

Transport Corridor Mobile Phone Application

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Abstract

Our goal was to help the Walvis Bay Corridor Group improve the safety and efficiency of trucking in southern Africa by furthering the development of an informational smartphone application. After meeting with transport and tourism companies, truck drivers, and tourists, we identified key problems that arise while driving through southern Africa. To address them, we recommended including safety, facility, and border information; conducting managerial training sessions; offering white-labeled versions; and assigning responsibility to oversee the application's continued success.

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Executive Summary

The Republic of Namibia is focused on increasing trade, tourism, and transportation through the network of relatively well-maintained roads within southern Africa known as the Walvis Bay Corridors. The Namibian segments of these roads are considered to be some of the best maintained in Africa. These corridors are the focus of the Walvis Bay Corridor Group (WBCG), a public-private partnership whose goal is to connect Namibia with southern Africa and the rest of the world.

To further improve the safety and reliability of driving through Namibia and southern Africa, the WBCG has initiated an effort to build a smartphone application to provide safety, navigational, and other information to drivers. The WBCG hopes to build this application to make driving through Namibia and southern Africa safer, easier, and faster. While there are multiple digital travel service resources available to drivers in Europe and North America, including Trucker Path, Yelp, and Waze, the availability of these resources are limited in southern Africa. This application would primarily benefit truck drivers, however, tourists could also benefit from the information.

A team of fellow Worcester Polytechnic Institute (WPI) students worked on the beginning of this initiative in 2016. This team provided recommendations about what the application should focus on and what may be included in it. We continued this effort by focusing on preparing the application for development and establishing strategies for the long-term sustainability of the application. To achieve the goal of furthering the development of the application, we had the following objectives:

- Identify application requirements and design
- Identify strategies for the promotion of the application
- Identify strategies for the sustainability of the application

We collected information from transport companies, truck drivers, and tourists. To connect with transport companies, we compiled a list of companies in Windhoek and Walvis Bay and contacted them for interviews. We asked the managers what problems their drivers face while driving along the corridors, what information would be helpful to drivers, and what challenges the companies faced in terms of managing drivers. We used a video demonstration, created by the 2016 project team, to show companies what features the application may contain and to receive feedback on the features included.

The 2016 team developed a preliminary list of features to be included in the application, and we further developed this list by ranking the features based on criteria including stated interest in the feature, ease to develop the feature, and cost. These criteria were based on a variety of feedback we received. For example, the amount of interest in a certain feature was gauged from interviewing

the transport companies and drivers, while the ease to develop and cost for each feature came from speaking to a Windhoek-based programming company. We used the ranked list of features to recommend which features should be implemented in which iteration, to keep the application progressing, and to make development easier.

The managers we met with expressed interest in the application and felt that it could benefit their company and their drivers. They mentioned problems they faced including not knowing the locations of their drivers, their drivers having problems crossing borders, and their drivers having to handle unlawful situations, including the need to pay bribes and being hijacked. Some of the larger companies provide periodically updated printed manuals to their drivers that contain information that the driver would need to know on their route. Even if formal manuals are not distributed, many companies have certain preferences, rules, or routes they want their drivers to take that are often communicated orally to their drivers. Since this information is valuable, many companies expressed interest in a white-labeled version of the application to ensure their information would not be shared with competing companies. White-labeled products are rebranded to appear as if a company produced it. The company would pay extra to have their own rebranded version of the application that would contain the information and features that the public version contains, plus their proprietary information. This could become a potential source of revenue for the WBCG and could offset the costs associated with developing a free version of the application.

To interview truck drivers, we visited Walvis Bay, where many drivers wait to pick up their cargo from the port. The feedback we received from drivers about the application indicated they would be interested in the application. They felt it could help them while traveling internationally, since problems often arise when they are outside Namibia, especially in the Democratic Republic of Congo (DRC). Drivers favored driving in Namibia, saying it was safe and relatively problem-free. We learned from this that a focus should be placed on providing information regarding crossing borders and traveling internationally.

Tourists present another possible source of revenue for the application. We traveled to Hosea Kutako International Airport outside of Windhoek to speak with tourists arriving and departing from the airport. We spoke with tourists from Europe, North and South America, and South Africa. Tourists demonstrated interest in the application, saying that important travel information, such as where service stations, tourist attractions, and other points of interest are located in Namibia is not always available. Some tourists were also willing to pay to use the application, offering prices comparable to physical maps or rented navigation systems.

Our conversations with transport company managers, truck drivers, and tourists provided us with information about which features would be most helpful to include in the application. We then met with a Windhoek-based programming company, Loop Technologies, to discuss how feasible and cost-effective it would be to implement each of the specified features. Following this discussion, we

created decision matrices to analyze the different features based on maintenance cost, development cost, development time, ease of collecting pertinent information, and number of parties who expressed interest in said feature. We used the results of the decision matrices to help us make recommendations about which features should be included into the application. We recommended that the WBCG create three successive iterations. The first iteration would include the top five features for truck drivers, as follows:

1. Contact information for both emergency and non-emergency services
2. Border post operating hours
3. Safety alerts
4. Travel service information
5. HAZMAT transportation requirements

After this iteration is developed, the WBCG should focus on implementing more complex features as part of a second iteration. In a later iteration, we recommended that the WBCG develop a strategy for white-labeling the application. This would involve creating a separate version of the application for interested companies. These separate applications will contain the branding of the host company and proprietary information to which the general public will not have access.

After discussing the application with tourists, we determined that they would need their own version of the application since their priorities for information differ from those of transport companies and truck drivers. The top five features for tourists we identified were:

1. Navigation with road conditions and traffic information
2. Alerts for criminal and animal activity
3. Local information including the locations of nearby towns, fueling and service stations, ATMs, cafes, restaurants, and shopping centers
4. Offline capabilities
5. Sightseeing information including wildlife hotspots, museums, and monuments

Once the application is developed, we recommended several strategies for promoting the application. To promote the application to truck drivers, we recommended that the WBCG pitches the application to logistics companies by providing training sessions for the companies' managers. The logistics managers could then train their truck drivers on how to use the application. We recommended that the WBCG promotes the application to tourists through rental car agencies. If the WBCG were to do so, the application could be advertised to self-driving tourists as a way for

them to navigate Namibia more efficiently and safely. They might be required to provide a financial incentive to the rental car agencies for promoting the application on the WBCG's behalf.

We also made recommendations pertaining to strategies for sustaining the application. The WBCG can further investigate the possibility of selling information that is generated in the application, such as where crime happens over time and where resources are, to relevant government agencies, including the Ministry of Works and Transport(MWT) and the Roads Authority. However, this brings up ethical concerns about selling user data, therefore the WBCG should focus on selling general data.

Overall, we learned from our research that there is a market for this application. Transport companies, truck drivers, and tourists have demonstrated interest in using this type of application. Therefore, this application has the potential to become a well used navigation system by those traveling throughout southern Africa. Once the application is developed, it will help to bring the WBCG closer to reaching their goal of improving the safety and efficiency of driving throughout southern Africa.

Authorship

Jason took a lead role in writing the Results chapter, Executive Summary, Introduction chapter, and Logistics section in the Background chapter. He also worked extensively with editing and organizing revisions. His interview efforts included traveling to Walvis Bay and Hosea Kutako airport and attending interviews and taking minutes. Jason also served as the point of contact with our liaison. He organized the submissions and presentation of the final proposal and report.

Rachel took a lead role with writing the Abstract, the Technology section in the Background chapter, the Data Collection Through Interviewing and Surveying and the Determine Application Requirements and Designs sections in the Methodology chapter, and the Recommendations and Conclusions chapter. She also helped to edit the entirety of the report. Rachel spent time reviewing the data that we collected from the interviews with transport companies and the surveys with tourists. She also created graphs and other visuals related to the data that will be included in the report.

Katie took a lead role with writing the Health Concerns section of the Background chapter, the Determine Strategies for Promoting the Application and the Determine Strategies for the Sustainability of the Application sections of the Methodology chapter, the Promotion Strategies section of the Results chapter, and the Recommendations section. She also spent time making edits and adding information where necessary to all sections of the report. Katie attended interviews with multiple companies and took minutes during the meetings.

Josh took a lead role in writing the Economy and Border Operations sections in the Background Chapter. He also took a lead role in compiling the references list and making sure all the information that we cited was up to date. Josh spent a lot of time editing and organizing revisions and drafting additional paragraphs in the Recommendations, Methodology and Results sections. Josh also served as the primary liaison with transport companies, setting up all of the meetings with company managers.

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Table of Acronyms

ART	Antiretroviral Therapy
CDC	Center for Disease Control
DRC	Democratic Republic of the Congo
HIV	Human Immunodeficiency Virus
IQP	Interactive Qualifying Project
JICA	Japan International Cooperation Qualifying
MTC	Mobile Telecommunications Limited
MWT	Ministry of Works and Transport
NAD	Namibian Dollar
NLA	Namibian Logistics Association
NSA	National Statistics Agency
NUST	Namibian University of Science and Technology
RWC	Roadside Wellness Clinics
SACU	Southern African Customs Union
SADC	Southern African Development Communities
STI	Sexually Transmitted Infections
TB	Tuberculosis
TKC	Trans-Kalahari Corridor
USD	United States Dollar
VAT	Value-Added Tax
WBCG	Walvis Bay Corridor Group
WPI	Worcester Polytechnic Institute

Chapter 1

Introduction

Truck driving serves a critical role in transport and trade throughout the world. However, it is classified as one of the highest risk occupations globally (Shattell et al., 2010). Truck drivers face many occupational stressors and hazards, such as social isolation, potential theft, hijacking, and violence. In southern Africa, to help reduce the risks caused by these stressors and hazards, there is a network of travel services including food, accommodations, fuel stations, and truck stops along trucking routes throughout the region (Mdlankomo & Chibira, 2015). However, these stops and other resources are often unsafe, creating the need for accessible and reliable information regarding safe places to stop (M. Van Taak, Personal Communication, March 22, 2018). Similar to truck drivers, tourists also have a strong need for reliable information, as they are often unfamiliar with the area.

While driving in Namibia is considered safe from hijacking and theft, driving into other countries in the Southern Africa Development Community (SADC) region can be dangerous (N. Marques, personal communication, April 12, 2018). The main challenges truck drivers face include cargo theft and hijacking (Neumann, 2015), mental health problems due to long stretches of travel (Shattell et al., 2010), and trouble avoiding unsafe facilities (B. Böttcher, personal communication, January 31, 2018). Drivers often ignore requirements for rest breaks due in part to the lack of accessible information about safe places, which can lead to dangerous situations (Ministry of Works and Transport, 2004). The lack of information is partly because small and medium sized businesses, which make up the majority of Namibia's transport sector, cannot provide the managerial and technical support needed to assist their truck drivers (World Bank, 2012).

To address this lack of information, the Walvis Bay Corridor Group (WBCG), a public-private partnership working to promote the usage of the Walvis Bay Corridors, has initiated efforts to build a smartphone application. In 2016, a team of students from WPI conducted initial research on the application, creating recommendations on how to proceed with the application development (Christine et al., 2016). This application, which will be promoted to transport companies, truck drivers, and tourists, will provide up-to-date safety and resource information for the SADC region. Similar applications, such as Trucker Path, exist for North America, providing information on truck stops, parking, weight requirements, and navigation. However, this kind of application is not yet available in southern Africa. In the first half of 2018, the WBCG began to secure grant funding that

could be used to start developing the application (B. Böttcher, personal communication, January 31, 2018).

Our goal was to improve the safety and efficiency of travel throughout southern Africa through furthering the developments of a smartphone application. Our objectives to help us meet this goal were to identify application requirements and designs, effective ways to promote the application, and strategies for fiscal sustainability of the application. To accomplish these objectives, we interviewed and surveyed transport company managers, truck drivers, and tourists who use the corridors to determine how the application can best serve their needs. We conducted these interviews and surveys in Walvis Bay, Windhoek, and the Hosea Kutako International Airport. Using the interviews and surveys, we gathered information about what types of features drivers want in the application. This helped us make recommendations on what the application should include.

The result of our project was a set of recommendations to the WBCG to help them plan how to further develop the smartphone application. We made recommendations about which features should be included in the application, how the application should be promoted, and how the application can be sustained in the long run.

Chapter 2

Background Information

In this chapter, we discuss Namibia's transport sector, economy, and the problems that drivers face while driving along the Walvis Bay Corridors. We also focus on border crossings, which are a major source of problems during long-haul trucking and for tourists entering Namibia via land. In addition to logistical concerns, we discuss the health concerns truck drivers and tourists face. We conclude with a discussion of mobile technology available in the region and how the WBCG can develop a smartphone application to help drivers manage the aforementioned problems.

2.1 Logistics and Economy

Namibia is home to the Walvis Bay Port, one of the most efficient and best equipped facilities in Africa, according to the African Development Bank (Oumarou et al., 2013). The port provides trade access to the rest of the world from and into Namibia and its neighboring countries, which are part of the Southern African Development Community (SADC). The SADC relies on these trade connections to support economic activity. Thus, a robust network of transport infrastructure is needed to promote economic vitality throughout the region.

Road freight travels through Namibia via four major transport routes: the Trans-Cunene, the Trans-Caprivi, the Trans-Kalahari, and the Trans-Oranje. These routes, known as corridors, connect the Walvis Bay Port with countries throughout the SADC region, as seen in Figure 2-1 (overleaf) (Dufresne et al., 2013). The routes play an important role in transporting goods around the area, especially into landlocked countries, such as Botswana, Zambia, Zimbabwe, and Malawi. The corridors are the main method of international transport as South Africa is the only other country into which the Namibian rail network crosses (TransNamib Holdings, 2015).



Figure 2-1: Map of the Walvis Bay Corridors

Orange represents coastal countries, yellow represents landlocked countries, and gray represents countries that are not the main focus of trade (Walvis Bay Corridor Group, 2018b).

One problem truck drivers face when transporting goods along the corridors is the long distances between safe parking locations (B. Böttcher, personal communication, January 31, 2018). In most companies, more experienced truck drivers know where to safely stop from experience, but this information is often not published or passed on to newer drivers.

As truck traffic has increased throughout Namibia, local municipalities have been unable to make adequate improvements to their roadside facilities for truckers (Collins, 2017). This is a problem for drivers traveling to or from Walvis Bay, since there is a lack of safe parking facilities for drivers to use while they wait to receive their loads. With the exception of along the Trans-Kalahari Corridor (TKC), there are no requirements mandating how many truck stops local governments should make available for these drivers (Nkala, 2016). However, the Japan International Cooperation Agency (JICA) (2015, March) is starting a USD 184 million (NAD 2.2 billion) project to build bypass roads and truck stops throughout Namibia.

An improved transportation infrastructure, including the Walvis Bay corridors, has the potential to help promote the growth of Namibia's economy by facilitating increased trade (B. Böttcher, personal communication, January 31, 2018). Namibia and its neighboring countries use the Walvis Bay Port to trade goods with the rest of the world.

In addition to providing economic growth, the transport sector can help reduce the nation's unemployment rate. Although Namibia's economy has been growing steadily over the past five years, unemployment has not decreased (Geingob, 2017). According to the Namibian Statistics Agency (NSA), the unemployment rate in Namibia is estimated at 37.3%, up from 34% in 2016 (Likela, 2018). While jobs in the transport industry account for only about 3.3% of the employed labor force (Shimuafeni, 2017), the average monthly wage of a transport industry employee is USD 667 (NAD 7,995), which is higher than the national average monthly wage of USD 564 (NAD 6,759). The jobs that the transport sector provide, along with the potential for economic growth that they create, make investing in transportation important for Namibia.

Namibia's high unemployment rate allows management to put pressure on the truck drivers to perform well because if the truck drivers are fired, it is difficult for them to get another job that pays above the national average wage. For this reason, an improved logistical infrastructure and an application that could help them perform well would benefit the drivers by enabling them to perform better with less hardship (B. Böttcher, personal communication, January 31, 2018).

In addition to the transport industry, tourism also contributes to improving Namibia's economy and employment rates. It is predicted that by 2025, tourism will provide around 50,000 jobs in Namibia (Scowsill, 2015). Namibia also generated about USD 594.2 million (NAD 7.106 billion) from money spent by foreign visitors in 2014, which is predicted to double by 2025.

Since Namibia has a comprehensive road system that can reach almost all popular tourist destinations, many tourists rent cars to drive themselves (B. Böttcher, personal communication, January 31, 2018). A recent tourist exit survey found that 83% of holiday tourists in Namibia travel via private or rental car (Herunga, 2013). However, this can be dangerous since foreigners may not be familiar with the roads, the services, and the Namibian driving laws, exacerbating typical problems encountered along Namibia's roadways. Namibia has the highest fatality rate from road crashes in the world, with 45 per 100,000 inhabitants (Sivak & Schoettle, 2014). While Namibia has comparatively good roads, there are still many dangers faced by both truck drivers and tourists within Namibia's borders.

2.2 Border Operations

In addition to the challenges faced within Namibia's borders, truck drivers and tourists face unique challenges when driving outside of the country. Of particular concern is crossing national borders, with clearing customs being one of the biggest impediments to trade throughout the SADC region (Southern African Development Community, 2012). Access to information on what to be prepared for, including what documents are needed, could help to ease the delays associated with crossing borders (Douglas et al., 2012).

There are many logistical problems facing border operations in southern Africa. For example, Zambia has lower weight limits per vehicle, depending on vehicular class, compared to Namibia, which could result in drivers getting fined once they enter Zambia (Douglas et al., 2012). These fines could potentially be avoided if the drivers had accessible information on what the weight limit is for their class of vehicle in each country they travel through.

Despite Namibia and Botswana both being members of the Southern African Customs Union (SACU), there are also logistical problems encountered when travelling between the two countries due to the lack of a treaty concerning the border (Namibian Broadcasting Corporation, 2016). In July of 2016, the two nations began working on a boundary management system, which should help to prevent long delays for the truck drivers.

There are seven border crossings between South Africa and Namibia, including two that handle commercial cargo: the Noordoewer/Vioosdrif and Ariamsvlei/Nakop crossings (Department of Home Affairs, 2018). Both of these border posts operate 24 hours a day. However, these borders frequently only allow commercial cargo to pass through during certain times (M. van Taak, personal communication, March 2018). If one of these border crossings is closed or experiencing heavy delays, the other one can be used without adding much time to the journey. This allows for a greater volume of goods to be passed through the border. However, the driver is typically unaware of heavy delays at the border until they arrive.

In addition to cargo passing through Namibia's borders, 68% of tourists arrive in Namibia through one of the nation's land borders (Herunga, 2013). This highlights the need to promote effective border crossings for the nation's tourists. In addition, "tourists are most likely to spend time in neighboring countries whilst visiting Namibia" (p.19). This means tourists who fly into Namibia might still pass through border posts to visit neighboring countries. Furthermore, tourists from Africa, 83% of whom enter the country through land borders, listed immigration as their worst experience about Namibia, indicating that tourists and truckers alike encounter difficulties at the border crossings.

2.3 Health Concerns

In addition to border crossings, there are many health issues that endanger long-haul truck drivers including diseases, long driving sessions, infrequent rest stops, and stress from passing through areas with high crime (Dufresne et al., 2013). When drivers require medical attention, the lack of information about nearby health services can be dangerous.

Mental health is a major area of concern for truck drivers in Namibia and the rest of southern Africa (Shattell et al., 2010). Trucking jobs can be stressful, especially for long-haul truck drivers who are frequently away from home, friends, family, and other support networks for many weeks at a time. Truck drivers also deal with the daily stresses of their jobs including bad driving conditions, isolation from people while driving, negative encounters with people while stopped, and fear of theft or violence when en route to their destinations. These problems can lead to truck drivers developing depression.

In addition, these problems are exacerbated when the pressure of time constraints leads to drivers sacrificing sleep (Shattell et al., 2010). To help drivers avoid sleep deprivation, the Namibian Government created a set of driving laws which are detailed in The Road Traffic Transport Regulation Amendment of 2001 (Ministry of Works and Transport, 2004). The laws mandate that an operator of a motor vehicle must:

- Only drive for a maximum of five hours continuously
- Only drive for a maximum of 14 hours within a 24-hour time period
- Rest for a minimum of 15 minutes at any given time
- Rest for a minimum of 30 minutes accumulated during a driving period of five hours and 30 minutes
- Rest for a minimum of nine hours within a 24 hour time period

These driving limits were put in place to help keep drivers safe, as getting rest is essential in reducing the probability of an accident (Dufresne et al., 2013). However, these laws are not being followed, possibly due to the lack of officials enforcing these regulations, the difficulty of enforcing the regulations, the lack of information on where to safely stop, and drivers' fears of losing their jobs if they do not meet deadlines. If a truck driver was able to easily access information about where they can safely stop nearby, then they might be more willing to take a break instead of driving more on little to no sleep.

Disease and sickness is another major concern for truck drivers and tourists traveling along the corridor. While some diseases can easily be prevented or avoided, others cannot be and upon contraction must be treated. One prevalent disease is malaria, a mosquito-borne illness that is the

leading cause of mortality in Sub-Saharan Africa and can be prevented by using insect repellent, a mosquito net, or medication (Erhabor et al., 2012). Information with up-to-date risk maps could allow drivers to prepare themselves when entering high-risk areas.

While on the job, boredom and the desire to relieve stress can lead to truck drivers engaging in risky behaviors, such as drug use and unprotected sex with prostitutes (Shattell et al., 2010). Using commercial sex services puts drivers at risk of contracting Human Immunodeficiency Virus (HIV). As of 2016, 230,000 people in Namibia (approximately 10% of the population) were living with HIV while only 150,000 people were receiving the Antiretroviral Therapy (ART) treatment (UNAIDS, 2016). HIV is especially prevalent in mobile populations, such as truck drivers, due to the lack of knowledge about the disease and how to prevent it (Bronfman, 2002). Accurate information on HIV, including the symptoms and when treatment is necessary, could be provided to truck drivers through the smartphone application.

The WBCG (2018a) works to combat the diseases contracted along the corridors in the SADC region by providing the “WBCG Wellness Service”. This service, funded by companies within the transport sector, is an initiative aimed at providing necessary health services along the corridors (Namibia Economist, 2016).

The main goal in setting up this service was to help reduce the impact that HIV has on individuals who work in the transport sector (WBCG, 2018a). In order to achieve this goal, the WBCG set up Roadside Wellness Centers and Mobile Wellness Clinics. The Roadside Wellness Centers provide health care services available to drivers during the times they are typically resting and are most likely to visit. The services offered at the roadside wellness centers include diabetes testing, HIV testing and counseling, tuberculosis (TB) screening, basic primary health care, condom distribution, and sexually transmitted infection (STI) screening and treatment. The Mobile Wellness Clinics offer many of the same services as the Roadside Wellness Centers, except the Mobile Clinics are able to travel (WBCG, 2018a). To make these services easier to find, the smartphone application could provide times available, services offered, and the current locations of these centers and clinics.

While the Mobile Wellness Clinics only operate in Namibia, there are other similar services available in neighboring countries. For example, the North Star Alliance operates clinics throughout Sub-Saharan Africa including South Africa, Zimbabwe, Botswana, and Zambia, which are all common destinations for freight departing from Walvis Bay (North Star Alliance, 2015). A recent independent study of the Roadside Wellness Clinics (RWCs) operated by North Star in South Africa found that truck drivers were satisfied with the experience at the RWCs (Lalla-Edward et al., 2018). Furthermore, the study found that most of the drivers visiting the RWCs did not regularly visit general practitioners or medical specialists which highlights the importance of providing roadside medical clinics.

In addition to truck drivers, tourists also face medical risk while traveling around Namibia

(Travel Risk Map, 2018). According to International SOS, the world’s largest medical security and travel security services firm, Namibia is rated as having Medium Medical Risk. Countries with “Medium Medical Risk” are classified as countries that have appropriate standard care available, reliable emergency services, elevated risk of food or water borne illnesses, and prevalence of infectious diseases. The US Center for Disease Control (CDC) (2018) has issued no current travel warnings for US citizens traveling to Namibia, indicating a lack of health risks. The only major infectious disease the CDC warns against are Hepatitis A and Typhoid, both of which can be prevented with immunizations. If a tourist were to contract a disease while traveling in Namibia, however, it would be helpful for them to be able to easily look up where they can go for treatment.

2.4 Technology

The above considerations, including logistics, border operations, and health, will be addressed by the smartphone application for truck drivers and tourists. In order to determine the extent of the application’s usefulness, technological considerations such as availability of smartphones and mobile connection quality, must be assessed to ensure drivers can receive this information while driving along the corridors.

As of 2012, there were approximately 2.35 million active mobile phone subscriptions in Namibia, which was 10% larger than the country’s population at the time (Namibia Press Agency, 2012). Of this, 470,000 Namibians were able to use their mobile device to access the internet. While specific statistics on the number of smartphone users or smartphone sales in Namibia are not readily available, it is known that, as of 2015, there were 160 million smartphones used in Sub-Saharan Africa (GSMA Intelligence, 2017), a region that had a population of around 1 billion people in 2015 (World Bank, 2018).

Recently, there has been an increase in mobile phones in Sub-Saharan Africa due to the increase in mobile broadband availability and the increased selection of affordable smartphones (Linington, 2015). Many Asian and European phone vendors are bringing low-priced smartphones to Sub-Saharan Africa, including the company Orange, which announced in 2015 that it would release a smartphone priced under USD 40 (NAD 475). In the same year, Google released a USD 90 (NAD 1,070) smartphone in Sub-Saharan Africa with the goal of lowering the price to USD 50 (NAD 597) by 2019.

After many launches of smartphones in Africa from foreign companies, a South African startup called Onyx Connect launched its own smartphone in 2017 (Tran, 2017). This smartphone is priced at USD 30 (NAD 358) and comes with a stock version of the Android operating system. This new company faces competition from foreign companies that currently have a larger presence in Africa but provides another low cost option. Recent measures to decrease the cost of smartphones have

been initiated as well, specifically in Namibia. In 2015, a Finnish mobile company, Jolla, launched a smartphone, working with Telecom Namibia (Lassila, 2015). This smartphone is priced at USD 435 (NAD 5,200) and comes equipped with the Linux operating system Sailfish OS. To provide their own customers, the network provider Mobile Telecommunications Limited (MTC) launched their own smartphone in 2016 priced at USD 33 (NAD 399) (Nakashole, 2016). This smartphone was meant to complement the MTC upgrade from 2G broadband connectivity to 3G across Namibia.

Based on trends from the broader Sub-Saharan Africa region, the decrease of smartphone prices paired with the increase of available smartphone options should promote the spread of smartphone use in Namibia (GSMA Intelligence, 2017). This will help ensure that the smartphone application will be available to most of the drivers who travel along the Walvis Bay Corridors.

In order for truck drivers to use the smartphone application on the roads, they must be able to access a connection to download maps and new information. Mobile broadband, the technology that connects a cell phone to its network, is provided on different “bands” that provide varying speeds and connection strength (European Broadcasting Union, 2012). In Sub-Saharan Africa, the older 3G mobile broadband technology is the most available and most likely will continue to be for the foreseeable future (GSMA Intelligence, 2017). However, the faster 4G technology is starting to be introduced, as seen in 2017 when 97 4G networks were being used across Sub-Saharan Africa. This newer, faster connection could provide more reliable and real-time information services to customers who are traveling.

Namibia has three mobile service providers, MTC, TN Mobile (provided by Namibia Telecom), and Paratus Telecom, with MTC having the most cellular and mobile data coverage (covering about 95% of the population, as shown in Figure 2-2 (overleaf)) (OpenSignal, 2017a). TN Mobile still covers the major cities of Windhoek and Walvis Bay, but fails to cover the lesser traveled roads as shown in Figure 2-3 (overleaf) (OpenSignal, 2017b). Paratus’ mobile data connectivity only covers the city of Windhoek, failing to cover any of the corridors (Paratus Telecom, 2018).

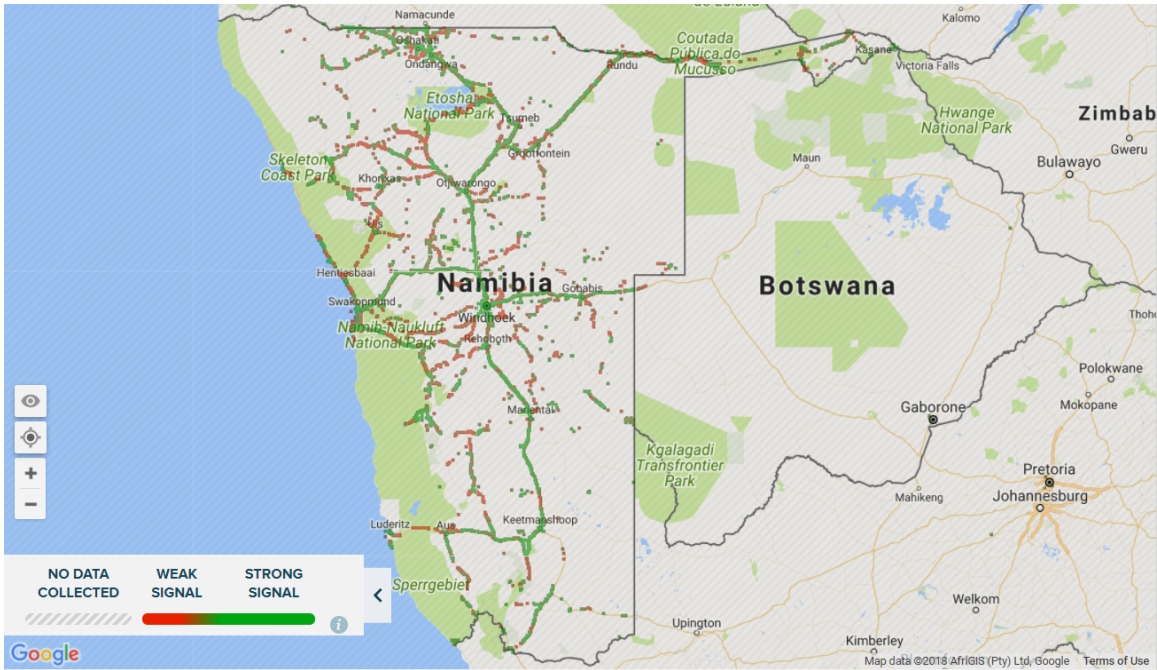


Figure 2-2: MTC Coverage
(OpenSignal, 2017a)

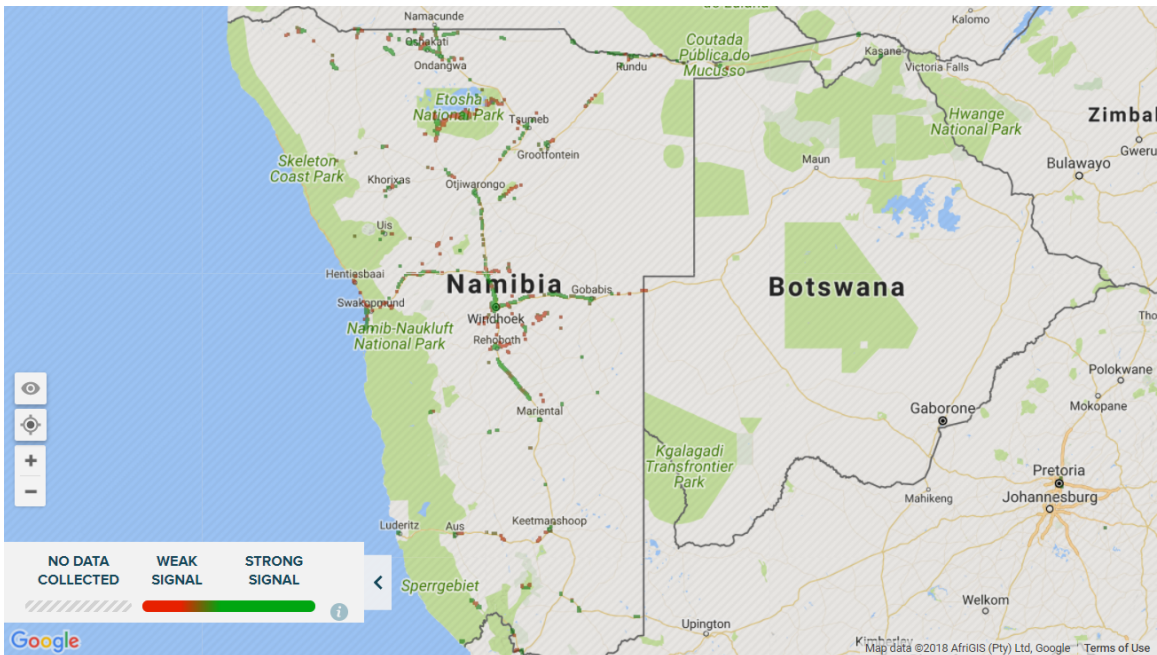


Figure 2-3: TN Mobile Coverage
(OpenSignal, 2017b)

The network coverage in Namibia by MTC and TN Mobile allows for a few options when creating the smartphone application (OpenSignal, 2017). For drivers with a better connection, the application would automatically be updated with real-time maps and information as the drivers travel along their routes. With less reliable networks, the application could be “offline enabled” so that the user could download the maps and information while they have a strong network signal, which could then be used along their routes.

Looking at other smartphone applications that are used around the world can show us how to structure the application by seeing what works and what does not work with users. There are many smartphone applications available in the United States that allow truck drivers to find accommodations and other travel services while on their route. For example, a popular application used in the United States is Trucker Path (2018a). This application allows truck drivers to see a real-time map with markers for stops with different amenities such as parking, fuel stations, weighbridges, hotels, restaurants, repair shops, etc. (Figure 2-4). Users can both write and read reviews from others about the stops listed. This application can serve as an inspiration for features and designs to be included in WBCG’s smartphone application.

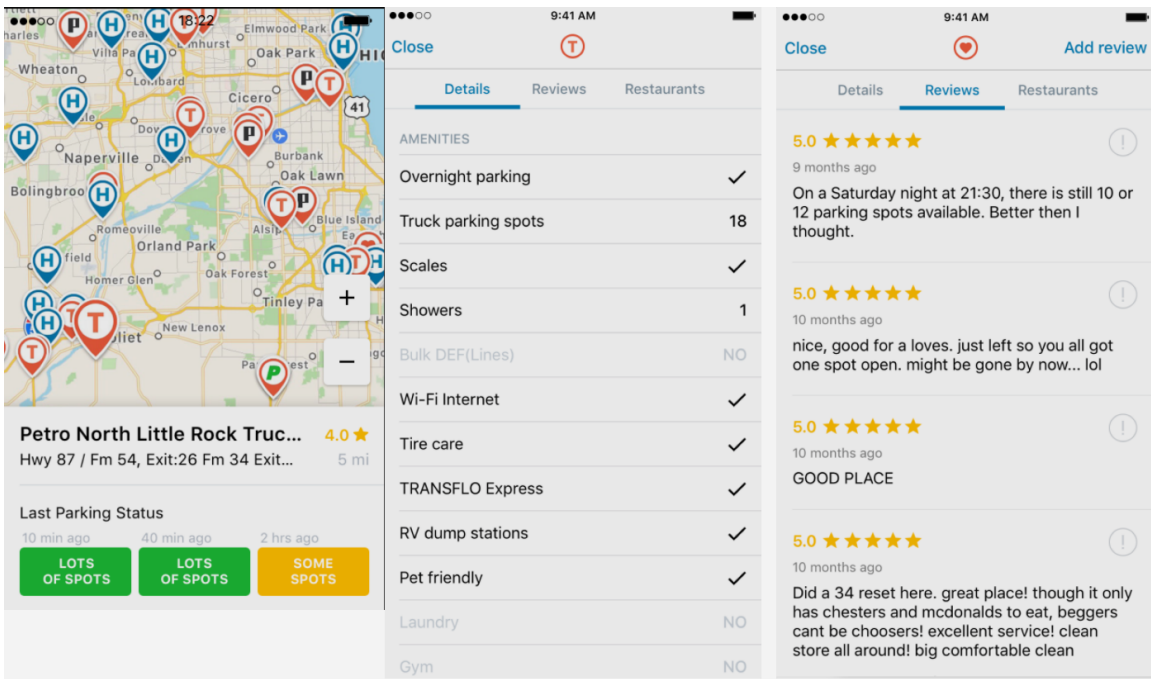


Figure 2-4: Screenshots of Trucker Path

The left shows a map of close truck stops (indicated by “T”) and hotels (indicated by “H”), the middle shows the details of what a selected truck stop has, and the right shows the reviews of a selected truck stop (Trucker Path Inc., 2018b).

2.5 Summary

Despite the fact that jobs in Namibia's transport industry are relatively well-paying, there are still many problems plaguing truck drivers. These problems primarily relate to the lack of information about travel services and susceptibility to health problems, which also affects tourists traveling along the corridors. The WBCG is attempting to address these problems in the form of a smartphone application to provide important information to drivers. To assist their efforts, we conducted field research, which is discussed in the following chapters.

Chapter 3

Methodology

Our goal was to help the Walvis Bay Corridor Group improve the safety and efficiency of trucking in southern Africa by furthering the development of a smartphone application to assist people who drive on the corridors. This project follows a previous Interactive Qualifying Project (IQP) team's work, who completed a project with the WBCG in 2016 to collect data regarding interest for an application and the features that would be desirable (Christine et al., 2016). We used this work as a starting point for our data collection. To reach our goal and build on the previous work, our objectives were to:

1. Identify application requirements and design
2. Identify strategies for the promotion of the application
3. Identify strategies for the sustainability of the application

3.1 Data collection through interviewing and surveying

We focused on collecting data from companies and drivers who drive through the Walvis Bay Corridors. To collect these data, we interviewed and surveyed transport company managers, truck drivers, and tourists in Hosea Kutako International Airport, Windhoek, and Walvis Bay. The information that we obtained from these interviews and surveys gave us insight into what features transport companies, truck drivers, and tourists would like included in the application. The interviews and surveys also gave us information on the best ways of promoting the application to other transport companies and tourists and how the application could be sustainable. We used this feedback to create a set of recommendations for the WBCG about what features to include in the application, how to promote the application, and how to help the application be sustainable. These recommendations, which we discuss in detail in Chapter 5, were used by a team of students from the Namibian University of Science and Technology (NUST), who started the development of the application.

To begin our research, we compiled a list of 140 transport companies and 40 tourism companies to contact to schedule interviews with managers and drivers. We found these companies through a combination of internet and phone directory searches, using keywords such as transport, logistics, couriers, and tourism. For each of the companies that we identified, we found key contact people through the Namibian Logistics Association (NLA) database of partners and through company websites and then reached out to them by email and telephone to explain who we are and to request a meeting.

Our initial interviews took place in the Southern Industrial and Prosperita areas of Windhoek, where we visited the offices of six trucking companies to complete interviews with transport managers and to survey their truck drivers. We also visited the Walvis Bay and Swakopmund area, which allowed us to interview and survey seven truck drivers from Zambia, and three managers from three transport companies involved in freight forwarding and shipping. Obtaining information from the truck drivers allowed us to receive feedback from the drivers who would be using the application on a regular basis.

During our interviews with the transport company managers we showed a video demonstration of the proposed application, which was created by the 2016 IQP team, to show what the application would look like and to improve their understanding of the project. This video showed a prototype smartphone application with sample features, such as a map of the user's current location, a list of nearby travel services, a search function, an information page with safety tips, health information, border crossing information, and an "about" page with information about the WBCG. We asked the managers about their own experiences with the corridors, what complications their drivers have while driving on the corridors, and how they believe an application would be able to assist their drivers. We asked these questions to gain an understanding of which features would be the most useful to include in the final application. We also asked what they believed would be the best strategies to promote the application to their drivers and to other companies, which helped us make recommendations to the WBCG about how to promote the application. Lastly, we asked whether they would prefer to pay an upfront price to access the application, pay for in-application features, have company sponsorships, have in-application advertising, or if they were unable or unwilling to pay for the application. If they responded positively to paying for a part of the application, we asked them how much they would be willing to pay. If they responded that they were unwilling to pay, we asked why they would not be.

When we met with transport company representatives and truck drivers, we asked questions about common problems encountered at the border crossings. We used the information that we collected to help make recommendations to the WBCG about what border crossing information should be included in the application.

While in Walvis Bay, we held interviews based on convenience sampling of truck drivers waiting

to receive their cargo. These drivers were all parked in a closed area, camping in their trucks until their cargo was ready. We used our truck driver interview protocol to ask the drivers questions and receive feedback. These questions involved problems the drivers faced, the driving conditions in southern Africa, whether they would use an application, and how many drivers had smartphones.

In addition to the information we received from transport companies and truck drivers, we also wanted to get feedback about the application from tourists. We determined that the best way to receive a large amount of information from tourists was to visit Hosea Kutako International Airport during the arrival and departure of large flights. We visited the airport to interview tourists disembarking from flights arriving from Doha, Johannesburg, Cape Town, and Addis Ababa. We also interviewed tourists waiting to board flights to the above destinations. Other interviews with tourists took place at the rental car agencies in the airport, including Bidvest, Thrifty, Hertz, and Avis. We were especially interested in tourists who had driven themselves because they were usually more interested in discussing the application, since they had experienced navigating Namibia. For the interviews, we stopped the tourists based on convenience since some were in a rush to leave or catch their flight.

The questionnaires for tourists focused on learning if they would use an application with features including navigation, emergency contact information, danger alerts, weather forecasting, traffic and road condition information, and what road services are safe to stop at. We asked how each person traveled around Namibia, such as by a rental car or by a tour company. We also asked how they navigated through Namibia, such as by GPS or physical maps. This helped us understand which tourists would be interested in this application. After, we listed features the application might have and asked if there were any additional features that would make their traveling easier and more convenient. Finally, we asked what they think the price of an application with these features should be and if they would still use the application if it was not free to use. This allowed us to understand if the application could produce revenue from tourists in addition to the transport companies.

We reached out to tourism companies as well to understand if they would be interested in such an application. We believed that their drivers would be able to use the application to help navigate the roads and to help them keep up-to-date with current road conditions. In the following sections, we will elaborate upon the specific methods used for each of our objectives.

3.2 Determine application requirements and designs

To make the smartphone application effective in helping all drivers navigate the corridors, we collected feedback from the trucking companies who manage drivers and the truck drivers, and tourists who drive themselves.

During our interviews with transport company managers, truck drivers, and tourists, we noted all the features mentioned. From this, we generated two lists of possible features which included the features mentioned from these interactions, the features proposed in the 2016 project, and the features that we thought of originally with help from our sponsor. One list contained the features that were specific to the transport companies and truck drivers, whereas the other list was specific to the features that the tourists mentioned.

After compiling both lists of possible features, we developed a decision matrix to help us decide which features were the most important. We weighted these features by each of the following criteria, starting with most important:

1. Ease of collecting information
2. Number of mentions during interviews and surveys
3. Cost to develop
4. Cost to maintain
5. Time to develop

We considered our first criterion, “ease of collecting information,” to be the most important because if the information for that feature cannot be collected, it is not worth pursuing even if the information is highly sought. The second criterion, “number of mentions,” is important because it showed what the managers, drivers, and tourists were specifically looking for in the application. We considered the last criterion, “time to develop,” to be the least important because we were not given a specific deadline for the completion of the application. The criteria “cost to develop” and “cost to maintain” ranked in the middle in terms of importance. By filling out these criteria based on the feedback we received for each feature, we were able to rank which features were most important. The professional programmer will develop the top five to ten features in the first two iterations of the application, whereas the bottom five features would be add-ons for the application after it is released and gaining revenue.

We gathered information about the cost to develop, the maintenance cost, and the time to develop each feature through an interview with representatives at a local programming company, Loop

Technologies. We met with Mr. Asen Mwandemele, who is a lead developer for Loop Technologies. Mr. Mwandemele walked us through the features we had proposed and the relative difficulty to add each to the application. We used this information to help fill out our decision matrices. We then gave the ranked lists to Mr. Mwandemele to get an estimate on the timeline and cost for development.

3.3 Determine strategies for promoting the application

A main priority of the WBCG is the promotion of the application, which includes encouraging trucking companies and drivers to use the application once it is released. We asked the trucking companies, truck drivers, and tourists about which methods of promotion they would prefer. The methods that we proposed were based on the strategies we found through our research, and included flyers, brochures, posters, digital media, word of mouth, and newspaper advertisements.

After our first few interviews, we determined that these strategies were not the best way to promote the application to truck drivers or tourists. We decided to change our promotion methods by focusing on training truck drivers on how to use the application. In our interviews and surveys, we asked what the best training methods would be to allow the truck drivers to learn how to use the application efficiently. To promote the application to tourists, we asked the tourists how they learned to navigate Namibia.

While discussing the application with the transport companies, truck drivers, and tourists, we promoted the application through word of mouth. We were able to inform each group that an application was being created to help them and that they should download and use it once it was released.

3.4 Determine strategies for the sustainability of the application

Beyond promotion of the application, it is important for the WBCG to develop a sustainability strategy to ensure there is enough funding and to ensure the information is updated regularly to sustain the application. To address this, we chose to research sustainability strategies because without continuous revenue and maintenance, the WBCG would not be able to keep the application running.

We researched different monetization strategies that are commonly used for mobile applications

to recommend how the application could be self-sustainable. We then used interviews and surveys to determine which of these strategies would be most accepted by the transport companies and the truck drivers. If the company was willing to pay for the application, it could be beneficial for both the company and the WBCG. The WBCG could use this money to help pay for the upkeep of the application and the application would help the company by providing useful information to its drivers.

In addition, we surveyed the tourists to learn if they would be willing to pay for the application. This is another source of revenue that the WBCG could use to fund the upkeep of the application. In our surveys, we asked the tourists how much they believe the application would be priced at and if they would be willing to pay for it. We also asked if they were more interested in paying for the application as an upfront cost or if they would rather pay per feature.

After the completion of our interviews and surveys, we developed a set of recommendations for sustaining the application. All of the recommendations for sustaining the application were mentioned by multiple parties who were interviewed. In addition, independent research confirmed that these were viable strategies for sustaining the application.

Chapter 4

Results and Analysis

Through our interviews, surveys, and internet research, we developed an understanding of what problems truck drivers and tourists face while driving along the corridors. We approached this project with a preliminary understanding of some of the problems drivers encounter due to discussions with our sponsor, which was further developed after speaking to managers and drivers, visiting key transport locations such as Walvis Bay, and investigating possible solutions.

We received feedback when speaking to managers and drivers about what features the application could include and how the application can help the drivers. We used the information from managers and drivers to shape our understanding of how road transport operates in Namibia. In this chapter, we discuss the feedback that we received and how it shaped our understanding of how to address the problem.

4.1 Requirements and Design Feedback

The WBCG initiated the plan to create a smartphone application in 2016 when sponsoring a previous IQP. The previous team proposed a list of potential features and created a video demonstration of an application prototype that formed the basis of our project, which focused on refining the original plans and collecting additional feedback on promotion and sustainability strategies. This involved approaching companies with the original, and later refined, list of features and the original group's video demonstration to receive feedback on what could be changed and whether drivers may benefit from the application. Due to the WBCG's focus on transport companies, we mainly focused on transport companies for the collection of information but also investigated tourism as a possible source of revenue and interest.

A major concern for our project was the availability of smartphones for truck drivers. There were no data on smartphone use for truck drivers in southern Africa, and we did not know whether they would have smartphones and mobile data available to use. We learned by speaking with managers and drivers that the majority of drivers have smartphones, almost all use android based smartphones, and many companies allot a weekly or monthly balance of minutes, texts, and data for their drivers to use. Therefore, the truck drivers would likely not have to pay out of pocket for smartphones or use

their own data to use the application while on the roads. One company, the Manica Group, provides all their drivers with smartphones and mandates that they have their phones turned on whenever they are driving. The managers of trucking companies told us that they typically communicate with their drivers via phone call, SMS, and WhatsApp group messaging. WhatsApp continued to be a common theme across all companies and individuals in Namibia, and we were told that companies often have separate groups for different employees.

The common reason that managers use WhatsApp is because of its good performance while in slow-data areas and while the driver is abroad. Out of the seven trucking companies that we talked to, all but one of them said that they use WhatsApp for communication between employees. Managers mentioned that in cities such as Windhoek and Walvis Bay phones can connect to 3G networks, but while on the road between cities most cell phones receive slower connections. People we interviewed made it clear to us that being able to download information while in these faster areas was important, and that access to data may not always be reliable when on the road due to network dead spots. This meant that it will be important to store, or cache, data for when a strong connection is available again. We later used this information obtained from interviews to determine application performance requirements.

Once we learned that most truck drivers have access to smartphones and data, we focused on ensuring the application included features that benefit both the drivers and their managers. The careful planning of the features and timeline for the application was essential as the development of a smartphone application is a large endeavor which requires time and significant funding. In addition, the WBCG requested that we explore the option of developing the application in stages, to decrease the time needed to launch. The first iteration, therefore, would focus on the most important features. To decide which features to include, we analyzed and weighted our list of features.

Based on our notes from the interviews with trucking companies, we created a decision matrix, as seen in Figure 4-1 (overleaf), to prioritize the first five features that should be programmed into the application. The top-five features that we identified from the decision matrix were:

1. Contact information for both emergency and non-emergency services
2. Border post operating hours
3. Safety alerts
4. Travel service information
5. HAZMAT transportation requirements

These features all focus on getting important information to drivers when they are in critical situations, such as getting through the border, running low on fuel, or are stuck in an emergency.

After identifying these top five features, we ranked the entire list of features to determine how many iterations the application should be developed in.

Decision Factors		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Criterion	Wt.	Navigation	Travel Service Information	Pricing Information for Hotels/Restaurants	Contact Information: Emergency, Border Agent, Local Support	Vehicular Legislation per Country	Border Crossing Paperwork and Requirements	Border Operating Hours	Border Crossing Estimated Wait Times	Alerts: Refuel, Stopping, Breaks, Crime/Animal Activity	Weather Forecasting	Currency Exchange Rates	Roadside Maintenance Tutorials	HAZMAT Requirements	Translation: Speech with Common Phrases	Traffic Information	Travel Service Feedback	Group Messaging	Order System for Fueling	Tracking	Management Controls	Sending Money
Number of Mentions during Interviews	3.0	1	3	2	4	1	1	1	1	2	1	1	1	2	1	1	2	4	1	3	1	1
Ease to Collect Information	4.0	4	4	2	4	3	3	5	2	3	4	4	1	3	4	2	2	5	5	5	5	5
Time to Develop	1.0	3	3	3	5	5	5	5	5	5	3	4	5	5	3	3	3	-3	-5	-3	0	-5
Cost to Develop	3.0	3	3	3	5	5	5	5	5	5	3	4	5	5	3	3	3	-3	-5	-3	0	-5
Maintenance Cost	2.0	3	3	3	2	3	3	4	2	5	3	3	2	2	4	4	4	3	0	3	3	0
Weighted Scores		37.0	43.0	32.0	52.0	41.0	41.0	51.0	35.0	48.0	37.0	41.0	31.0	42.0	39.0	31.0	34.0	26.0	3.0	23.0	29.0	3.0

Figure 4-1: Feature Decision Matrix for Truck Drivers

The score in blue represents the highest score, green represents top features, yellow represents middle ranking features, and red represents lowest ranking features.

From this decision matrix, we learned that some features that we initially expected to be important, such as navigation, ended up being less important than other features, such as border post operating hours. We also learned that some of the features that the companies wanted, such as providing managers with information about their drivers, would have to be implemented later once the application starts generating revenue since it would be expensive to implement.

Speaking with industry professionals and truck drivers, we learned that driving within Namibia is relatively safe from crime compared to driving throughout the rest of southern Africa. In most cases, the roads are suitable for driving, the service stations and facilities tend to be safe, and the drivers know the area. From interviews with transport industry professionals, we determined that the most commonly encountered problems are long wait times at the borders; bad road conditions; and theft, hijacking, or bribery. Out of the nine transport company interviews we conducted, ten

different border problems were mentioned, bad road conditions were mentioned five times, and theft, hijackings, or bribery were mentioned eight times. These problems, however, are typically only encountered once the driver leaves Namibia. The feedback we received from the industry professionals was corroborated by the truck drivers with whom we spoke. These problems, as seen in Figure 4-2, also present an opportunity to help by providing information and advice for drivers to address the issue.

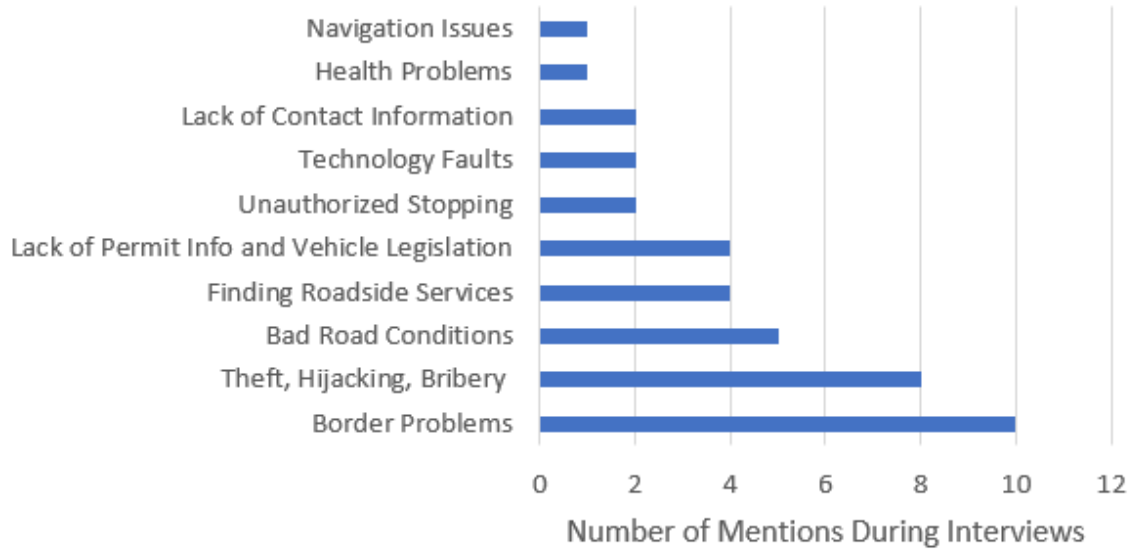


Figure 4-2: Common Problems Mentioned during Interviews

Much of the routine information that drivers need, such as what roads to drive and which gas stations they should stop at, is currently provided through a combination of company publications and years of experience. For example, the FP Du Toit trucking company maintains a booklet of information per major route that contains everything the company has learned over years of experience. This booklet of information is provided to each driver and is updated every six months. When a driver starts a new route, they are given the booklet that guides them on how to complete their deliveries. This information is valuable to their drivers because it helps guide them where they need to go and where they can stop for specific needs, such as fuel. Companies want their drivers to go on their preferred routes, go to the fuel stations with whom they have a partnership, and stop in specific places. This company-specific information is something that they want to keep confidential. However, even though companies have their own specific methods of travel that they want their drivers to follow, they still want to benefit from the information that can come from having so many drivers from different companies connected through the application. To solve this, the companies we interviewed were interested in purchasing their own custom branded (or white-labeled) version of the application, while still having access to a shared version of the application.

White-labeled products are products that have been rebranded to appear as if a company produced it (Gainor, 2014). Larger trucking companies are interested in paying more to have an application with their name on it, where they can provide their drivers with proprietary information, without having this information accessible to the greater community. For example, a manager at FP Du Toit, Ryno Badenhurst, said that he would not be willing to share his company's mapped out routes because he finds it to be a competitive advantage against other companies.

White-labeling the application would work as follows: there would be a generic WBCG smart-phone application, which provides all of the features that we have identified above, using information provided by the general population of drivers and using the information collected and provided by the WBCG. The white-labeled companies could then select certain extra features and add in their own information, which would not be available on the general application. However, one of the most important parts of this application is information pertaining to safety and the power of real-time updates. Several companies, such as FP du Toit and DB Schenker, have expressed that they would most likely be willing to share any safety updates that their own drivers provide in order for the general population to benefit. The managers of these companies could then use that information from other companies to update their own drivers.

The real-time safety updates are one of the most valuable features of the application and one of few that would need to be constantly updated. We envisioned a system where drivers can leave feedback on certain locations, alert drivers of animal and criminal activity, and correct any incorrect information that may be in circulation. This essentially creates a real-time map of what is happening on Namibia's roads. This information would be valuable to managers and the government; this is further discussed in Section 4.3.

Though truck drivers and transport companies were our main focus, we also contacted tourism companies and tourists to gather information about whether they would benefit from this kind of application. The tour companies that responded to our emails and phone calls mentioned that they typically do not travel along the major corridors and therefore would be uninterested in such an application. Tourists, however, were interested in the application because many drive themselves during their stay in Namibia. The information that the application provides may be of most use to tourists since they may know very little about the roads on which they travel.

When we went to Hosea Kutako International Airport, the feedback we received from tourists was mostly positive. Twelve of the 34 groups of tourists we spoke to said they were not planning on driving themselves around Namibia, which made the application less appealing to them. The 22 groups of tourists that drove themselves throughout Namibia were much more interested in the application. One mother from the United Kingdom, who completed a two week trip in Namibia, told us her family would have used the application during their trip. Another group from Germany said that the application would have been nice since they mostly used paper maps and books to

navigate around Namibia. In total, 19 groups of tourists told us that they would use the application to help navigate Namibia.

From these data, we were able to create another decision matrix (Figure 4-3) for the features that the tourists mentioned during the surveys. The criteria for this matrix were the same criteria we used for the features that the trucking companies wanted.

Decision Factors		Sightseeing Information (Wildlife Hotspots)	Accommodation Information (Hotels, Camp Sites)	Workshop/Tutorials	Immigration Information	Offline Option	Navigation with Road Conditions/Traffic information	Weather Information	Local Information (Nearby Towns, Fueling/Service Stations, ATM Locations, Café Locations, Restaurants, Shopping Centers)	Tips for Tourists (Namibian Laws, Photography Norms, Car/Road Recommendations)	Alerts for Crime/Animal Activity
Criterion	Wt.	1	2	3	4	5	6	7	8	9	10
Number of Mentions in Surveys	3.0	5	6	2	1	7	18	3	10	6	16
Ease to Collect Information	4.0	3	3	2	2	5	2	4	3	2	3
Time to Develop	1.0	4	3	4	4	1	4	3	4	4	4
Cost to Develop	3.0	4	3	4	4	1	4	3	4	4	4
Maintenance Cost	2.0	3	3	4	4	4	4	3	3	3	5
Weighted Scores		49.0	48.0	38.0	35.0	53.0	86.0	43.0	64.0	48.0	86.0

Figure 4-3: Feature Decision Matrix for Tourists

The complete decision matrix for tourists with ten possible features. The scores in blue represent the highest score, green represents top features, and red represents the lower ranking features.

After collecting information from transport company managers, truck drivers, and tourists, we reached out to Loop Technologies, a local programming company in Namibia. From our conversation with Loop Technologies, we identified that the white-labeling of the application, as well as the managerial features of inputting proprietary information and monitoring drivers would take considerably more effort and funding than the other features. Most of the proposed features simply involved collecting data and presenting it in the application with a nice user interface. This relatively static information with a user interface is simple to develop and cost-effective compared to dynamic features. Therefore, we decided to focus on these features, with the managerial features and white-labeling to be developed later. From the list that Loop Technologies provided of what would be possible in a certain timespan, we altered our evaluations in the decision matrix in Figure 4-1, resulting in a list of “first iteration” features.

During our meeting, Loop Technologies’ lead developer Asen Mwandemele, agreed to send us a quote with a tentative timeline for how much time and money the application would need to be fully developed. The cost for the development of the application would be around USD 13,334 (NAD 164,000) while the fee for the application to be deployed on the Google Play store and the Apple Store would cost about USD 406 (NAD 5,000), excluding Value-added Tax (VAT). The full development of the application, including a testing phase, would take fewer than 50 days, as seen in Figure 4-4 (overleaf).

PHASE 1: REQUIREMENT SPECIFICATION	<u>DURATION</u>
Our team will draw up a draft requirement specification and hold a series of discussions with relevant staff detail requirement specification. A software development strategy will be drawn up and included in the requirement specification document for approval.	2–6 Days
PHASE 2: DEVELOPMENT	<u>DURATION</u>
Design and development of the web and mobile applications (Android) as specified in the software requirements phase.	30 Days
PHASE 3: TESTING	<u>DURATION</u>
A beta version will be available and uploaded onto a secure server for internal testing	5-10 Days
PHASE 4: FINAL REVIEW OF PROTOTYPE	<u>DURATION</u>
Relevant staff members will be trained on the new website as content management, social media integration and related software where applicable.	2-5 DAYS
PHASE 5: PLANNING & IMPLEMENTATION OF RELEASE VERSION	<u>DURATION</u>
Finalized solution will be submitted to the Live server and a Backup & Restore Plan will be implemented. Mobile applications will be submitted to app stores for approval from the vendors. A Service-Level Agreement will be in effect for maintenance of the website content and security.	TBD

Figure 4-4: Timeline for Development of the Application

Timeline for the development and release of the application broken down into specific phases (Loop Technologies, 2018).

From the feedback we collected, we were able to decide which features were most important to drivers and therefore should be incorporated into the application. We developed the final list of features based on those that are most useful for managers at transport companies, truck drivers, and tourists. We discuss our recommendations based on these data in Chapter 5.

4.2 Promotion Strategies

Part of the challenge of developing a new application is building a user base. Our initial ideas for promotion of the application included flyers, brochures, posters, digital media, word of mouth, and newspaper advertisements. These methods require that users take action based on the information that they received. However, it came to our attention during our interview with Claytone Chigiaro

from the trucking company DB Schenker, that an in-person training for managers before the drivers used the application might be the best option, a sentiment that was shared when discussing the application with other industry professionals. The managers also mentioned that the WBCG providing training would serve as promotion for the application. This new information led us to switch our approach from posters, flyers, and brochures, to asking managers what type of training they think would work best for their drivers. When we suggested four different methods of training, the common order of preference of the methods turned out to be:

1. In-person managerial training
2. Group training
3. Video training
4. Manual training

Managers expected in-person training sessions to be the most effective method of promotion. The managers would learn how to use the application and then present their knowledge to their drivers. This process would minimize the number of people that need to be present during training, while maximizing the number of people that will learn how to use the application.

While this was the most preferred method of training, managers also mentioned that group training, video training, or providing a manual could all be possible sources of training and promotion. Group training would allow many drivers to receive the information at once, but managers expressed difficulty in working around schedules. A video could also be provided, but would represent an inability to ask questions or work with drivers directly, which managers felt was necessary. Lastly, a manual could be given to drivers or managers, but managers felt that this would be difficult to use. Managers expected that non-personal training or information may not be an effective form of promotion because it requires the truck drivers watch a video or read a manual and figure out the features on their own without being able to ask questions. Their fear is that if the truck drivers are not motivated to learn something new, then they may never watch the video or use the application because managers said that this type of thing will often happen with drivers. Managers also reported language barriers, and instructing drivers would require communicating in different languages, such as English, Oshiwambo, Afrikaans, French, Portuguese, etc.

From our conversations with tourists, we learned that many tourists were unsure of which promotion strategy would be most effective. The tourists who already use similar navigational applications or devices mentioned that they learned about those forms of navigation either through internet research, a rental car company, or through friends and family.

4.3 Sustainability Strategies

Our vision for this application is that the best version will be made after many truck drivers and tourists have used the application and the WBCG has analyzed the feedback generated. Based on the cost of maintaining the application, there needs to be a plan to maintain sufficient funding. We explored options including white-labeling the application, selling data collected from the application, and having an up-front cost for every user.

Based on the feedback we received, a desirable option is to allow companies to white-label the application, or pay for company-specific features. Five out of the seven trucking companies we interviewed would be willing to pay for a white-labeled version of the application. White labeling is a long-term plan, however, as according to Loop Technologies, this model would come at a considerable cost since the customizable application would be developed by a professional developer, who would have to rebrand the application and would have to add more extensive managerial controls. Ultimately, if white labeling were an option, it would provide a recurring source of revenue for the WBCG and would help fund the general version of the application for the public.

Data on the locations of drivers, safe travel services, stops along the routes, and where problems occur present a valuable view of Namibia's road infrastructure. This information is important to drivers and managers as they can quickly reroute and avoid dangerous places before one of their drivers encounters it. The government could use this information to repair problems with the roads, monitor areas with high crimes, and watch for speeding. The MWT, whose Permanent Secretary sits on the WBCG Board of Directors, is one agency that would potentially be interested in obtaining data generated from the application. Transport companies could use this information to plan better routes and deliver loads faster. This information is valuable so selling the information could be a considerable source of income for the WBCG.

Another source of income could be an up-front cost for every user. This would involve setting a price to download the application that everyone, except for the truck drivers using a corporate account, would have to pay. An up-front cost would allow tourists to easily download the application to use all the included features, rather than having to pay separately for specific features, and it would also allow the WBCG to have another source of income.

Correctly pricing the application is important, as overpricing will drive away revenue while underpricing will be unsustainable. To correctly price the application, we factored in how much companies would be willing to pay, and how much the application will cost to develop. The application development cost was based on our meetings with a local programming team, Loop Technologies. They gave us estimated costs based on the initial development, as well as ongoing six-month interval maintenance. Estimates for how much companies may be willing to pay for the application was based on existing company subscriptions to Ctrack, which is paid on a per-truck basis (C. Chigariro,

personal communication, March 22, 2018). In addition to initial setup and equipment costs, Ctrack charges a monthly vehicle hub fee for each vehicle and cellular fees on a per-account basis. We collected anonymous information from one company on their Ctrack rates, which was about USD 210 (NAD 2,600) per vehicle for one month, and used this to estimate what appropriate pricing might be for the application. Companies were most interested in paying a per-driver rate, so that smaller companies do not need to pay for what they will not use.

The management and coordination of this application will be a major responsibility. Not all information will be perfectly accurate and most likely will need to be reviewed. This is similar to methods that other applications use. For example, TripAdvisor uses a combination of moderators and automated tools to verify reviews (2018). When companies need help or something needs attention, then there will need to be someone to support it. This person's role is to maintain the ongoing maintenance and contracts with the local development team. He or she will also be responsible for making sure that the application is updated every so often so that the information drivers are receiving is constantly up-to-date.

4.4 Summary

The feedback we received from companies, drivers, and tourists will help to shape the outcome of the application and can help increase safety while driving in southern Africa. By speaking with trucking company managers, truck drivers, and tourists traveling around southern Africa, and working with the WBCG, we shaped our understanding of the problems drivers face and used this to create a set of recommendations. We decided that the refined features list will make its way into the first few iterations of the application while the funding strategies can shape the development lifecycle. The collective information has the potential to be valuable to the WBCG and can help ensure the project has a successful start. In the following chapter we present our recommendations for the development of the application.

Chapter 5

Recommendations and Conclusions

There are a number of steps that the WBCG can take to further the development of a smartphone application to help improve the safety and efficiency of driving in southern Africa, as we present below.

5.1 Recommendations

Due to the size and complexity of this project, we recommended that the WBCG hire a professional programming company to develop the application. The NUST students with whom we worked alongside with could continue building the application, and once they were no longer working, could be completed by a professional company. Further, we made recommendations regarding which features should be included in the application, how the WBCG should promote and teach the application to drivers, and how the application can be made sustainable without the need for regular funding allocations from the WBCG.

5.1.1 Recommendations for Requirements and Designs

We found that many features that would be useful in the application are based on static (infrequently changing) information. This static information is simpler to include in the application since it is easy to develop and would not cost as much as dynamic features. To accelerate development of features, we recommended that the application be built in multiple iterations. Since some of the features will require a lot of time and money to create, it is best to make a first iteration of the application with the features that require less time and money. The programmer of the application can then ensure that a first iteration can be finished and ready for drivers to use in a shorter amount of time, than if we had chosen more complex features. After the baseline application starts to generate revenue, the WBCG can use these funds to add more of the dynamic features which will require more time and money to develop.

While white-labeling will be implemented for those companies that want the more dynamic features in their application, we recommended testing the white-labeling with one company that is

successfully using the base application and that would be willing to fund their own version. It is easier to test the application with one company first rather than many because it will allow the WBCG to focus solely on one test version. This will allow the WBCG to collect feedback about the white-labeling process and decide if they should expand the option to more companies. The success of the white-labeling process will be measured by the company's feedback about the application and by how much revenue the WBCG can collect by having such an option. If proven successful, the WBCG should expand the white-labeling option to as many companies as possible.

In addition to the application for truck drivers, we recommended that WBCG create a separate version of the application designed for tourists. Tourists require similar but different information from truck drivers. For example, both tourists and truck drivers want to know where they can stop for food, gas, and rest, and where road conditions are bad. However, tourists want to see information such as when the national parks open or where the most popular destinations are located, whereas the truck drivers want to know how long it will take them to cross a border and how much weight their trucks can be carrying. Therefore, it makes the most sense to have two versions of the application tailored to each group of drivers. The application can ultimately share a lot of the development since the programming of the applications will have a lot of overlap.

5.1.2 Recommendations for Promotion

Proper promotion is key in making the application well-known and getting people to use it. Based on managers' feedback, we recommended that training on the application be done by in-person managerial training.

For the in-person managerial training, a trainer from the WBCG or from the developing company would go through the main features of the application and demonstrate how to use them. During the training session the managers could ask questions and try the application on their devices. This would allow the managers to see what they understand about the application and what things they need more information on. Following the training, the company managers would take this new knowledge of the application back to their company and have training sessions with their own drivers so they can download it and learn how to use it.

In addition to the managerial training, we also recommended that the WBCG create a tutorial video that will teach managers and truck drivers to use the application. This will allow the managers or truck drivers to reference the video in the event that they forget something from the initial training sessions. A tutorial video is preferred to manuals because drivers have varying literacy and speak a wide variety of languages. It can also help with reaching drivers who have difficulty scheduling time with their managers.

We also recommended that the WBCG designate one person to be in charge of the upkeep of

the application. That person should meet with the developers and learn how all the features of the application operate. This person from the WBCG should also be in charge of conducting in-person managerial trainings.

In order to market the application to tourists, we recommended that the WBCG partner with rental car companies located around Windhoek and at the airports. Many of the tourists that would use a travel application had rented a car and drove themselves around Namibia. If the WBCG partnered with rental car companies, the application could be advertised to tourists who rent cars as a way for them to navigate Namibia more efficiently without spending time and money to search for paper maps or other forms of travel guides. Because the WBCG mobile application may compete with navigational products offered by the rental car agencies, the WBCG would likely have to negotiate terms to allow the WBCG to promote the application. By recommending that tourists download the application, the application could have the potential to become a well-used travel guide.

5.1.3 Recommendations for Sustainability

A smartphone application requires a large amount of upkeep to ensure it will continue working and contains updated information. In order for the application to be sustainable, the application will need to generate sufficient cash flow for the WBCG to offset maintenance costs. As mentioned above, white-labeling will be used for companies which should be a source of funding for the WBCG.

Besides having white-labeling to bring in revenue, we also recommended selling the information from the base application to various agencies within the Namibian Government, including the Ministry of Works and Transport (MWT), and the Roads Authority. The application would generate information from those who use the application, such as road conditions, unsafe areas, and where people tend to drive above the speed limit. The shared information would be aggregated data that shows trends across the entire country, not individual's users data. The government would be able to use this information to learn where they should focus on improving the roads, where they should have increased security, or where they should watch for excessive speed while driving. For example, Namibia has road checkpoints at various points to combat speeding and drunk driving. The application could inform the government if there are better places to put these checkpoints to keep drivers safe.

For the tourist's version of the application, we recommended that the WBCG charge an upfront cost at a reasonable price. We suggest that it is priced no more than USD 8 (NAD 100), which was determined by the cost of similar applications and through our surveys with tourists. This price can help fund the more complicated features for the trucking version of the application.

5.2 Conclusions

Overall, we learned that there is a market for this application. Transport companies, truck drivers, and tourists all have demonstrated interest in using this application. Additionally, these parties have demonstrated an interest in paying to use this application or paying extra for a white-label version. Since there is a sizable market for this application, we recommended that the WBCG continues progress on development of the application that includes the aforementioned features. This application has the potential to become a well used navigation system by those traveling throughout southern Africa. Once the application is developed, it will help to bring the WBCG closer to reaching their goal of improving the safety and efficiency of driving throughout southern Africa.

The WBCG's overarching goal is to connect the SADC to the world and one step to achieve this is to make Namibia more popular to trade through. The WBCG's work in promoting trade helps push Namibia closer to becoming the leading trade route in the SADC. If Namibia can become the leading trade route in the SADC, it can gain access to global markets all over the world. However, there are still major obstacles pertaining to truck driving that are holding Namibia back from becoming a major transport hub in the global economy. We identified three of the main problems that truck drivers faced while using the corridors, and to help mitigate these problems, we created a list of possible features to be included in the application.

The features that were identified as useful to truck drivers or tourists will be used in an application that will help improve safety along southern Africa's dangerous corridors. Our results confirm that transport companies, truck drivers, and tourists would use this application because they understand how the application will make driving throughout Namibia and southern Africa safer and more efficient. The application would be able to be used in countries with similar infrastructure and levels of development to Namibia, which would allow the application to improve the safety and efficiency and driving throughout the developing world.

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