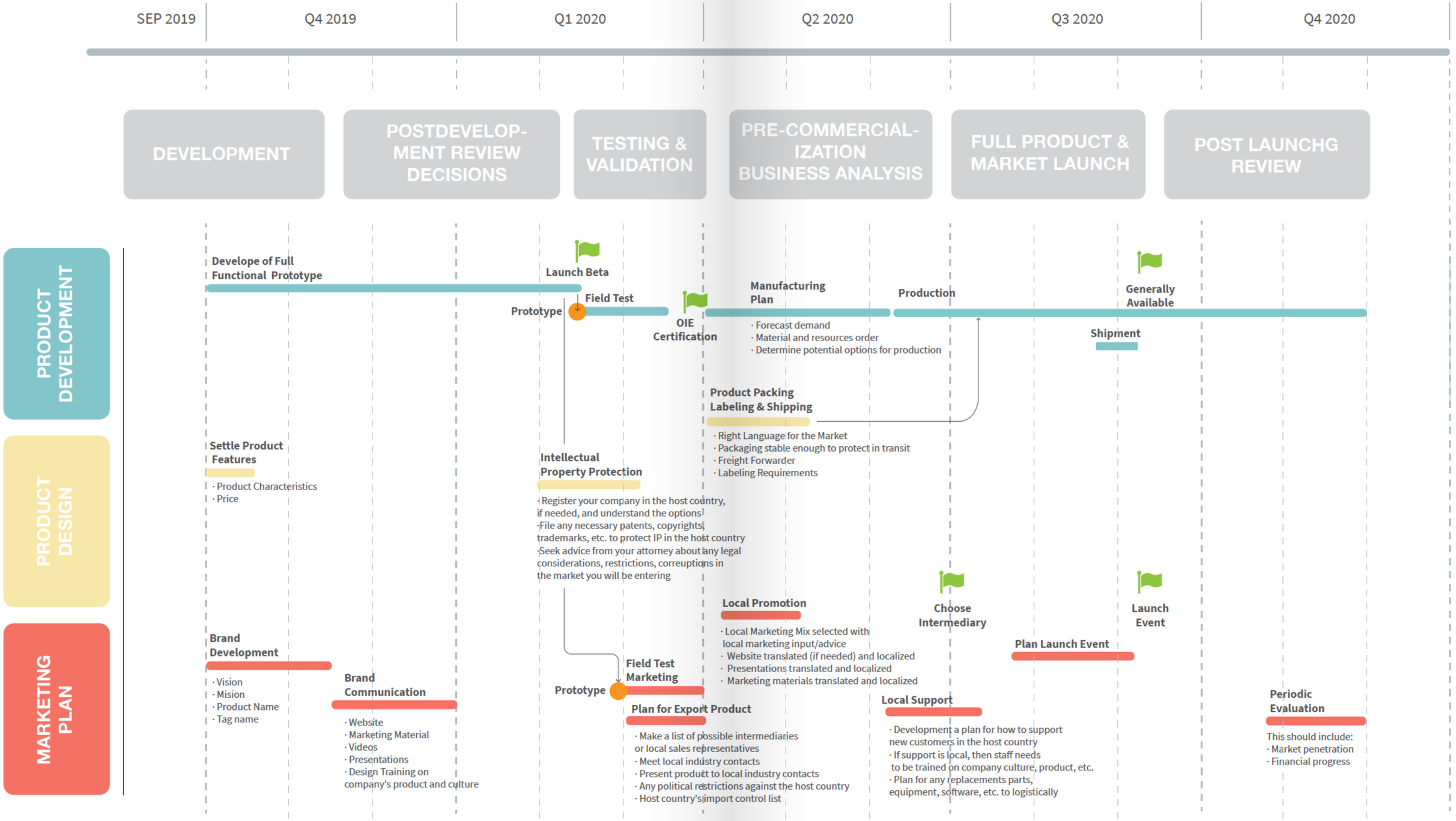
First, the company should develop a website. This will be the most important communication tool, because it is the only connection from the company to the target customer. The website should be a place to learn about the device, benefits and specifications. The website should also include videos of how to use the product, traders contacts and company's contact for after sale problems.

The second promotional material will be through product presentations, where the intermediary will present the product and have a face-to-face conversation with the target customer. During this product presentations is needed to have promotional material like brochures, videos demonstrations and contact cards.

SECTION 9: PRODUCT LAUNCH TIMELINE

A product launch plan is a timeline-based roadmap that clearly communicates the deliverables in relation to time. This roadmap is organized by three categories product development, product design and marketing plan, which was acquired from the method Product Innovation Process by Roozenburg & Eekels. The time horizon for this product launch plan is around 15 months long, which is divided in phases. These phases were based from "Stage-Gate New Product Development System" from Paul O'Connor (1994).

The length of the product launch was mainly based on the current development of the device. It was just hired a new master student, who is going to develop as a master thesis the algorithm to detect the parasite on the blood. The time to develop a thesis is a minimum of six months. The rest of the company's team is going to be developing the other elements of the products. As well, the team should be working on the marketing plan, at the same time the product is developed.


SEP 2019
Q4 2019
Q1 2020
Q2 2020
Q3 2020
Q4 2020
DEVELOPMENT
POSTDEVELOP-MENT REVIEW DECISIONS
TESTING & VALIDATION
PRE-COMMERCIAL-IZATION BUSINESS ANALYSIS
FULL PRODUCT & MARKET LAUNCH
POST LAUNCHG REVIEW
PRODUCT DEVELOPMENT
PRODUCT DESIGN
MARKETING PLAN
Develope of Full Functional Prototype
Launch Beta
Field Test
Prototype
OIE Certification
Manufacturing Plan
· Forecast demand
· Material and resources order
· Determine potential options for production
Production
Generally Available
Shipment
Product Packing Labeling & Shipping
· Right Language for the Market
· Packaging stable enough to protect in transit
· Freight Forwarder
· Labeling Requirements
Settle Product Features
· Product Characteristics
· Price
Intellectual Property Protection
· Register your company in the host country, if needed, and understand the options
·File any necessary patents, copyrights, trademarks, etc. to protect IP in the host country
·Seek advice from your attorney about any legal considerations, restrictions, correuptions in the market you will be entering
Local Promotion
· Local Marketing Mix selected with local marketing input/advice
· Website translated (if needed) and localized
· Presentations translated and localized
· Marketing materials translated and localized
Choose Intermediary
Launch Event
Plan Launch Event
Brand Development
· Vision
· Mision
· Product Name
· Tag name
Brand Communication
· Website
· Marketing Material
· Videos
· Presentations
· Design Training on company's product and culture
Prototype
Field Test Marketing
Plan for Export Product
· Make a list of possible intermediaries or local sales representatives
· Meet local industry contacts
· Present product to local industry contacts
· Any political restrictions against the host country
· Host country's import control list
Local Support
· Development a plan for how to support new customers in the host country
· If support is local, then staff needs to be trained on company culture, product, etc.
· Plan for any replacements parts, equipment, software, etc. to logistically
Periodic Evaluation
This should include:
· Market penetration
· Financial progress

05

CHAPTER: EVALUATION

Section 6: Business Model Canvas
Section 7: International Market Entry
Section 8: 4Ps Marketing Mix

In this chapter, the selected scenario from the previous chapter is described in detail. Also, it is described the market entry strategy.

SECTION 10: CONCLUSION

This research aimed to identify effective strategies to introduce to the market the diagnostic device for the neglected tropical disease T. Based on a qualitative information gathered by conducted semi-structured interviews with different actors involved in the context. This result in a more in-depth understanding of the context of T in Uganda, which helped to answer Objective #01: Identify who is our customer segment, the user and the beneficiary.

It can be concluded the farmer is the beneficiary, and also the payer for the treatment. The government or research institution is the payer for the diagnosis. The veterinarian or CAHWs is the user, as they perform the screening. These results may fluctuate between customer journeys. Nevertheless, these was the tendency between the customer journeys.

The next objective to be answered was Objective #02 Understand how to reach our customer segment. During the interviews made in Uganda, it was asked about past experiences acquiring devices in Uganda. These questions were designed to encompass the whole acquiring experience which involved the five channels phases: awareness, evaluation, purchase, delivery and after sales.

The goods used in animal health services can be divided in two broad categories: drugs (medicine) and devices. These two categories have a small different in the distribution channel. Normally, when an international company wants to enter to the market at Uganda, the company gets a certified intermediary. drug distributor. The intermediary is in charge of the whole distribution process. The intermediary creates awareness through their existing contacts, afterwards the clients will decide to buy conditional of the features. The three more important features for the customer are: first that all needed characteristics are fulfilled. The second most important characteristic is the price, which is accessible or cheaper than competitors. The third characteristic is brand, if the drug or device have the same characteristics and price, the customer will buy from the strongest brand.

The next channel is purchase, which is always an asset sale, either in drugs or devices. The following channel is delivery of the product; usually the intermediary, pharmacies, have stores distributed through Uganda or some pharmacies also count with rural distributors that move from town to town. On the other hand, medical devices distributor generally does not count with a store; the intermediary sends the product to the client. And the last channel, after sale, the intermediary is responsible for any complain or further clarification.

The recommendation was to follow the same distribution channel as most international companies do when entering to Uganda's market. This method makes it easier for international companies to enter to a new country without the need of a big investment or knowledge on the market.

The following goal was Objective #03 Understand the budget possibilities of the target market. This objective was answered through two methods. The first method was through semi-structured interviews where it was asked to experts the value perception of the new diagnostic device. The answer was between the range of 120 to 500 USD. Only one actor mentioned a higher price of 700 USD.

Secondly, it was asked the prices of a similar product, which is the compound microscope. The microscope is currently used for most diagnostic methods of T. In Uganda. The price for a compound microscope, in Uganda, is around 400 to 500 USD. Therefore, based on the previous information mentioned, the budget possibilities of the customer segment are around 300 to 500 USD.

Subsequently, the last objective is Objective #04: Identify the best strategies to enter to the market. The objective was answered through different methods. First, it was used the business model canvas to outline the most important concepts of the company's business. Subsequently, it is detailed the marketing plan through International Market Entry (Preece, C. M. M., Saman, & Ibrahim, 2016) complemented with 4P's Marketing Mix (Mullins & Walker Jr., 2013).

The main value of the company is to develop and manufacture an automatic diagnostic device for thick bone diseases that an unprofessional person can do a rapid and reliable diagnosis on the field. The customer segment is the government, because they are the largest employer in veterinary services delivery. The distribution channel will be through intermediaries, because they have a deep understand of the local market. As well, the company does not need a large capital investment on developing a distribution channel. The main revenue would be through asset sale of the diagnostic devices.

Thereafter an International Market Entry was planned. This entailed the entry location (EL), entry timing (ET), and entry mode (EM). The company will be an early entry and focused on a niche market on veterinary health. The entry mode selected was indirect exports, meaning the company will sell the device through an intermediary, because is the most feasible method to reach the customer, without the high investment of resource, and lack of knowledge for reaching the market.

Finally, the strategy is described with the concept of 4P Marketing Mix (Mullins & Walker Jr., 2013) which includes product, price, place and promotion. The product should have two main characteristics, to be a diagnostic tool, which is used to identify or determine if there are parasites on the blood. And, the product should also be epidemiological tool, which helps to describe the distribution of disease by case, place and time. The second P's is price. The targeted price is around 300 to 500 USD; however, this does not take into consideration the manufacture and shipping costs. The third P is place, the diagnostic device will be physically represented by equipment vendors and product demonstrations to the target customer and trade shows. Lastly, the promotion will be through the intermediary in the product demonstration. For these, it is necessary to prepare the promotional material like a website, brochure and presentation cards.

Makerere University College of Veterinary Medicine,
Animal Resources and Bio-Security

SECTION 11: RECOMMENDATIONS

This project presents the first attempt to concretely come up with ways to bring to the market a portable diagnostic device for AAT, developed by the company Aidx Medical BV. Therefore, market entry, which is developed in Section six, seven and eight should be seen as the first recommendations for entry strategy.

11.1 CONTEXT VARIATIONS

11.1.1 Disease Context

AAT is a thick-bone disease affecting 38 countries in SSA and other regions worldwide. However, in each of these countries is affected in different degrees, making AAT economically irrelevant compared to other thick-bone diseases. For example, in Uganda, AAT is considered an endemic disease, however it is not the main thick bone disease affecting the country. In Uganda, the three main thick bone diseases are ECF, Anaplasmosis, Babesiosis. Therefore, it is not possible to generalize that AAT is an economically relevant disease in SSA.

Recommendation
Subsequently, it is essential to take into consideration that AAT may not be the most problematic thick-bone disease of the country. Therefore, it is essential either to validate or research which thick bone diseases are causing the major economic burdens. Therefore, it is essential to understand these possible variations, to personalize the product according to the customer segment needs.

11.1.2 Market Entry Strategy Variation

For this project, AAT has been studied with an emphasis on Uganda. As the field trip took place in an endemic country in Uganda, the steps and decisions made during this project are based on the insights and information collected explicitly from this country. Therefore, insights gathered from the findings are valid for this particular country and cannot automatically be generalized for all SSA countries or worldwide. The disease context and the commercialization of animal medical devices can vary between countries of SAA and especially worldwide.

The market entry strategy is constructed by several elements, the business model canvas, entry strategy and 4P marketing mix. All these elements may differ from country to country. An example of this is the government structural adjustments in the late 1980, where the veterinary services were privatized. This configuration defined the several elements of business model canvas like customer segments. Thanks to this privatization, currently the government is the largest employer in veterinary services. However, this may differ in another endemic country as Coast Ivory, where the customer segment may be the private industry. Therefore, it is essential to understand the possible context variations between different AAT endemic areas in Africa and worldwide, to facilitate the market entry of this diagnostic device.

Recommendation
Consequently, it is essential to keep in mind that the proposals are based on Uganda market. Even though there may be similarities between countries, adjustments in the market entry strategy might be required. Therefore, it is essential to make further studies of each country the company is interested to enter. This will help to make an entry strategy suitable and higher the possibilities of success.

11.2 FURTHER DEVELOPMENT

11.2.1 Expand or change your sales channel

On the market entry strategy, the mode entry proposed was through an indirect export. This mode was the most suitable entry mode for Aidx Medical BV, because the start-up doesn't need to make big financial investments neither the managerial experience on distribution. However, it has the disadvantage of the dependency on the intermediary, ignorance of export trade, and profit are lower. The current proposal depends on the context of the market and company, available resources and possibilities. Though, the suitability of the market entry strategy may change during time as the company develop resources and band name.

Recommendation
At the beginning, it may be more cost-effective to work with a channel partner as a startup but, once the company has matured enough and acquire resources, penetrating new markets with your own sales team may be a more a suitable strategy. Likewise, there is the possibility to combine two sales channels, such as partnering with a distributor in certain regions while directly selling to hospitals in other locations or expanding the website to include ecommerce, where the device and accessories are available for purchase online.

SECTION 12: PERSONAL REFLECTION

It has been a pleasure being able to work on this project, which on times was exciting but also challenging. I learn a lot from a new context, but this project also enabled me to learn about myself, personally and professionally.

At the beginning of this project, I did not know what to expect. During my master I always try to specialize towards technology. However, the moment I saw this project I knew, I wanted to get involved. I hesitated, as this was not my area of specialization, and I wanted to able to deliver a valuable project that could really help not just the company but also the people. Nevertheless, I decided that this project would be a great opportunity, not only to explore an entirely new context and methods.

Throughout the development of this project, I my favorite phase was research. It was hard at the beginning, but I enjoyed reading and understand the complexity of the disease. Also, I found fascinating listening to people about their expertise and opinions. Subsequently, transforming all the knowledge to understandable visual stories

However, I also experience struggles during the project. My main difficulty was the management and planning. Sometimes, I could not continue the project, as first I needed to understand what I needed to do and with what methods and tools developed. It was no easy task choosing the right methods of tools to tackle the next phase, as it involved a considerable amount of time. As well, there were several moments during the process that going back and forth was needed. This makes me question if I was doing the right decisions.

In overall, there is still a lot to improve and learn, but for now, I can say that it has been a great pleasure to work on this project.

Laboratory family at Makerere University College of Veterinary Medicine, Animal Resources and Bio-Security

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CHAPTER: EVALUATION

Section 13: Bibliography
Section 14: Addendum

CHAPTER 13: BIBLIOGRAPHY

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Appendix A: Interview with experts on the field

	Who	What	Where
A	Pierre Mukadi Kaningu	PHD Student at University of Antwerp, Belgium - Diagnosis of malaria and sleeping sickness among diagnostic laboratories in Democratic Republic of the Congo.	Democratic Republic of the Congo
B	Jérémie Ilunga	Medical Biologist Laboratory manager at Programme National de Lutte contre la Trypanosomiase Humaine Africaine (PNLTHA)	Guinea
C	Dr. Skhumbuzo Mbizo	Veterinarian Parasitologist	South Africa
D	Dr. Yahaya Adam	Head of Tsetse and Trypanosomosis Control Unit of the Veterinary Services Directorate of the Ministry of Food and Agriculture	Ghana
E	Sakara Yakubu	Farmer & Animal Health Technician	Ghana
F	Sabine Liebenehm	Development and agricultural economics	Germany
G	Mr. Alirah Weyori	Development and agricultural economics	Germany

Interview Veterinary

Research topic

"What are the main needs in the context where Trypanosomiasis is develop?"

Introductory script

1. Thank the interviewee for taking part in the interview.
2. Inform the interviewee about the usage of the data collected
3. Confidentiality: stress the possibility for anonymity if desired. If anonymity is not necessary, ask for consent of being quoted. If consent for quotation is given, ask if it would be necessary to share the transcripts and/or quotations
4. Ask for consent to be recorded.
5. Offer that questions after the interview are always possible. Provide mobile phone number and email.
6. Start off with first part of interview protocol.

Hello! My name is Paola Bautista, I am a master student in Strategic Design at TU Delft University in Netherlands. For my graduation project I am working with Aidx Medical BV. The area I have decided to focus on the detecting the main needs in the context where Trypanosomiasis is developed.

I want to thank you for taking part in the interview; and I am interested to hear your opinion and experience on this topic, as it will be very valuable information. For the purpose of my project it will be really useful if I can quote some of the things you say today, in there. Is this okay for you? And would you like to remain anonymous if I quote you?

Can I audio record this conversation? Since I cannot make notes while we are talking!

Feel free to ask questions or interrupt me at any time if you need to. Let me know if you need to take a break at any point. If you feel uncomfortable with the interview just let us know, we can stop it anytime.

Ok, let's begin! This should take about 45 minutes to one hour!

Interview Guide

Part #00: General questions

1. Can you tell me about a little bit about yourself?

2. Who you are?
3. Age?
4. What do you do for living?

Part #01: Work day

1. Can you describe me a normal day?
2. What are your daily activities like?
3. What animals do you normally treat?
4. Do you treat livestock?
5. What are the most frequent diseases you treat for cattle?
6. How many times the week/month do they call you for African Animal Trypanosomiasis(ATT)?

Part #02: Disease Journey

Please, can you tell me a story about the last time you treated a case of trypanosomiasis?

1st Step Contact

1. What person contacts you when they have an AAT disease problem?
2. How did the person or farmer contact you?
3. Did the disease cow arrived in your medical facility or do you go to the farms?

2nd Step: Examination

4. What is the first step you do when you exanimate a cow?
5. What are the symptoms for AAT?
6. How do you make a decision to do an AAT test?
7. What AAT test do you do?
8. How do you do the AAT test?
9. Where do you do this AAT test?
10. How much time does an AAT involves?
11. How much money an AAT involves?

3rd Step: Treatment

12. What do you do when an animal has a positive or negative AAT test?
13. How many times a week or month a cow is tested with positive AAT?
14. How many AAT test in a week or month results negative AAT?
15. How expensive is to treat AAT?
16. How long does it take to treat AAT?

4th Step: Monitoring

17. What do you do after a cow is treated of AAT?
18. How do you monitor the incident of infection?

19. Do you create any report of infection for the district or government?
20. How often is the reinfection in the cattle?

Part #03: Personal Experience

1. What are your top 3 hardest moments you have face when you treat AAT?
2. Why were they hard?
3. How did you solve it now?
4. Do you think that solution can be improved?
5. What are your top 3 proudest or happies moments you have face treating a trypanosomiasis disease?

Part #04: External Relationships

1. Generally, how is your relationship with the farmers?
2. What do you think about how the farmers treat the disease of AAT?
3. How is the relationship of the government, with veterinaries and AAT disease?

Extra questions

What types of farmers exists?
How many cows and income do they have this different types of farmers?
How much money is for the equipment?
Why they can't have an equipment on the field?
How much money is for the test?
How much money is for the medicine?
How much money is to hire a veterinarian?
Does trypano resistance occurs? If it happens, what happens to the cow?
Giving constant toxi medicine to the cow does not devaluate its value?

Interview Researcher

Introductory script

1. Thank the interviewee for taking part in the interview.
3. Inform the interviewee about the usage of the data collected
4. Confidentiality: stress the possibility for anonymity if desired. If anonymity is not necessary, ask for consent of being quoted. If consent for quotation is given, ask if it would be necessary to share the transcripts and/or quotations
5. Ask for consent to be recorded.
6. Offer that questions after the interview are always possible. Provide mobile phone number and email.
7. Start off with first part of interview protocol.

Hello! My name is Paola Bautista, I am a master student in Strategic Design at TU Delft University in Netherlands. For my graduation project I am working with Aidx Medical BV. The area I have decided to focus on the detecting the main needs in the context where Trypanosomiasis is developed.

I want to thank you for taking part in the interview; and I am interested to hear your opinion and experience on this topic, as it will be very valuable information. For the purpose of my project it will be really useful if I can quote some of the things you say today, in there. Is this okay for you? And would you like to remain anonymous if I quote you?

Can I audio record this conversation? Since I cannot make notes while we are talking!

Feel free to ask questions or interrupt me at any time if you need to. Let me know if you need to take a break at any point. If you feel uncomfortable with the interview just let us know, we can stop it anytime.

Ok, let's begin! This should take about 45 minutes to one hour!

Interview Guide

Part #00: General questions

1. Can you tell me about a little bit about yourself?

Part #01: Trypanosomiasis Disease

1. Where does the disease comes from?
2. What are the different kinds of Trypanosomiasis?
3. How long does it take to show the symptoms after exposure?
4. How long does it take to diagnose the disease after exposure?
5. How do you treat AAT when it is in acute phase? And how long does it take?
6. How do you treat AAT when it is chronic disease? And how long does it take?
7. How much does it cost the medicine for every phase?

Part #02: Trypanosomiasis Diagnosis

1. Who makes the AAT diagnosis test?
2. Does the diagnosis test detect what type of AAT is?
3. What is the normal cost of an AAT diagnosis test?
4. Do the cattle owner are able to pay for the AAT diagnosis?
5. How long does it take an AAT diagnosis test to do?
6. Does the AAT diagnosis detect the length of the disease? If not, how the treatment is decided?
7. It is common the reinfection in animals? How often the reinfection occurs?
8. What are the top 3 difficult process in making a diagnosis?
9. Why were they hard?
10. How did people solve it now?
11. Do you think that solution can be improved?

Part #03: Context

1. Who is the people involved when there is a case of AAT?
2. Do you think there is another person capable to do the diagnosis? Why?
3. What do you think about the education the farmer has about the AAT disease?
4. How is the support of the government or other organizations treating AAT?

Appendix B: Semi-structured Interviews

	Who	Category	Title
H	Dr. Bigirwa Godfrey	Veterinarian	Lecturer at College of Veterinary Medicine in Makerere University
I	Dr. Wilfred Enelau	Veterinarian	Lecturer at College of Veterinary Medicine at Mekerere University
J	Dr. Francis Mutebi	Veterinarian	College of Veterinary Medicine at Mekerere University
K	Dr. Ben Sekera	Veterinarian	Veterinarian at the Ministry of Agriculture Animal Industry and fisheries (MAAIF)
L	Dr. Joshua Nabangi	Animal Health Technicians	Laboratory technician at Makerere University
M	Dr. Cesar Owak	Animal Health Technicians	Jubaili Pharmaceuticals [Kampala-Uganda]. Animal production technologist marketing vet pharmaceuticals for a wholesaler
N	Alex Taremwa	Pharmacist & Animal Health Technician	Animal Production Technologist Marketing Vet Pharmaceuticals for Jubaili Pharmaceuticals
O	Muhigirwa Edward	Pharmacist	Co-founder of ERAM Uganda LTD
P	Dr. Muhigirwa Alicia	Pharmacist	Co-founder of ERAM Uganda LTD
Q	Dr. Angubua Sylvia	Uganda Veterinary association (UVA)	President of UVA; lecturer at Makerere University
R	Dr. Charles Waiswa	Control of Trypanosomiasis in Uganda (COCTU)	Director of COCTU
S	Dr. Gerard Nizeymana	Food and Agriculture Organization of the United Nations (FAO)	Postdoctoral Researcher at FAO
T	Dr. Joseph Nkamwesiga		Director of IAMAT

Field Interview

1. Presentation

I am Paola Montserrat; I am originally from México, however currently I am studying in Netherlands. I am doing my master's in strategic design in TuDelft University. For my graduation project, I am working with Aidx Medical BV.

Aidx Medical BV, a tech start-up, is currently developing a portable, field compatible, affordable and smart optical diagnostic instrumentation for early detection of African Animal Trypanosomiasis (AAT) infection and other Hemoparasitic infections in animals. The area I have decided to focus, it is on the development of a business model that has a positive social impact, yet it is financially sustainable.

2. Short Interview

I want to thank you for taking part in the interview; and I am interested to hear your opinion and experience on this topic, as it will be very valuable information. For the purpose of my project it will be really useful if I can quote some of the things you say today, in there. Is this okay for you? And would you like to remain anonymous if I quote you?

1. **Please**, can you tell me about a little bit about yourself? (**name, age profession**)
2. What is your relationship with the disease of Animal African Trypanosomiasis?
3. Please, can you tell me a story about the last time you treated a case of trypanosomiasis?
4. What devices generally there are used to treat Trypanosomiasis?
5. Where do you buy these devices?
6. Who buys these devices?
7. When do you buys these devices? In which situations
8. Why these devices? What is your process for buying these devices?
9. What is the most important characteristic to choose a specific device? (price, functions, aesthetics, brand)

3. Device Presentation

4. Present Story boards - Present Scenario

5. Ask advantages & disadvantages

6. Thanks!

Consent to take part in research
Trypanosomiasis Diagnostic Device

I..... voluntarily agree to participate in this research study.

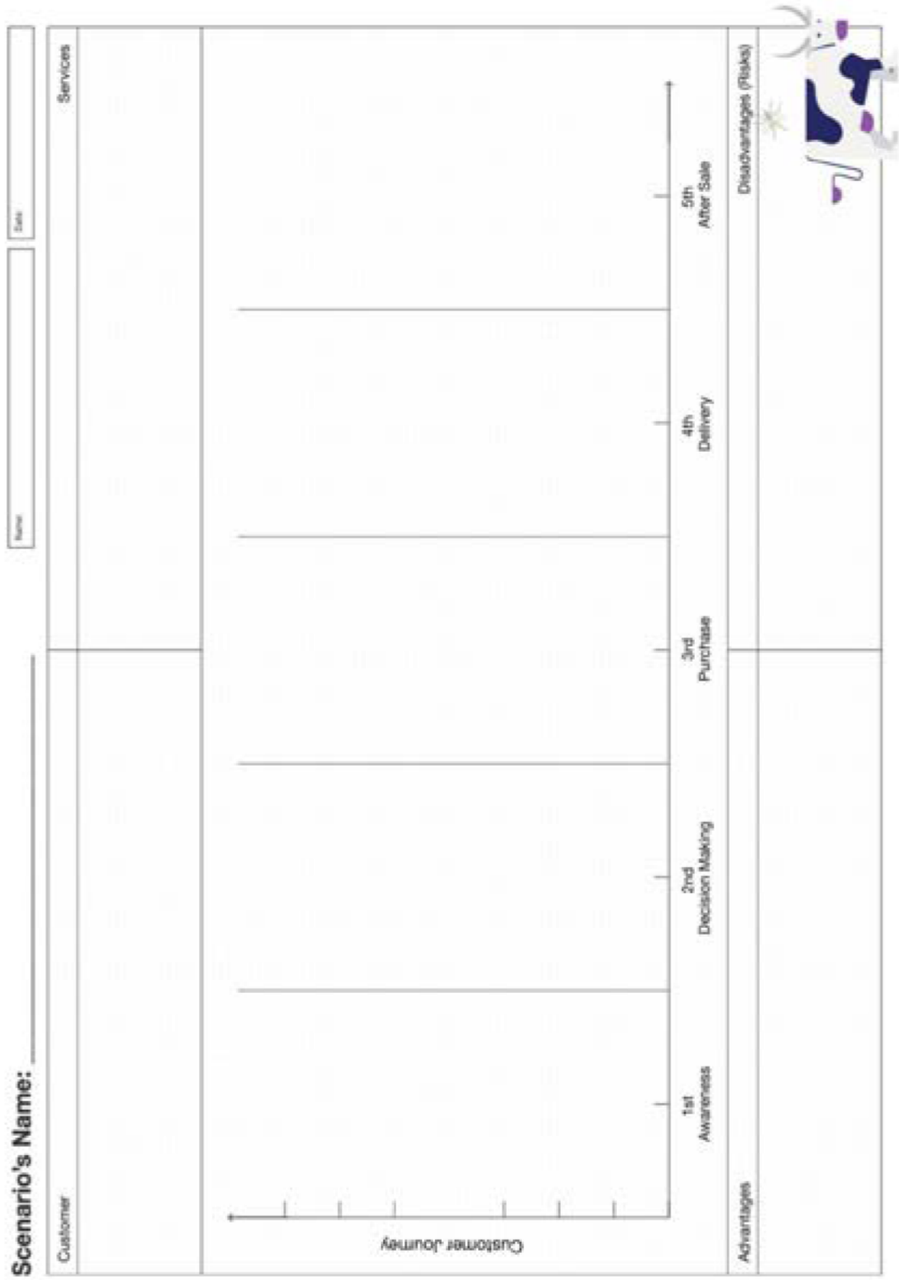
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview.
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being audio-recorded.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- I understand that if I inform the researcher that myself or someone else is at risk of harm they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

Name

Degrees

Signature of research participant

Appendix C: Distribution Channel Framework



Appendix D: List of 38 countries Affected by Tsetse Flies

Appendix E: Information about SA T

South American Trypanosomiasis

Trypanosomiasis not only exist in Africa; it has spread to other continents. It is assumed that the disease was introduced in 1830 into South America (SA) by imported cattle from Senegal to French Guyana and Antilles (Dávila & Aguilar M.S. Silva, 2000). The parasite has now spread to ten of the thirteen countries of the South American continent. These new trypanosome stocks are called New World, and the main behavioral difference between the Old and New World is the inability to infect Tsetse flies (Wells, 1984). The New World T. is transmitted by parasite-laden secretions from hematophagous triatomine insects (Pereira Nuñes, Dones, Morillo, Encina, & Ribeiro, 2013). These triatomine insects are also known as kissing bugs, assassin bugs, and vampire bugs. The insects acquire trypanosomes via blood meal. After 2-4 weeks of development, some of the parasites travel to the hindgut creating infective feces. The infection occurs when bug either during or after feeding defecate on the host, facilitating parasite transmission through mucous membranes or breaks in the skin. Humans and animals can also be infected by eating triatomine insects or insect feces (Center for Food Security & Public Health, 2017).

Four species of New World T. have social or economic importance in SA. T. cruzi causes human trypanosomiasis also called "chagas" disease. T. brucei equiperdum affects horses; the disease is called "mal de caderas." The last two species T. vivax viennei and T. brucei evansi afflict horses and cattle causing the disease "derrengadera", also known as "peste boba" or "murrina" (Wells, 1984). Derrengadera also affects other mammals like water buffalo, monkeys, alpacas, and llamas. The clinical signs of derrengadera are similar with AAT that are fever, suppression of milk yields, abortion, occasionally deaths lethargy, and weight loss (Dávila & Aguilar M.S. Silva, 2000).

Currently, it is estimates than 11 million head of cattle are at risk from infection in the Brazilian Pantanal and Bolivian lowlands. This could create with potential losses in excess of US$160 million (Jones & Dávila, 2001). However, the disease is not a problem in other areas of SA. For example, the study of Richard Zapata Salas, in the north region of Antioquia in Colombia, shows that only 3,6 and 0% of the cattle suffer T. vivax and T. evansi respectively (Zapata Salas, et al., 2017).

Appendix F: Compound names of medicines

Compound	Trade name	Activity in the field	Object
Diminazene aceturate	Berenil Veriben Ganaseg	T. congolense T. vivax (T. brucei) (T. evansi)	Cattle Small ruminants [dogs] [equidae]
Homidium chloride	Novidium	T. congolense T. vivax	Cattle small ruminants pigs [equidae]
Homidium bromide	Ethidium		
Isometramidium chloride	Samorin Trypamidium	T. congolense T. vivax T. brucei T. evansi	Cattle small ruminants equidae camels
Quinapyramine dimethylsulphate	Trypacide sulphate	T. congolense T. vivax. T. brucei T. evansi T. equinum T. simiae	Camels equidae pigs dogs
Quinapyramine dimethylsulphate	Trypacide Pro-salt		
Suramin	Naganol	T. evansi	Camels Equidae

Source: (Peregrine, Chemotherapy and delivery systems: haemoparasites, 1994)

Appendix G: Project Brief

DESIGN FOR our future

TUDelft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy"
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name [redacted]
initials
student number
street & no.
zipcode & city
country
phone
email

Your master programme (only select the options that apply to you):
IDE master(s): ( ) IPD ( ) DfI (★) SPD
2nd non-IDE master:
individual programme: (give date of approval)
honours programme: ( ) Honours Programme Master
specialisation / annotation: ( ) Medisign
( ) Tech. in Sustainable Design
( ) Entrepreneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair Dr. ir. Diehl, J.C. dept. / section: DE/DFS
** mentor Willemijn Brouwer dept. / section: PIM/MOD
2nd mentor Mirte Vendel
organisation: Aidx Medical BV
city: Delft country: Netherlands
comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v.

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

TUDelft

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF
To be filled in by the chair of the supervisory team.

chair Dr. ir. Diehl, J.C. date - 04 - 2019 signature

CHECK STUDY PROGRESS
To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 24 EC
Of which, taking the conditional requirements into account, can be part of the exam programme EC
List of electives obtained before the third semester without approval of the BoE

(★) YES all 1st year master courses passed
( ) NO missing 1st year master courses are:

name date - 04 - 2019 signature

FORMAL APPROVAL GRADUATION PROJECT
To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: ( ) APPROVED ( ) NOT APPROVED
Procedure: ( ) APPROVED ( ) NOT APPROVED
comments

name date - 04 - 2019 signature

Personal Project Brief - IDE Master Graduation

TUDelft

Designing the Business Model for a Social Start-up — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 01 - 04 - 2019 — 26 - 08 - 2019 end date

INTRODUCTION **

Please describe the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...)

Tsetse are blood-feeding insects that transmit trypanosome pathogens which causes the potentially fatal disease of African Animal Trypanosomiasis (AAT) in livestock. Tsetse flies infest approximately 10 million km2 of the continent affecting 38 sub-Saharan countries (Murray & Gray, 1984). It is estimated that the annual direct production losses in cattle breeding alone amount to between US$6-12 billion, while animal deaths reach 3 million (Hursey & Slingenbergh, 1995). Since no vaccine for AAT is currently available for use, there is the urgent need for controlling the disease, including case detection, treatment, and vector control.

Diagnosis is notoriously difficult because there are no specific clinical signs and standard diagnostic methods are complex. There are two standard method for detecting ATT. The first one is the Giemsa Stain, which examines through multiple microscopy stained blood films. The other method is Buffy Coat, which concentrates the blood through centrifugation in a hematocrit tube. Both methods are not very accurate in the detection. Besides that, both requires expensive, professional instrumentation and specialists in the field.

Aidx Medical BV, a tech start-up, is currently developing a portable, field compatible, affordable and smart optical diagnostic instrumentation for early detection of AAT infection and other Hemoparasitic infections in animals. An optical smart parasite detection technique using automated smart algorithms integrated into a potentially low-cost imaging platform is being developed by the R&D team. The new prototype is already producing promising results. Its aim is to create a rapid and reliable diagnosis on the field that can be carried out by unskilled personal. The functionality of the diagnostic instrument will also be extended to detect Bovine Babesiosis, a tick-borne infection endemic in Europe, America and, since recently, in Australia.

The goal for my Master thesis project at the start-up is to develop a business model and positioning to help the new venture start their business.

space available for images / figures on next page

Personal Project Brief - IDE Master Graduation

TUDelft

introduction (continued): space for images

image / figure 1: Cattle of South Africa

image / figure 2: Tsetse fly

Personal Project Brief - IDE Master Graduation

TU Delft

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Aidx Medical BV is currently developing a portable, field compatible, affordable, smart optical diagnostic instrumentation for early detection of AAT infection and other Hemoparasitic infections in animals. So far, the prototype is showing promising results. It is expected that the final product will be 30 times more sensitive, 20 times faster, and being able to be used by nonprofessionals. At the moment, the start-up is devoting all their resource into the production of a fully functional prototype. However, as a company they need to start defining the answer to simple questions as: How is the product going to be distributed?

Aidx Medical BV needs to turn their visionary idea into a successful business. It is critical to define how they will create, deliver and captures the value of their product to their customers. The start-up requires to define themselves as a business and prepare a strategic plan for development. They need to define the major components of their business, like customer segments, value proposition, channels and cost structure among other components. This is possible with a well-defined business model. A business model is like a blueprint for a strategy to be implemented through organizational structures, processes, and systems (Osterwalder & Pigneur, 2010). Having a business model will help them to define a strategic path at the moment the product is ready for introducing into the market.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas. .... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

In this graduation project I will design a business model and positioning to help the new venture define the path of their business.

Firstly, the business model will help to express their business. This will be an overview of the company, their mission, vision, and the main problems and solutions they are tackling. Secondly, a business model will help to define the value proposition of the company, this is a statement of the specific benefits the company delivers. Thirdly, it will help to validate their product expectations and define their market opportunities. In the development of a business model, it is needed to research with experts, customers and other stakeholders to ensure that the business model not only sounds promising, but also responds to the actual needs of the market. Finally, a business model is very helpful to enhance the selling proposition. It will help to explain to prospective investors the social and economic value of the business.

Initials & Name Paola Montserrat Bautista Gauna Student number 4721721

Title of Project Designing the Business Model for a Social Start-up

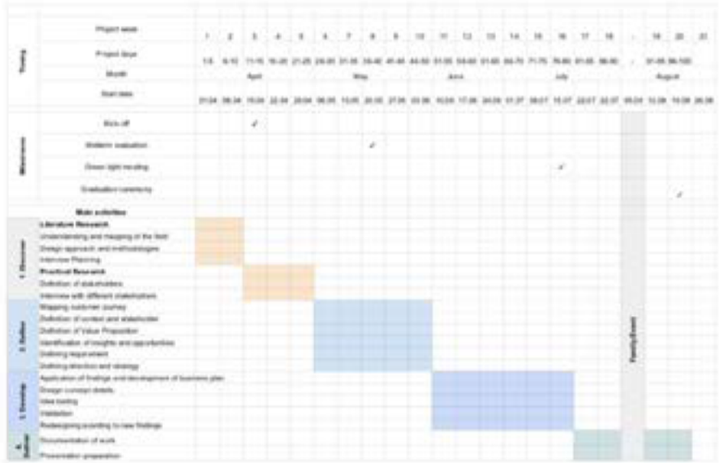
Personal Project BriefIDE Master Graduation

TU Delft

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of yo project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit wit the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-ter meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 01 - 04 - 2019 26 - 08 - 2019 end date



The project is divided into four phases. The first phase is "Discover", that is divided in two subsections: literature research and practical research. The literature research will focus on the understanding of the disease Trypanosomiasis and the context where and how it is developed. Furthermore, it will include the study of methodologies and the development of business models. In the third to fifth week, I will start interviewing experts and stakeholders. The second phase is called "Definition" where the material from the research from the first phase is analyzed and the main insights are defined. Once all this research is conducted, the third phase, "Develop", will start. The third phase will be about designing the positioning for the startup and delivering it. The final phase, "Deliver," will be destined to work on the finalization of the report and other deliverables preparations. The final presentation is expected to happen towards the middle or end of August, considering tentative vacation times of the supervisors.

The project should conclude and be presented before the end of August. This plan considers some weeks of room for unexpected requirements or events.

Initials & Name Paola Montserrat Bautista Gauna Student number 4721721

Title of Project Designing the Business Model for a Social Start-up

Personal Project Brief - IDE Master Graduation

TU Delft

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in-depth knowledge on a specific subject, broadening your competences or experimenting with a specific tool and/or methodology; .... Stick to no more than five ambitions.

During my bachelor, I was a volunteer in the youth led, non-profit, Latin organization TECHO. TECHO seeks to overcome poverty in slums, through the joint work of families in extreme poverty with youth volunteers. I was volunteer for more than 3 years, and this experience made me passionate about humanitarian projects.

I started the program of Strategic Product Design, without thinking it will be possible to combine my profession and my extracurricular activity. For my surprise, it is possible to combine both in my master thesis. I will be working for a social start-up company. I will furthermore get practical experience, as I will be working in the field with a project which has an important purpose.

My learning aim is to get a deeper understand of business model innovation, so I will be able to translate the company strategy, combined with the market opportunities into a strong product. Additionally, by the end of the thesis, I want to have gained the experience of using different design methods, like explained in the Design Delft Guide, that enables me to get insights and tools to maximize the end results.

Bibliography:
Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation. Hoboken, New Jersey, Unted States: John Wiley & Sons Inc.
Hursey, B., & Slingenbergh, J. (1995). The tsetse fly and its effects on agriculture in sub-saharan Africa. A Quarterly Journal on Animal Health, Production and Products: 50 Years . Retrieved from FAO - Food and Agricultural Orhanization of the United Nations: http://www.fao.org/3/v8180t/v8180T0s.htm#bibliography
Murray , M., & Gray, A. (1984). The Current Situation on Animal Trypanosomiasis in Africa. Preventive Veterinary Medicine, 2, 23-30.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Initials & Name Paola Montserrat Bautista Gauna Student number 4721721

Title of Project Designing the Business Model for a Social Start-up

Master Thesis
Paola Montserrat Bautista Gauna