

Critical success factors for mobile application deployment in Africa

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ABSTRACT

At the time of writing, mobile applications had arguably redefined how most people interact with their mobile phones. The platform from which these applications were marketed and sold, created a \$34.2 billion industry by 2015 (Jackson, 2016) world-wide. With the Sub-Saharan Africa (SSA) market continuously searching for disruptive innovation (Ojoma, 2016) and with the continent's mobile application related revenue only contributing a small fraction to the international market, led to the research question for this dissertation: What could be done to increase the success rate (disruptive innovation) of mobile application development and deployment (MAD) in SSA?

Deployment of a mobile application (in the context of this research) referred to a business driven by the revenue stream of a mobile application. This meant that the primary objective of this research was to identify (from literature, surveys and interviews), understand and rank the critical success factors required for successful MAD in SSA, as a business.

The second objective of this research was to prove or disprove the research hypothesis. It was hypothesised that the Lean Start-up (LSU) business model approach could increase the success rate of MAD in SSA.

The research made use of questionnaires distributed to representatives of innovation hubs and the information technology (IT) sector, to rank the factors that influence mobile application development and deployment in SSA. The research problem and research hypothesis were also tested with the questionnaire. Follow-up interviews were used to supplement and verify the factors ranked in the questionnaire.

From the questionnaire and follow-up interviews, it was evident that the factors identified from literature were a high priority for MAD in SSA. The research findings also concluded that the LSU model could increase the success rate of MAD in SSA.

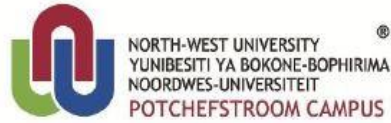
Key words: Mobile Application Deployment (MAD), Sub-Saharan Africa (SSA), Lean Start-up (LSU), Information Technology (IT), Critical Success Factor

ABBREVIATIONS

Acronym or Abbreviation	Definition
ACP	Application Creation Project
AIP	Administrative Incentive Pricing
CAGR	Compound Annual Growth Rate
CST	Communications Services Tax
DRC	Democratic Republic of the Congo
DTPS	Department of Telecommunications and Postal Services
EF	External Factor
GDP	Gross Domestic Product
GPS	Global Positioning System
GSMA	Group Special Mobile Association
ICT	Information Communication Technology
ISP	Internet Service Provider
IT	Information Technology
LSU	Lean Start-up
LSUC	Lean Start-up Key Metric Canvas
SA	South Africa
SAVCA	South African Venture Capital and Private Equity Association
SIM	Subscriber Identity Module

SME	Small to Medium Sized Enterprises
SMS	Short Message System
SSA	Sub-Saharan Africa
MAD	Mobile Application Deployment
MMS	Multimedia Messaging System
MVP	Minimum Viable Product
NHIL	National Health Insurance Levy
OS	Operating System
POC	Proof Of Concept
UI	User Interface
UK	United Kingdom
US	United States
VAT	Value Added Tax

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To whom it may concern

Re: Critical success factors for mobile application deployment in Africa, Mr J van Niekerk, 20803885

I hereby confirm that I have reviewed the project's research design in terms of sample size and sampling method.

I have also reviewed the questionnaire in terms of face validity and basic statistical justifiability.

The translation and content validity of the questionnaire as well as ensuring that the study fulfils the academic requirements remains the responsibility of the student and supervisors.

Kind regards

A handwritten signature in black ink that reads 'M. Pretorius'.

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LANGUAGE EDITING

This letter serves as proof that the following document was submitted for language editing in February 2017.

Author: Juan van Niekerk
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I applied all reasonable effort to identify errors and made recommendations about spelling, grammar, style and punctuation.

I attempted to be consistent regarding language usage and presentation.

The bibliography was also checked and corrections were made where necessary.

I confirmed the content as far as possible, but cannot be held responsible for this as all facts could not be confirmed. This remains the responsibility of the author.

Thank you very much.

Kind regards.

Rentia Mynhardt

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1. INTRODUCTION AND OVERVIEW OF RESEARCH

At the time of writing, the mobile application industry had arguably redefined how most people interact with their mobile phones. With a variety of mobile application categories ranging from news, games, social media, health and many more, mobile applications enable a person to use their mobile phones to access the digital world from every conceivable perspective available as consumer goods or services (Pong, B. 2015). The impact of innovation and disruption that led to the success of this platform was predicted to continue growing as technology and the mobile ecosystem that hosts the mobile phone continued to evolve (Random House, 2007).

In the beginning of 2015, the global mobile application market was worth an estimated \$34.2 billion (Jackson, 2016). It was estimated that this number would reach \$77 billion by the end of the year 2017. This growing application industry was built on a mobile platform (smartphones) that was scaling rapidly with an estimated 3.6 billion mobile subscribers worldwide at the end of 2015 (assuming at the time that every subscription was paired with a smartphone or feature phone device). This meant that half of the world's population had a mobile subscription. It was predicted that an additional one billion subscribers would have been added to the market by the year 2020, reaching a global penetration rate of 60% (Pong, B. 2015).

The research conducted for this dissertation originated from the writer's interest in mobile application development. At the time of writing the author was working part-time on his own mobile application which he envisioned would scale into a successful business. The insight gained from his research was intended to deepen his understanding of the challenges present in deployment of mobile applications in Sub-Saharan Africa (SSA).

1.1 African market share

At the time of this research, the success of mobile applications could be directly related to the following variables (Varshneya, 2014):

- The number of downloads for the application via application stores (i.e. Apple, Android, Windows, Blackberry, etc.).
- The amount of revenue generated through the various pricing models. Pricing models included:
 - Paid applications
 - Free applications with advertisement
 - In-application purchases revenue model
 - Paywall revenue model
 - Sponsorship

Successful application (by country) development can be broken down into the following key metrics:

- The number of application developers per country.
- The number of applications developed per country.
- The national market wherein the application was mostly consumed (national or international).
- The total amount of revenue generated for the country of application origin.

1.2 Problem identification

Tanzania, Kenya, Nigeria, Ghana and South Africa are the countries that have (up until the time of writing) produced the most mobile applications of all the SSA countries. These countries will thus be used to discuss the state of mobile application development in SSA in comparison to the international market space. The following figure presents the abovementioned SSA countries in terms of the following metrics:

- Developers per country.
- Which nations consume a given country's mobile applications.
- The revenue that each country owns from mobile applications.

All of the metrics listed above are presented as a line in the figure, with the thickness of each line representing the relative weight each metric lends to the country's mobile application market value.

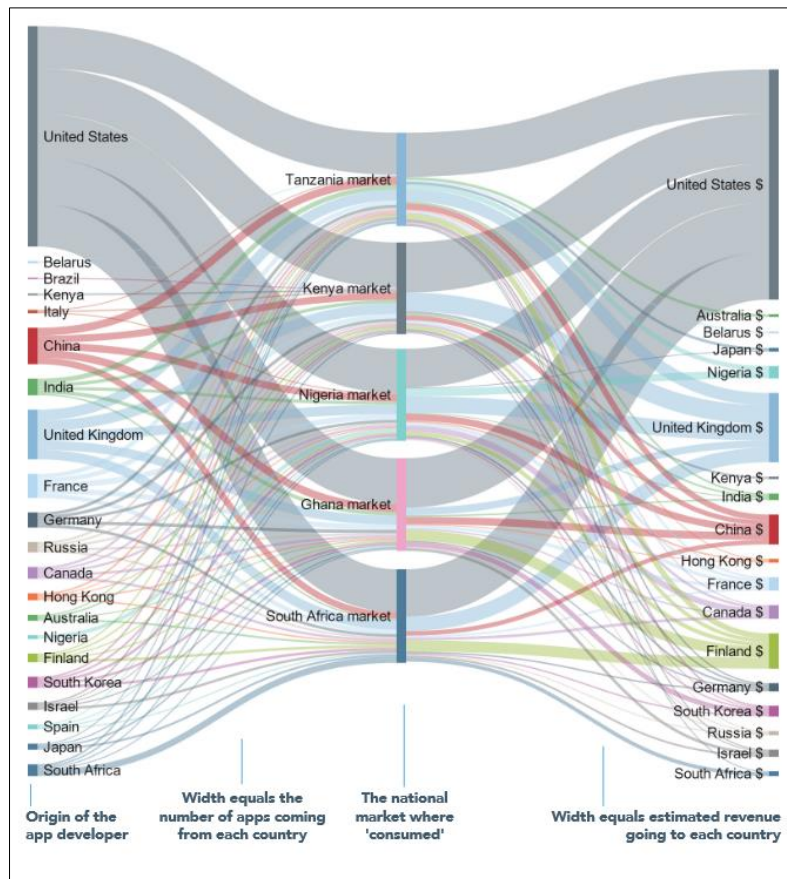


Figure 1 - Sub-Saharan value contribution (Pong, B. 2015)

The main trends taken from the figure above are given in the following bullet points:

- The United States (US), United Kingdom (UK) and China are the top performers in terms of numbers of developers, mobile application exports (i.e. mobile applications used by countries that are not from the mobile applications' origin) and revenue produced from mobile applications.
- The SSA countries represented in the figure consume more US developed mobile applications than locally developed mobile applications.
- The US earns more revenue from its mobile application sales in SSA than locally developed and consumed mobile applications in SSA.

In summary from the above figure, it can be seen that the SSA countries contributed a small total of mobile application developers to the international market. Furthermore, the subset of SSA countries did not export a lot of applications (compared to major mobile application markets). The total number of mobile applications exported by a country is not necessarily an indication of the country's relative value it contributes to the international mobile application market, as the revenue generated from one application could represent the total revenue generated from 50 applications. For this, revenue produced from mobile applications per country as a function of total mobile application exports, is a better indicator of a countries international mobile application market

value. However, the SSA (at the time of writing) did not export high volumes of mobile applications (compared to major mobile application markets), nor did it produce large totals of revenue. This proves that the SSA have not been able to produce a truly market-disruptive mobile application.

1.3 Research problem

SSA countries have not been able to produce a truly market-disruptive mobile application that could rival mobile applications that were developed and consumed by major mobile application markets.

1.4 Research question

In the previous section it was shown that SSA only contributed a small fraction to the international mobile application market. With the SSA market continuously searching for disruptive innovation (Ojoma, 2016) and with the continent's mobile application related revenue only contributing a small total to the international market, it led to the research question for this dissertation:

What could be done to increase the success rate (disruptive innovation) of MAD in SSA?

Disruptive innovation was referred to (in the context of this research) as a process wherein a product starts off (as a simple application) at the bottom of a market and continues to rapidly move up the market, ultimately displacing established competitors (Christensen, 2016). In addition, the word successful (or increased success rate) was used to describe a product that could be considered to bring about disruptive innovation.

1.5 Research hypothesis

A well-structured and comprehensive business plan is important to the success of entrepreneurial ventures (Gumpert & Rich, 2016). Whether the business plan is used for a business start-up or raising capital for an existing product line, a business plan plays a vital role in obtaining funding for a new business venture. The Harvard Business Review lists the following three key features, important to any business plan (Gumpert & Rich, 2016):

- Market space
- Potential investors
- Product designers and developers

The following describes the SSA market space stated in terms of the key business plan features noted by Gumpert and Rich:

- **Market Space:** According to the World Bank, the rural population represents 62.8% of the population in SSA (World Bank, 2014). The high level of rural population in SSA makes it hard to define the market space, given a wide variety of cultural differences and technical challenges (for example: infrastructural challenges facing the telecommunication industry in SSA). Acquiring critical mass for a new product in SSA cannot be based on future market predictions, given the ever-developing and changing nature of the SSA market. Therefore, developing for the SSA market requires the following (Quaye, 2016):
 - New product development in SSA has to assume nothing about the final product.
 - Be constantly exposed to the SSA market space during development to learn what works and what does not.
- **Potential investors:** Due to the volatile nature of the SSA market (for example political and basic infrastructural challenges SSA faces), it poses large risk to potential investors, making capital investment scarce (Quaye, 2016). Products or services are thus required to be developed with low capital input.
- **Product designers and developers:** The SSA contributes 3% of all product developers to the international mobile application market (Dogtiev, 2016).

Describing the SSA market space at the hand of the key business plan features (as defined by Gumpert and Rich), does not make for a convincing business proposition. Given this, entrepreneur Victor Agolla proposes the Lean Start-up (LSU) business model approach, as opposed to the hit-or-miss proposition that a conventional business plan suggests. The key features (in comparison to a conventional business plan) of the LSU business model approach are given in the following bullet points (Agolla, 2015):

- **Market space:** Experimentation in the market is favoured above elaborate planning.
- **Potential investors:** Customer feedback is valued above intuition. This means that a MVP (Minimum Viable Product) is tested and adjusted in the market directly, allowing the product to be developed with low capital input.
- **Product designers and developers:** Iterative design is favoured above traditional “big design up front” development. This reduces the experience required for product development.

The research hypothesis development process was based on the alignment between the LSU features and what was required by the SSA market for new product development and deployment. The research hypothesis thus worked on the presumption that the LSU business model approach could result in a higher success rate for mobile application deployment (MAD) in the SSA market space.

1.6 Research aim and objectives

The proposed research will attempt to identify, understand and describe the critical success factors required for the deployment of a successful (disruptive innovation) mobile application business in the SSA market space, measured by the LSU business model from an SSA market perspective.

The research aim was to recommend a business model that could be used as framework for MAD in SSA. The information gained, by testing the research hypothesis (LSU as a better suited business approach for MAD in SSA) was used to conclude and recommend a business model framework.

The World Economic Forum had predicted that small to medium sized enterprises (SME) would play a large role in the economic development of the African continent. The value of these SMEs came in the form of employment, which at the time of writing, contributed 80% to the employment rate. This led to the establishment of a middle class, which in turn fuelled the demand for various goods or services (de Sousa & dos Santos, 2015). As mentioned above, the research aim was to recommend a business model framework. The insight gained from the research aim could potentially be used to structure a mobile application based SME in SSA.

Accomplishing the research aim required research objectives. The over-all objectives defined for this research were (refer to Appendix J for a detailed breakdown of the research tasks):

Primary objective – Identify and rank the critical success factors required for MAD in SSA.

Secondary objective – Test if the LSU business approach is a better suited model for MAD in SSA.

1.7 Chapter overview and conclusion

Chapter 1 introduced the value of the mobile application market worldwide. The chapter also contextualised the size of the mobile application development market in SSA, in proportion to the international market. Given this, the research problem and question were identified. In addition, the chapter continued by structuring an argument for the research hypothesis and actioned all of the above with the research aim and objectives.

The research focussed on the deployment of a mobile application in SSA, rather than the development thereof. For this, the research continues in Chapter 2, by exploring the concept of MAD from the perspective of a value proposition. Chapter 2 then continues by discussing the state of mobile application development and deployment thereof in SSA. LSU as an alternative

business approach is also discussed. The chapter is concluded with a description of a driver (as it was used in the context of this research.)

2. LITERATURE REVIEW

Chapter 2 starts off by contextualising the mobile application in terms of a value proposition. The chapter then continues by discussing the platforms from which mobile applications are sold and what types of pricing strategies are used to monetise these applications. The state of mobile applications (and supporting technologies) in SSA are also discussed in this chapter, which follows into a description of the business approach (suggested by the research hypothesis) tested for MAD in SSA. The chapter is concluded with a summary of the factors that drive MAD in SSA.

2.1 Introduction

By 2014, the number of mobile phones had exceeded the total number of people on earth. At the same time, smartphones (the mobile phones that run mobile applications) had reached an estimated 1.75 billion units. Mobile applications had raked in \$25 billion in sales for the year 2014, which represented a 62% increase from the previous year (GSMA, 2015). Given this statistics, it seemed hard to believe that smartphones (in the mass market) did not even exist before 2007 and even more so that mobile applications only appeared by the end of 2008 (Mace *et al.*, 2009). The impact of innovation and disruption that led to the success of this platform was predicted to continue growing as technology and the mobile ecosystem that hosts the mobile phone, continued to evolve (Random House, 2007). So why had this mobile industry become so successful?

2.2 Smartphones and mobile applications

Modern smartphone technology had grown rapidly since the introduction thereof in 2007 (Clayton, 2013), with average processing speeds set at 15 times faster than a Cray-1 supercomputer (1979-model) or as powerful as the world's fastest 1987 computer. In addition to being a computer, a smartphone was fitted with a radio (for phone calls or internet access) and an array of sensors such as GPS (Global Positioning System), accelerometers and magnetometers. The smartphone had packaged the power of a desktop computer into a device that was the size of a mobile phone. The processing power of smartphones enabled the device to run an operating system (OS). An operating system is the software platform that runs a computer and hosts an environment wherein 3rd party software programs (i.e. mobile applications) can be installed (Uswitch, 2016).

2.2.1 Web vs. native mobile applications

There exists two platforms from which mobile application are run. The platforms are given in the following bullet points:

- Web applications: Mobile applications that are accessed via an internet browser (the web browser is installed on a smartphone). These applications are not installed on the

smartphone. The assumption of a web application is that, given the universal nature (across all mobile smartphones) of internet access, a web application can reach a wider audience.

- Native applications: Mobile applications that are accessed directly from the smartphone. The applications are installed on the smartphone device itself.

The main differences between these platforms are presented in the following table (Perera, 2016):

Table 1: Native mobile applications vs. Web mobile applications

Native mobile applications	Web mobile applications
Applications build, tested and thus tailored to one type of smartphone.	Applications developed and tested for multiple smartphones and smart add-on devices.
The application can access and take advantage of all the resources offered by the smartphone, including sensors.	As the web application interacts through a web browser with the smartphone, "full native smartphone" processing power access is limited.
Testing of the application is done for a small group of smartphones.	Complex testing cycles, as the application is required to function on a diverse collection of smart phones (or smart devices).
The application software iterations are restricted to a small group of smartphones and thus a smaller user base.	A larger total of users can be accessed as the application can function on any device that is capable of accessing the internet (including smartphones, tables or smart watches).
A user has a one-step access procedure, as native applications can be accessed directly from the smartphone home screen.	The application is accessed via a web browser, which in turn accesses the web application. The interaction with a web browser adds an additional step to the access of the application.
A native application can function without internet connectivity.	A web application is dependent on internet connectivity. A disruption of internet connectivity can lead to a bad user experience.

A user is required to download and install an application software update manually.	A web application can be updated directly on the hosting server, eliminating the need for a user to install the update manually.
Major smartphone operating systems offer powerful payment systems via application stores, which can be used to monetise the application.	Web applications offer limited monetisation options.

According to comScore's 2016 U.S. Mobile Application report, users spend more time on native applications than web-based applications (Rowinski, 2016). This research was focussed on native mobile applications, given that it's the dominant application platform.

2.2.2 Mobile application development

One of the contributing success factors of the mobile application development and deployment came from 3rd party development; this meant that any individual or legal entity could develop and submit a mobile application to a mobile application store (Varshneya, 2014). These mobile application stores are generally owned by smartphone producers (for example Apple) or a smartphone OS software vendor (for example Google). Mobile application developers have a variety of application stores to pick from. The major application stores include:

- Apple: App Store
- Google: Play Store
- Microsoft: Microsoft Store
- Blackberry: Blackberry World

The mobile application store serves as a shop front, from which mobile applications can be purchased and downloaded. In addition to hosting applications, the mobile application store-owned companies provide developers with software tools to create applications (Haselmayr, 2013). The process can be outlined in the following figure:

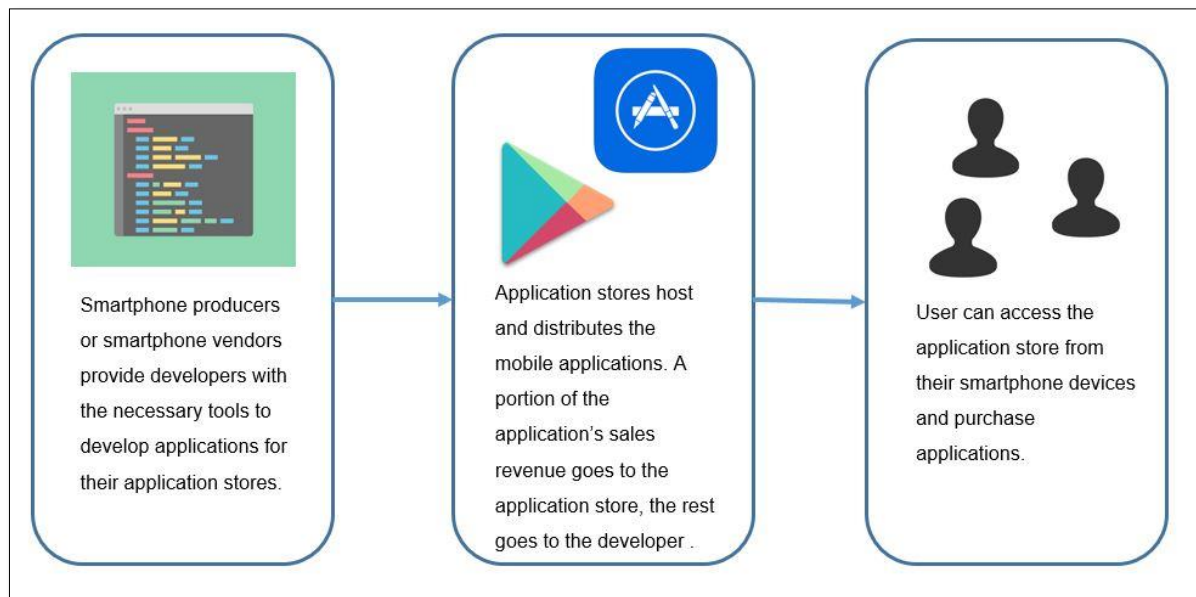


Figure 2: Mobile application development process

Smartphone producers for example Apple (iPhone smartphone) and Google (Nexus smartphone) provide the developer with all the software tools required to create and submit an application to the application stores (Haselmayr, 2013).

2.3 How are mobile applications monetised?

A revenue model is defined as a description of how a company will earn an income, produce a profit and generate a return on investment (Business Dictionary, 2016). The mobile application (with its accompanying features and / or services) is the value offering that a mobile application company sells to customers. It is important for a mobile application business to select a revenue model that will enable the business to monetise as much of the value proposition as possible, given that only 2% of mobile application developers claim 54% of all application related revenue (Munir, 2014).

The mobile application industry offers six general methods of producing revenue from an application. The following section explores these revenue streams and offers the advantages and disadvantages of each.

2.3.1 Paid applications revenue model

This revenue model requires a user to pay for the application before he has the opportunity to download and install the application. The key to success with this model is upfront showcasing. The monetary value of this model is gained before any user application interaction (Munir, 2014).

Advantages

- Revenue is earned with every download of the application.
- Having spent money on the application, a typical user is more likely to become engaged and frequently interact with the application.
- Better application experience, as all of the “screen real estate” can be committed to the application and not in part to an advertisement banner.

Disadvantages

- Free application competition reduces the demand for paid applications.
- 30% of revenue produced by the application is paid to the application store.
- 90% of paid revenue models are downloaded less than 500 times daily.

2.3.2 Free applications with advertisement revenue model

This model removes the upfront cost barrier associated with an application store download. The drive of this model is to accumulate a large user base for advertisement. Information about the user base is collected while the users interact with the application. The data collected from the user interactions are packaged and sold to application publishers. The analytical insight gained from the data is then used to place targeted advertisement on the application. Value in the form of user information and advertisement is thus gained from this model while the user interacts with the application (Munir, 2014).

Advantages

- The typical smartphone user interacts with his smartphone 150 times per day (Ballve, 2013). This means that smartphone applications are perfectly situated to collect user data.
- The model proves effective with moderate amounts of advertisement, which is targeted to a user.
- The free offering provides a user with the opportunity to engage with the application without paying upfront.

Disadvantages

- Advertisement tends to limit user experience.
- This model tends to be less effective with utility applications, where users need to perform quick or important tasks.

2.3.3 Freemium revenue model

The freemium revenue model offers the application as a free download, but omits certain features of the application, which can be unlocked if paid for. Users can use basic functionality of the application, but are charged to use premium or propriety application features. The premise of this revenue model is based on a rich preview of the application's functionality. The objective is to accumulate and engage with potential users until the users are in a willing position to pay for in-application functionality (Kumar, 2014).

Advantages

- This revenue model allows for the application to be showcased upfront to a large audience, without advertisement. The user base can then be incentivised to purchase additional application functionality.
- The freemium revenue model enables flexibility, as the model can easily be adapted to channel user flow through the application.

Disadvantages

- Too much features offered on the application will reduce incentives for additional functionality purchasing.
- Too little features offered on the application will diminish any interest in the application and a potential user base.

2.3.4 In-application purchases revenue model

The in-application revenue model revolves around selling virtual or physical goods, from within the application (Dogtiev, 2015). In-application purchases can include a variety of consumer or virtual goods (for example virtual currency).

Advantages

- In-application purchases offer a portal from which marketers can sell goods at a low risk.
- In-application purchases generally lead to higher levels of engagement.
- Profit margins tend to be higher as this model allows for much lower overheads in comparison to a shop-front approach.
- This model is very flexible, as partnerships or affiliate programmes could lead to increased referrals.

Disadvantages

- 30% of revenue produced by virtual goods is paid to the application store. Physical products or services are exempt.

2.3.5 Paywall revenue model

The paywall revenue model is similar to the freemium model, except that it mainly focuses on restricting or “gating” content not features. Paywall allows users to view a certain amount of content for free. The user is then prompted to sign up to a subscription for additional content. This model is mainly used for service providing applications (Weisert, 2016). This approach allows application developers to earn revenue through monthly subscriptions.

Advantages

- User experiences all of the application’s functionality, which leads to a longer engagement time.
- This revenue model produces continuous payments. Subscription is renewed automatically, which in turn insures continual subscription instalments.
- Subscribers to the application are generally loyal.
- Content gating and subscriptions provide application marketers and developers with incentives to curate higher quality content, which in turn is worth paying for by the users.

Disadvantages

- Generally only suited to news, entertainment or lifestyle applications.
- It is challenging to find the correct place to construct a paywall.

2.3.6 Sponsorship revenue model

A sponsorship-based revenue model requires a partnership with advertisers, who will in turn reward users for completing in-application actions. The application earns revenue from redeemed rewards (Munir, 2014). This model provides a method for incorporating advertisement into an application that enhances an application’s ability to engage with users.

Advantages

- Advertisement used for this revenue model is relevant and related to the core functionality of the application.
- All stakeholders gain value as developers and marketers earn revenue and users benefit from free promotions.

Disadvantages

- This revenue model (at the time of writing) was a new concept to the application world, which had not been tried and tested.

The following figure compares the five most popular revenue models, based on the percentage of applications present, in the Android, Apple, Blackberry, Windows and web-based application stores.

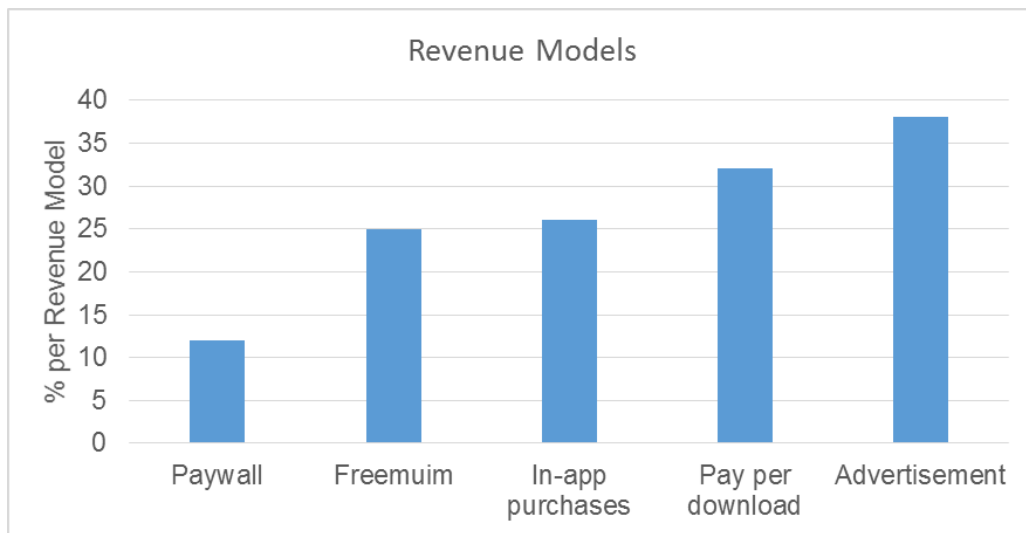


Figure 3: Mobile application revenue models (Munir, 2014)

It can be seen from the figure that the advertisement-based revenue model is the most frequently used approach, while the paywall method is the least used. At the time of writing, blended models were emerging and gaining a lot of popularity. These blended models combined the advantages of two or more revenue models, resulting in a model that offered higher levels of value leveraging while still maintaining user interest (Munir, 2014).

2.4 Platform modularisation

The introductory section of Chapter 2 started off by describing the success of mobile applications in terms of its total worldwide market value. The chapter continued by discussing the six most popular revenue models that mostly contributed to the success of the mobile application industry. This, however, only contributed partly to the success of the mobile application industry. Another element to consider is the platform from which the mobile applications industry functions. A platform (in the context of this research) is defined as the crucial structural element within an industry architecture (Ballon, 2009). The industry architecture refers to the mobile application's eco-system, containing all required infrastructure needed to make a mobile application function. The eco-system contains many integrated architectural elements, which for the sake of this discussion will be limited to the parts that generate monetary value, or more specifically the areas that function as gatekeepers. Gatekeeping (in the context of this research) is defined as the portal through which any mobile phone related service must move to be able to function (Ballon, 2009). The value in gatekeeping lies in service dependency, which an entity (that owns the gatekeeping role) can leverage from, by requiring the service user to pay a fee.

To understand the gatekeeping role and how it has evolved from the introduction of the mobile application industry, one has to compare a smartphone dominant market (with its accompanying platform) with that of a market that is still feature phone based.

At the time of writing, the SSA market space was considered a feature phone dominant market (GSMA, 2015). Given this, the SSA market space will thus be used to describe the platform from which this feature phone dominant market functions. The following figure outlines the platform for this market:

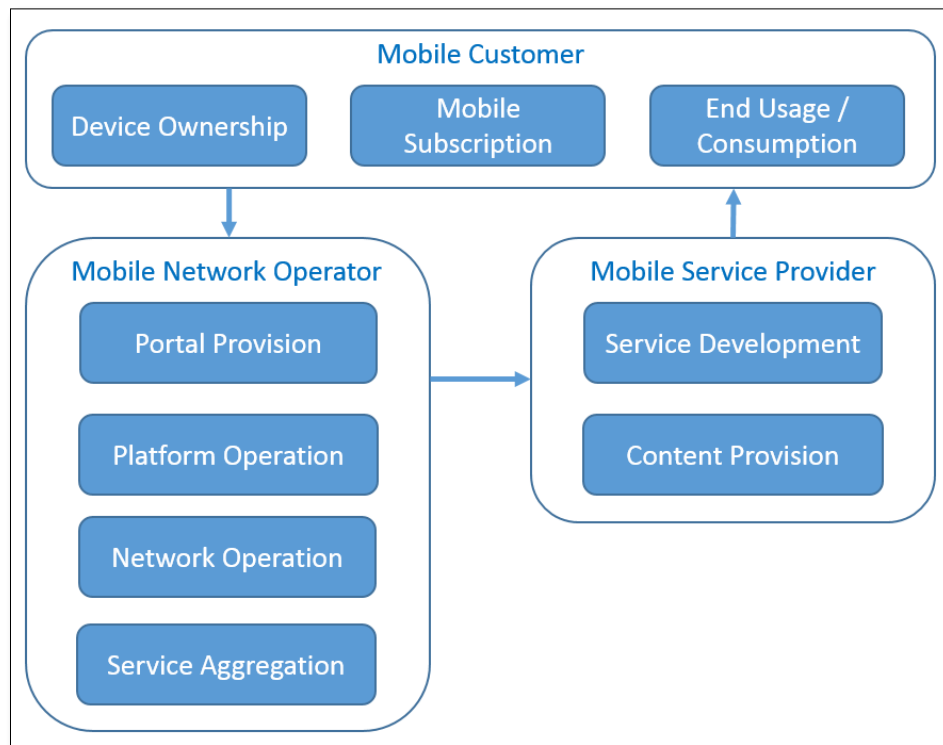


Figure 4: Mobile network operator centric – platform (Ballon, 2009)

The figure shows three components (or entities). Each of these entities is described in the following bullet points:

- **Mobile customer:** Any mobile customer that wants to use voice call, sms or data related services on their mobile phone. Device ownership lies with the mobile customer. The customer has the choice of the mobile phone make and model. Any mobile service delivery requires the mobile customer to interact with the mobile network operator and / or the mobile service provider.
- **Mobile network operator:** The mobile network operator manages portal provisioning, platform operations, maintains network operations and service aggregation. The MTN mobile carrier is an example of a mobile network operator.
- **Mobile service provider:** Any entity that offers a mobile service other than what the mobile network operator is not already offering (i.e. voice calls, sms or data). The M-Pesa mobile phone based micro-financing company is an example of a mobile service provider (Mugambi, 2014).

As depicted in Figure 4, the mobile customer contacts the mobile network operator to initiate the service offering. The mobile service provider entity dispatches the service to the customer. It is important to note that the mobile network operator entity hosts the entire service offering end to end. In other words, the platform channels all service activity through the mobile network operator. This characterises the mobile network operator centric platform in the following bullet points:

- The mobile customer interacts with the service through a mobile network operator owned portal.
- As mentioned above, the mobile network operator provides four elements to the platform: Portal provisioning, platform operations, service aggregation and network operations. All four operations are centralised to one entity in this mobile platform architecture.
- Given that the mobile network operator is situated central to the service delivery process, it enables the mobile network operator to sign deals with mobile service providers. The mobile network operator brokerages the interaction between the mobile customer and mobile service provider, as the mobile customer pays the mobile network operator for network access and the mobile network operator in turn pays the mobile service provider for service delivery.
- Any service creation is subject to agreements made directly with the mobile network operator. This means that the mobile service provider is dependent on the mobile network operator.
- Client information is captured and managed by the mobile network operator, as the mobile subscription contract is applied for, directly from the mobile network operator. Furthermore the mobile network operator can log user activity as the user connects to the cell phone network.
- Charging and billing: A direct (first point of contact) billing relation exists between a customer and the mobile network operator for access to the mobile network and extended services.

The mobile network operator plays a central role in the service offering that includes basic mobile service (i.e. voice calls, sms and data) and any additional mobile based services (for example micro-financing through M-Pesa). The mobile service provider and mobile customer are both dependent on any form of mobile service delivery irrespective of whether the service is hosted by the mobile service provider or directly through the mobile network operator.

The mobile network operator platform has been the popular method for a mobile customer base that is saturated with feature phones. However, the introduction of the smartphone (with mobile applications) has transformed the mobile network operator centric platform into a mobile device centric platform. The mobile device centric platform is modularised, through the addition of entity gatekeeping roles. This platform shifts some of the gatekeeping control of a mobile network operator to a smartphone device manufacturer (Ballon, 2009). Consider the device centric platform as depicted in the following figure:

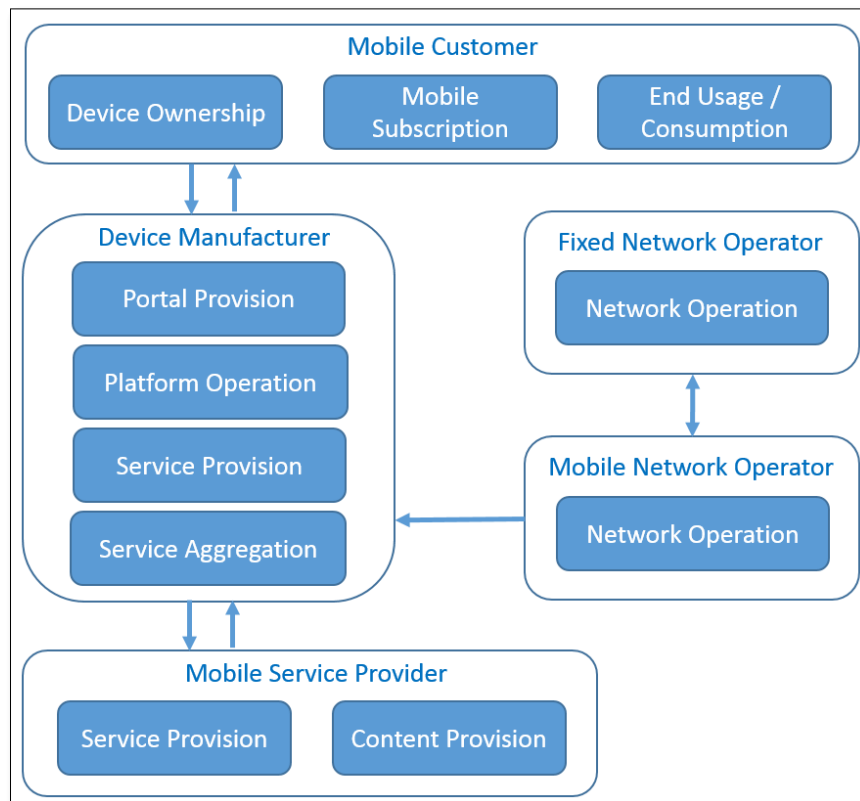


Figure 5: Smartphone centric – platform (Ballon, 2009)

The above figure introduces an extra entity to the platform, namely the device manufacturer. The characteristics of this platform are given in the following bullet points:

- **Device manufacturer:** The device manufacturer provides 3rd party developers with the necessary tools to create and sell mobile applications for their mobile device (thus creating mobile services through mobile applications). In addition to development tools, the device manufacturer enables the developers to shop-front their mobile applications through a mobile application store. The mobile application store is managed and owned by the device manufacturer. This means that the device manufacturer owns portal provisioning, control of the platform operations, service provisioning and the services aggregation. Apple's iPhone with its accompanying app store is an example of a device manufacturer for this platform (Ballon, 2009).
- **Fixed / mobile network operator:** Mobile services that use to flow through the mobile network operator (in contrast to the mobile network operator platform) are now limited to voice calls, sms and data services.
- **Mobile service provider:** The control of mobile services provisioning has been moved away from the mobile network operator and channelled through the mobile device manufacturer's application store to mobile applications.

The success of mobile applications can be (in part) contributed to the mobile device centric platform. The platform modularises gatekeeping control to the device manufacturer, which in turn creates a value proposition for 3rd party mobile application developers. As mentioned above, this platform only partly contributed to the success of the mobile application industry (Ballon, 2009).

The service aggregator centric platform extends the mobile device platform by removing the device manufacturer entity and centralising the portal provisioning, platform operations and service aggregation to one entity that is neither the network operator nor a device manufacturer. This approach builds on the device centric model by still removing the central service portal role from the mobile network operator and shifting the portal management to the service aggregator which functions independently from the mobile network operator (Ballon, 2009).

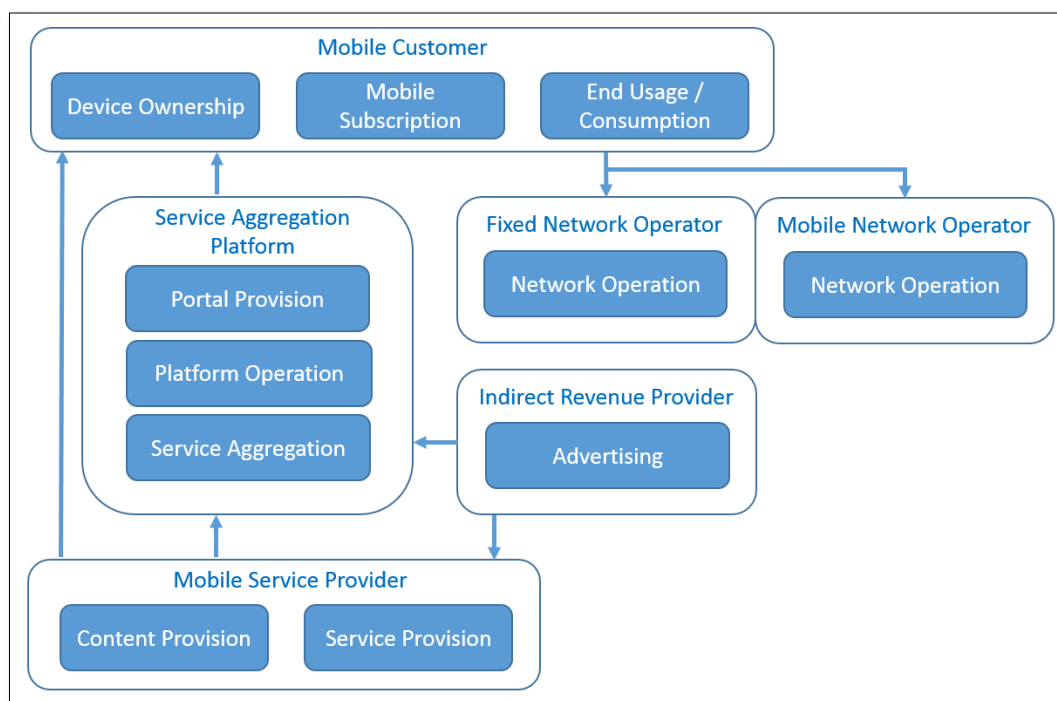


Figure 6: Aggregator centric – platform (Ballon, 2009)

The main characteristics of the platform are given in the following bullet points:

- The mobile customer can gain access to data bandwidth from any ISP (Internet Service Provider) to gain access to mobile services.
- The portal provisioning is managed by the service aggregator. This enables the mobile customer to select individual services.
- The mobile customer is not limited to one specific mobile device brand.
- The service aggregator functions independently from the mobile network operator.
- The service aggregator builds the platform and supplies the underlying development tools to 3rd party mobile application developers.

- Activity, profile and identity information is owned by the service aggregator. The service aggregator plays the role of a broker between the individual applications and the mobile customer.
- The service aggregator does not have control over what type of mobile service is created. This means that any 3rd party developer can create a mobile through a mobile application.
- The gatekeeping role is spread across the service developer, the mobile network operators and the service aggregator.

Modularisation of the platform that supports the mobile industry has diversified gatekeeping roles, allowing more entities into the end to end value chain of mobile application delivery. This resulted in a mobile application industry (or mobile service industry) that provides an entity with the monetary incentive to create mobile applications, in turn driving high quality mobile services through mobile applications (Ballon, 2009).

Chapter 2.4 has compared a smartphone dominant platform with that of a platform that was still feature phone based. The section continued by describing a mobile network operator centric platform by using the SSA market as an example. The section continued, by describing SSA as a feature phone dominant market, supported by a mobile operator centric platform (GSMA, 2015). In light of this, the next section investigates the telecommunication sector of SSA as an ecosystem for the mobile service provider. The section continues by describing the challenges SSA faces while driving smartphone adoption (as a requirement for mobile applications).

2.5 Sub-Saharan Africa telecommunication infrastructure

The following section gives an overview of the state of SSA's telecommunication and ICT (Information and Communication Technology) industry as a feature phone dominant market. The section also describes factors that are influencing the progress of the SSA market, moving from a feature phone dominant market to a smartphone based market.

It is said that mobile services are becoming an ever-important tool for poverty alleviation in SSA (Londhe, 2014), with the telecommunication and ICT industry contributing 2.4% to the GDP in 2014. Mobile phones (with a supporting mobile network operator) empower the SSA population by providing communication through voice calls, sms and data bandwidth. These mobile services have led to enhancements in healthcare, peer-to-peer financial services and agriculture in SSA. Mobile service delivery plays an important role in the development of SSA (Murugesan, 2013).

Understanding the SSA mobile service industry as a sector that services countries that have high levels of rural population, requires a break-up of basic mobile communication (including voice calls, sms and data bandwidth) into its primary components. The primary components for basic mobile communication in SSA are depicted in the following figure:

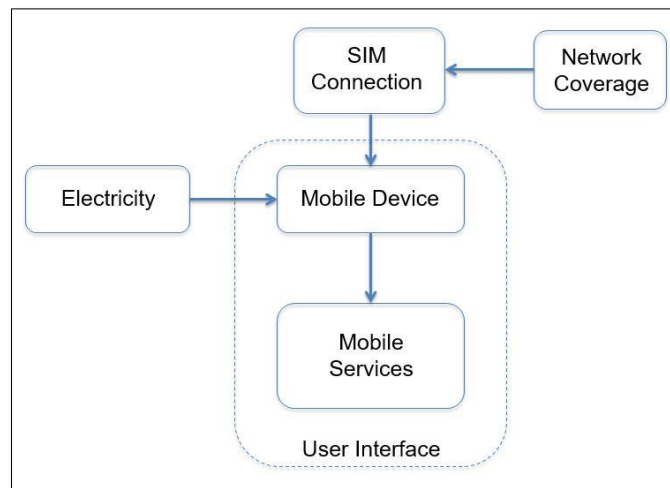


Figure 7: Basic mobile communication requirements

The above figure illustrates basic mobile communication requirements from an operational perspective. The mobile service is run from a mobile device. The mobile device requires electricity to recharge its battery, which is used to power the device. The device gains access to the mobile operator network via a sim (subscriber identity module) card, provided that the area from which the mobile device attempts to make a connection to the mobile network has network coverage.

Bridging the gap between basic mobile communication services and a smartphone with supporting mobile applications, requires the mobile phone to first operate at a level that supports basic mobile communication. Only when these basic services are provided, can a mobile device support mobile applications. This hierarchy of mobile application requirements is presented in the following figure:

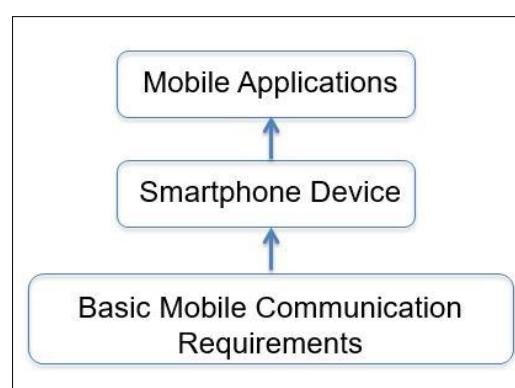


Figure 8: Hierarchy of mobile application requirements

The above figure depicts three components namely: A mobile application, smartphone device and basic mobile communication. The mobile application element cannot function without a smartphone device, which in turn requires a mobile network, providing data bandwidth services.

This bottom-up approach shows that a mobile application requires various underlying elements to function (Flora, 2014). The requirements are listed in the following bullet points:

- Smartphone device.
- Electricity.
- Mobile network coverage.
- Mobile subscription packages with a mobile network operator.

The state of these requirements (or the penetration levels) in SSA determines whether a mobile application can be deployed to a market that is large enough to justify economic viability for a mobile application business. The next section describes the state of these requirements in the SSA context.

2.5.1 Connectivity and mobile packages

The mobile packages offered by network operators in SSA generally come in two forms, namely contract and pre-paid. The contract option bundles a pre-selected total of voice calls, sms services and data into one package. The pre-paid option acts as a pay as you go service. This option enables the subscriber to buy mobile services on an ad-hoc basis. The mobile service offering is given in the following bullet points:

- Please call me services
- MMS (multi-media messaging system)
- Voice calls
- SMS
- Data

The majority of SSA users use the pay as you go subscriber plan (GSMA, 2015).

The following figure shows the total of unique mobile subscribers in SSA. The figure also predicts the estimated growth of unique mobile subscribers up until 2020. The overall trend showed a rapid increase of mobile subscribers from 2010, which was predicted to continue until 2020.

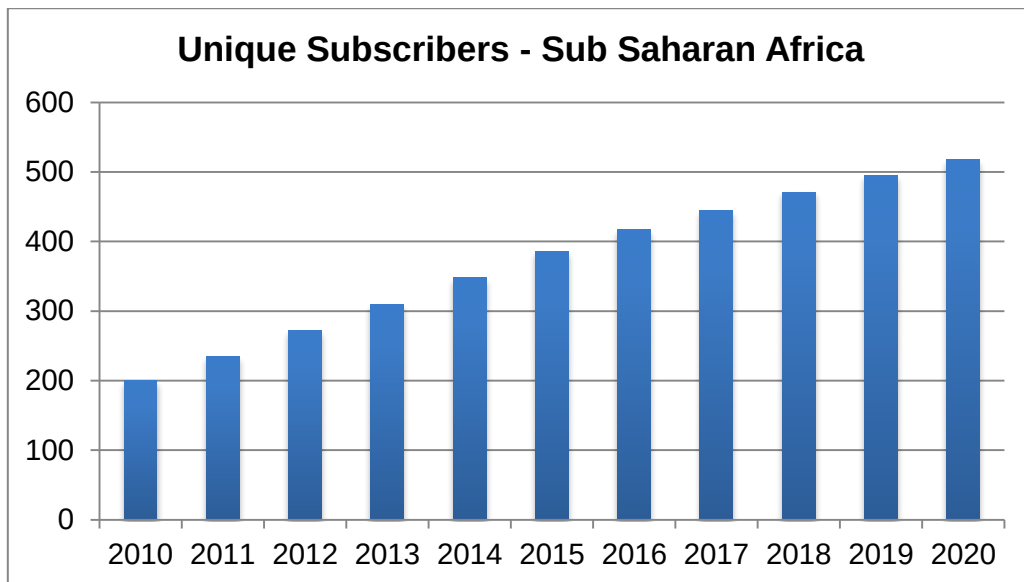


Figure 9: Unique subscribers – SSA (GSMA, 2015)

From the figure it can be seen that SSA had 367 million unique mobile subscribers at the end of the second quarter of 2015. This translated into a CAGR (Compound Annual Growth Rate) of 13% for the first half of the 2010 to 2020 decade. For the same period, the global CAGR was estimated to be 6%. SSA was set to reach a total of 518 million unique subscribers, representing a penetration rate of 49% by 2020.

2.5.2 Regional sub-groupings of SSA

SSA includes 48 countries, with a population of 800 million (World Bank, 2016). This region represents a large part of the African continent. Each of the SSA member countries have entities or systems that contribute differently to the telecommunications and ICT industry in SSA (Asongu, 2016). These different entities or services include:

- Governmental telecommunication / ICT sector interactions.
- Smartphone penetration rates.
- Mobile network service delivery.
- Electricity infrastructure.
- Digital literacy.

The following section therefore describes the abovementioned points on a SSA regional level. Breaking up the set of SSA countries into regional groupings allows for a more in-depth view of the different supporting SSA mobile entities or services. The SSA regions discussed, consist of East (EA), Central (CA), West (WA) and Southern African (SA).

Eastern Africa Group

The EA subgroup consists of five member countries, with a combined population of 153 million. Less than five people owned a mobile device by the end of 2014. Access and affordability were the main limiting factor for subscription growth in this region. This is especially true for the part of the population that lived in deep rural areas. Approximately 60% of the population represented in this region lived in deep rural areas. Kenya and Burundi had the highest and lowest penetration, with 42% and 17% respectively. The penetration rates for these countries were predicted (at the time of writing) to increase the following five years, but still lag behind the other regional groups.

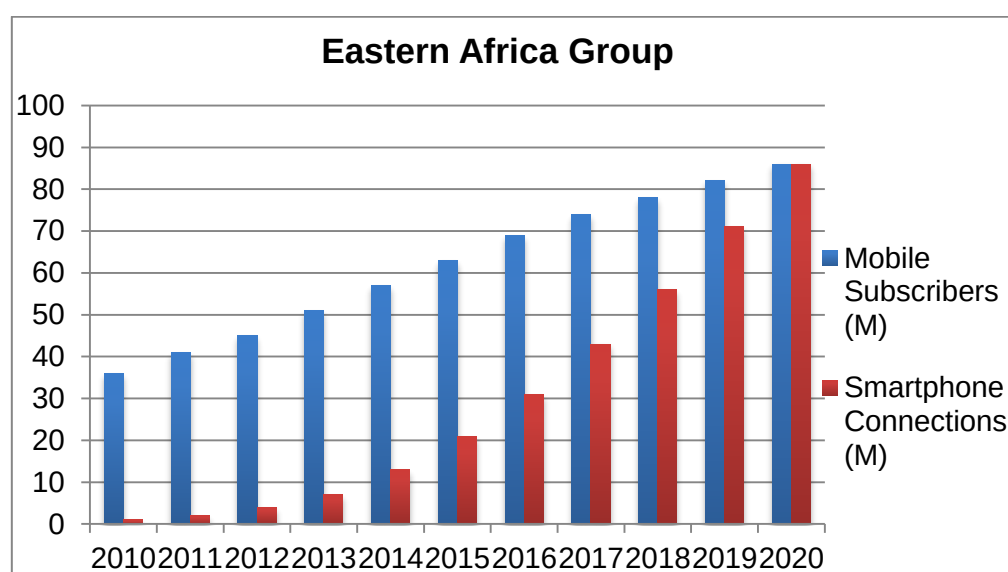


Figure 10: Eastern Africa group (GSMA, 2015)

The EA group had undergone a rapid upgrade to mobile broadband in the 2010 to 2016 period. The majority of the region had 2G-connectivity (approximately 80% by the end of 2014). This figure was set to decrease to less than 50% by 2020. The 2G capable networks were replaced with high speed 3G or 4G capable networks, which were better suited to mobile broadband services (GSMA, 2015).

Central Africa (CA)

The CA group consists of 10 member countries, with a combined population of 146 million. This group had a mobile penetration rate of 38% (as of 2014). This was lower than the SSA average of 42%. As with the EA group, it was predicted that this region would undergo a six year subscriber growth period, estimated at a CAGR of 11%. The largest contributors to the subscription growth (for the period ending 2020) were predicted to be Cameroon and the DRC (Democratic Republic of the Congo).

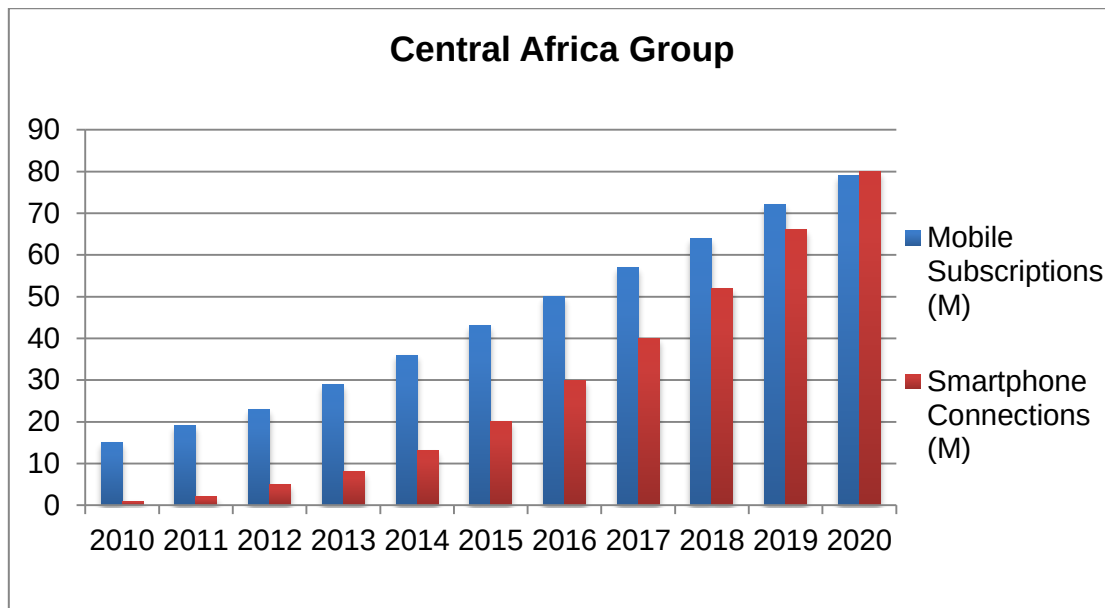


Figure 11: Central Africa group (GSMA, 2015)

The majority (90%) of network coverage for these countries consisted of 2G-technology, with a strong broadband growth outlook for the period leading up to 2020. Countries like Angola and Gabon were among the first to roll out 4G-networks. The combined mobile network base was predicted to reach 5 million connections by 2020. Cameroon and the DRC launched 3G-networks in 2015, which at the time was considered to be the two largest contributors of mobile broadband coverage in the CA group.

Smartphones usage rates were also predicted to grow in the years leading up to 2020, with smartphone adoption rates reaching 5% by the end of 2014. The growth of the smartphone adoption rate was largely due to increased 3G-network coverage, implemented in the CA group. It was predicted that by 2020 54% of all mobile devices would be smartphones in the CA group (GSMA, 2015).

Western Africa (WA)

The WA group consists of 15 member countries, with a combined population of 328 million. WA, the largest SSA subgroup, with a 40% mobile subscriber penetration rate, had a larger number of mobile subscribers than the SSA subgroup average. The SSA group had a large difference between its maximum and minimum subscriber base bounds, with Niger having a penetration rate of only 17% and Mali, 68%. Nigeria had the largest subscriber base (among member countries of the WA group) with 85 million. This number represented more than half of the WA group's subscriber base.

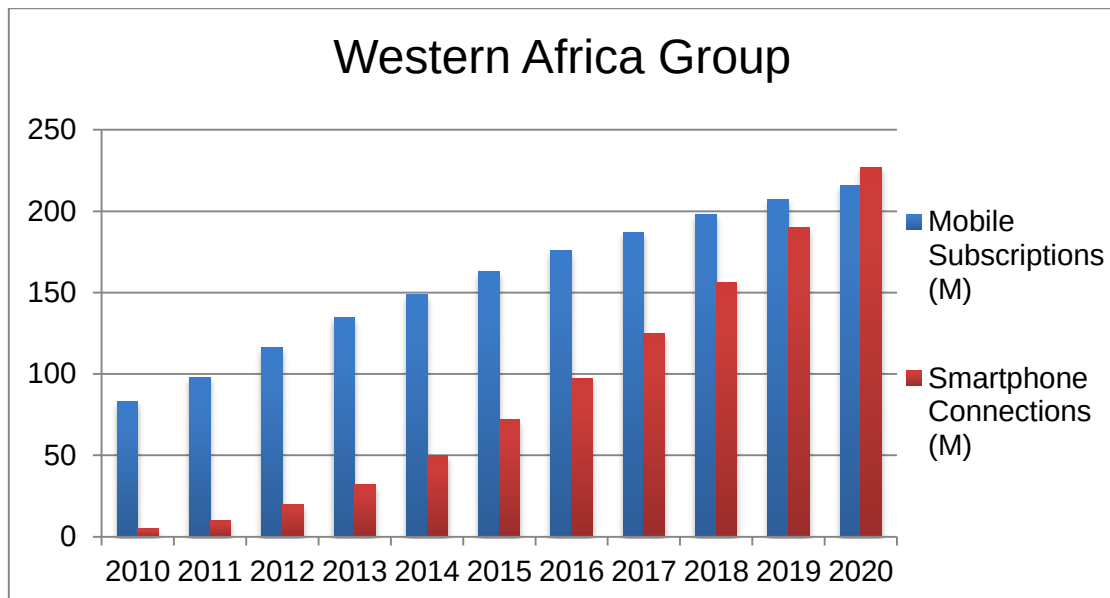


Figure 12: Western Africa group (GSMA, 2015)

A 2G-capable network dominated the network capacity for this region, which accounted for 90% of all mobile connections. The rollout of 3G-networks were gaining traction, with an estimated 40% penetration rate by 2020. Spectrum availability would, however, result in this region to have the lowest 4G-adoption rate by the end of 2020.

Smartphone connections represented 20% of all mobile devices by the end of 2014. The group had a high smartphone adoption rate, contributing approximately half of all the smartphones in circulation for the entire SSA region. This high smartphone penetration rate was predicted to be maintained through to the end of 2020 (GSMA, 2015).

Southern Africa (SA)

The SA subgroup consists of 15 member countries, with a combined population of 295 million. The SA region had the most developed ICT sectors of all the SSA groups at the time of writing. These countries are South Africa, Mauritius and Angola. The SA group had the highest penetration rate of mobile devices in the SSA region, with a 50% penetration rate. The group did have a large deficit between maximum and minimum bounds, based on mobile penetration rates. Madagascar and Botswana had mobile penetration rates of 19% and 70% respectively. South Africa contributed the largest mobile market, contributing approximately 30% to the group, with 38 million subscribers by the end of 2015.

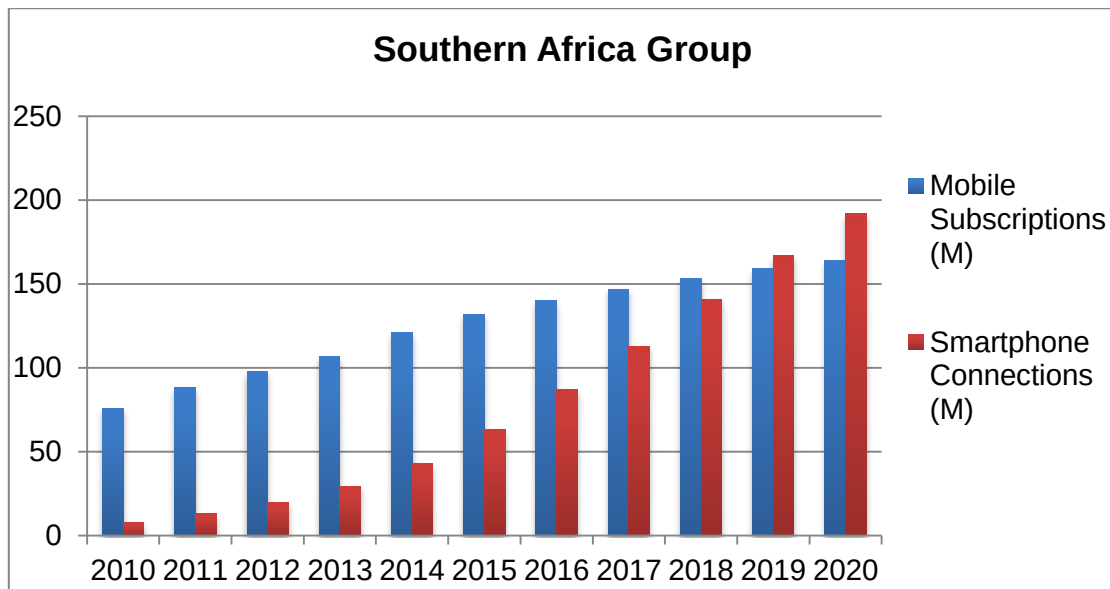


Figure 13: Southern Africa group (GSMA, 2015)

Migration to 3G- and 4G-capable networks was predicted to increase for the period leading up to 2020. At the time of writing, mobile broadband represented 30% of all mobile connections. This was predicted to grow to 60% of connections by the end of the decade. South Africa was predicted to implement 50% of 4G-capable networks leading up to 2020.

The SA group had the second largest smartphone market in the SSA region. SA represented the highest smartphone adoption rate, sitting at 25% of total connections. The adoption rate was predicted to reach 60% by the end of 2020 (GSMA, 2015).

The state of telecommunication and the ICT sector of SSA can be summarised, in terms of the mobile application hierarchy of requirements, in the following bullet points:

- Basic mobile communication requirements: Mobile network subscriber counts were rapidly increasing for the period 2010 to 2016. This growth was predicted to continue, reaching an estimated 50% of the SSA population by 2020.
- Basic mobile communication requirements: 2G-capable mobile network technology dominated areas that had mobile network signal coverage. 3G and 4G-infrastructure rollouts were underway in 2016, for a small set of SSA countries.
- Smartphone device: Smartphone penetration rates were low in the majority of the SSA subgroupings. This penetration rate was predicted to increase to the level of mobile subscriber counts by 2020.

It can be seen from the above listed points that by 2016, smartphone devices, mobile network subscribers and mobile network technology (as mobile application requirements) constrained mobile application deployment in SSA (GSMA, 2015). However, increasing mobile network

infrastructure rollouts and increased smartphone penetration rates were predicted to transform the SSA market space to a region that would be easier accessible by MAD (as per the mobile application hierarchy of requirements). The following sections continue by discussing some of the factors that influence the progress of SSA's telecommunications and ICT sector, as an underlying requirement for MAD.

2.5.3 Mobile device cost

The 2015 GSMA African conference revealed that the growth of 3G-technology in SSA was largely reflective of the rising smartphone adoption rates, which had doubled in the period 2014 to 2015 to 20% of total mobile device connections. This figure represented 50% of the global average which, according to the GSMA, was estimated at 40% at the time of writing. The penetration rate (which was set to accelerate further to 33% of mobile device connections by 2017 and more than 50% by 2020) was benefitting from the increase in availability of low-cost devices. The average selling price (ASP) of smartphone devices had decreased significantly in most SSA markets, with the introduction of devices that fell in the sub \$100 price range. The GSMA predicted in 2015 that, despite of the regional move towards smartphone and mobile broadband, close to 450 million mobile subscription connections would still have been feature phone based by 2020. The association concluded by stating that smartphone affordability remained a key limiting factor for most consumers in SSA, especially in rural areas, which at the time of writing still struggled to afford data-enabled devices and its associated bandwidth tariffs (GSMA, 2015).

2.5.4 Device recharging

The largest barrier to mobile device usage (especially in rural areas of SSA), is access to electricity. It was estimated in 2015 that 68% of the SSA population lack access to a reliable energy supply. This made it challenging and costly for most individuals to recharge their mobile devices (IEA, 2015). Even access to electricity did not necessarily result in usage, as people might have not been able to afford electricity at home. A solution to this was to recharge a mobile device at a "recharging station." Some people would go as far as sending their mobile devices by bus to a trading centre once a week for recharging. This, however, did come with the risk of theft, given that mobile devices were left unattended while charging. Companies like Motorola and Chinese mobile handset manufacturer, ZTE, had started to introduce low cost renewable energy generation units in an attempt to offer an alternative source for device recharging (Hellström, 2010).

2.5.5 Taxation cost

High levels of taxation imposed by governments on mobile network operators in SSA drove up service cost for consumers which resulted in reduced incentives to invest in scaling mobile connectivity operations and service offerings. For example, Tanzania's mobile network operators had to pay in an excess of \$540 million in the 2013 to 2014 financial period. To put this figure into perspective, \$540 million represented approximately 50% of the combined revenue for these network operators. Another dimension to the high tax problem came in the form of GDP. The combined turnover of the mobile network operators contributed 3.8% to Tanzania's GDP, which translates into 11% of Tanzania's tax revenue (GSMA, 2015).

A recent study conducted on Ghanaian tax laws by the GSMA found the following:

- Overall taxes represented approximately 25% of the cost of ownership of mobile connections in Ghana.
- The ICT sector was one of the highest taxed sectors in Ghana, with mobile network operators paying in excess of \$650 million per year.
- National Health Insurance Levy (NHIL) and custom duties (introduced in 2013) sets the VAT (Value Added Tax) associated with mobile device purchases at 37.5%.
- The main mobile service offering (voice calls, data and sms) was subject to a 6% tax. These taxes include CST (Communication Services Tax), VAT and NHL.
- At the time of writing, the government was considering adding an additional tax on sim card activations.

In addition to paying national taxes, mobile network operators pay high administrative costs due to multiple (and often complicated) taxation laws.

2.5.6 Digital literacy and local content

The expansion of the mobile internet has revolutionised the way people interact and do business on their mobile phones (Deen-Swarray, 2016). The World Bank had estimated that 10% in mobile device penetration would create a 1.4% increase in SSA's GDP (Kim, 2010). This situation, however, did not come without concern, as many "would-be" mobile internet users in SSA were illiterate and that the rapid expansion of mobile internet access could leave illiterate SSA communities behind (GSMA, 2015). In 2016, literacy represented the primary level of concern (given that most of the internet related content was communicated by text), when it came to mobile internet in the developing world, with 80% of illiterate adults living in developing countries. Efforts to solve the problem included visual cues, pictures or videos to replace the text-based communication medium. Verbal mobile command tools had also been used to communicate with users. Some argued that these tools only solved part of the problem, as mobile technology

developers had not taken cultural context into account. Research had shown that conceptual literacy posed a significant barrier to technology adoption. Cultural norms had been found to be the driving force for consumers' saving needs. As example, in rural areas of SA, it was common for individuals to spend their entire savings on funerals for their relatives. This resulted in people having no use for basic saving accounts. The interpretation of a given concept is very significant between cultural contexts. Given this, conceptual literacy is an important consideration for mobile application design in SSA. Ubiquity of the mobile internet generates opportunity for people and communities. Unlocking these economic and social opportunities require mobile developers to prioritise the underlying cultural context of mobile content creation (Chhatpar, 2014).

2.5.7 Feature phones in Sub-Saharan Africa

Studies had found that by 2015 80% of people in SSA still used feature phones, while at the same time smartphones were predicted to reach a penetration of 50% by 2020. Feature phones (by the year 2015) were clearly the preferred choice for most SSA mobile subscribers. The following bullet points list why feature phones dominated the SSA market (GSMA, 2015):

Function: Studies had found that the majority of people in SSA used their mobile phones for text messaging, photos or videos, which a feature phone offers. Feature phones also worked well with popular micro fund transferring financing services like M-Pesa or mPedigree which validated medicine originality.

Cost: While the entry cost to smartphones were falling, the majority of the SSA population could still not afford cheaper smartphones, given that an estimated 33% of the SSA population lived on less than \$1 per day.

Cost of electricity: Most 2016 smartphone technology required daily recharges. This posed a problem to individuals who had limited access to affordable electricity. Feature phones however, could last a week on a single recharge.

2.6 Mobile application business considerations in Sub-Saharan Africa

The previous section has given an overview of the state of SSA's telecommunication and ICT industry as a feature phone dominant market. All of the topics discussed in the previous section either operate on a macroeconomic level or at least contribute highly to the development of the telecommunications and ICT sectors of SSA. This means that it falls beyond the domain of control for a mobile application business start-up deployed in SSA. This, however, does not mean that a mobile application business should not consider these external factors when making strategic business decisions (Kadocsa & Francsovcics, 2011). The following section minimises the scope of

the SSA market space discussion and refocuses on the factors that a mobile application business can control.

2.6.1 Venture capital in SSA

Information from the 2016 Venture Finance in Africa report showed that capital funding and angel investment secured by 462 SSA based ventures had doubled for the period 2015 to 2016, from the \$27 million to \$73 million (Kazeem Y, 2016). Despite the increased funding by 2016 venture capital and angel investment still only accounted for 12% of investment available to start-up businesses in SSA. This meant that business founders were still mostly dependent on their own capital, bootstrapping or grants. The following figure shows several sources of capital available to SSA entrepreneurs.

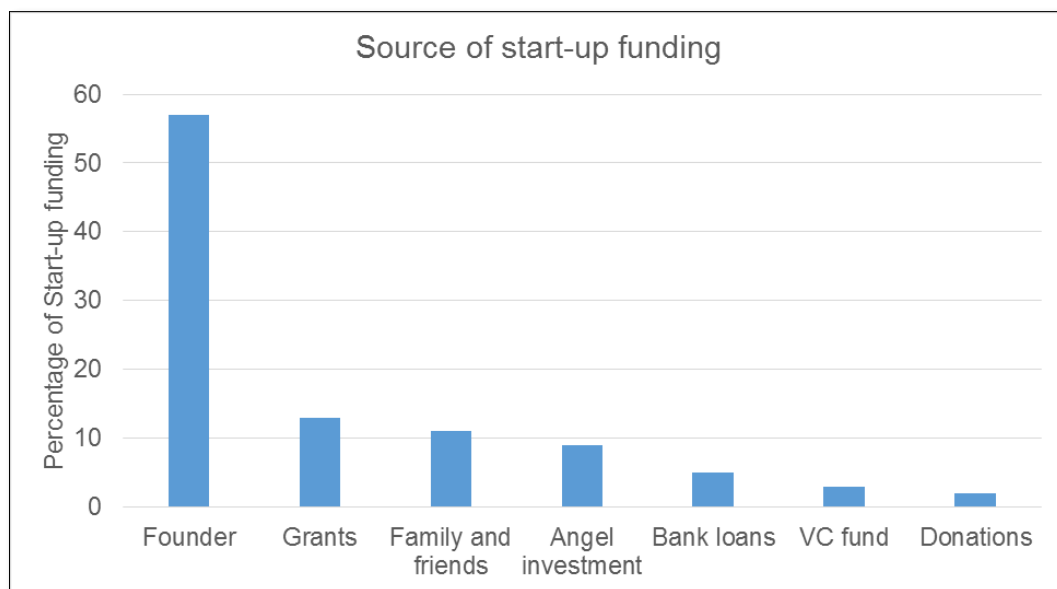


Figure 14: Sources of start-up funding in SSA (Kazeem Y, 2016)

From the above figure it can be seen that capital provided by business founders remained the main source of capital for start-up funding in SSA, whereas donations contributed the least. The behaviour could be explained by the fact that, at the time only a small group of investors operating in SSA made profits. Although some of these investors had taken risks they had benefitted greatly. However, given the fact that by 2016 most technology based start-ups were still in their early stages, investors were likely to follow a long term investment strategy, rather than a short term position to make a quick return (Kazeem, 2016).

While business founders continuously seek investors' capital, knowing where and how to search for investment is important. The Venture Finance in Africa report showed that successful SSA based start-up businesses work through an incubator or accelerator. In addition, these start-up businesses partake in technology related events (Kazeem, 2016). Co-founder of start-up news

portal Disrupt Africa, Tom Jackson said that the relative lack of investment could also be contributed to investor reticence. “For many investors Africa is still deemed too risky”, he continued, by stating that: “This perception is slowly changing, but it will take time to completely change” (Jackson, 2016).

2.6.2 Business approach

A well-structured and comprehensive business plan is important to the success of entrepreneurial ventures (Gumpert & Rich, 2016). Whether the business plan is used for a business start-up or raising capital for an existing product line, a business plan plays a vital role in obtaining funding for a new business venture. A business plan document generally includes the size of a new opportunity in the market, a description of the problem that needs to be solved and an answer to the problem (which the new business venture will provide). In addition, a business plan includes forecasts of income, profits as well as cash flow for the new business venture. The business plan is built on the assumption that one can predict most of the unknowns of a business before any capital is raised and the business idea is executed (Blank, 2013).

Once an entrepreneur obtains capital from investors, he starts developing a product. Large sums of money and time is spent on preparing the product for a launch, with little to no customer input. The first substantial product feedback is only obtained when the sales team attempts to sell the product. Often after months of development, an entrepreneur learns the hard way that the customer does not want or need most of the product’s features, which most of the time lead to business failure. Research by the Harvard Business School shows that 75% of all start-ups fail. The key conclusions from this research show the following points (Blank, 2013):

1. A business plan rarely predicts the needs of a customer the first time around.
2. Five years financial forecast are generally not accurate.
3. New start-up companies are not smaller versions of developed companies. This means that start-up companies do not grow and develop in accordance to a predefined plan. Companies that become successful, transitions quickly to a new market, adapt, iterate and continue to align their initial idea to that of the customer’s requirements.

In an attempt to better approach the potential pitfalls of the above listed points, entrepreneur Eric Ries proposed the LSU approach (Ries, 2011). The LSU method has three key principles given in the following:

An entrepreneur following the LSU approach accepts that he only has a set of untested hypotheses and rather than writing a business plan to describe and predict the business outcome of these hypotheses, a framework called a business model canvas is used to summarise the hypotheses. The business model canvas is essentially a diagram of how a given company creates

value not only for itself, but also for its customers (Blank, 2013). The business model canvas lists the following key metrics:

- Key partners
 - Key activities
 - Key resources
 - Cost structure
 - Value proposition
 - Revenue streams
 - Channels
 - Customer relationships
 - Customer segments
- Customer interaction is used to develop the product. This means that the product is developed through a iterative process, wherein a MVP (Minimum Viable Product) is created, tested with customers and continuously adjusted based on feedback from the customer, until the product reaches its final iteration (as the market requires it to be). All the business model elements are tested in the market. These elements include: product features, pricing of the product, the distribution channels as well as a customer acquisition strategy (Blank, 2013).
 - Agile development is used for product development. This technique integrates well into customer based development. Product development cycles are kept short, with emphasis on flexibility and speed. The Agile method develops products incrementally and iteratively (Blank, 2013).

This business approach followed is compared to traditional business approaches in the following table:

Table 2: Lean start-up compared to a traditional business plan

Lean	Traditional
Strategy	
Business Model	Business Plan
Hypothesis Driven	Implementation Driven
New Product Process	
Customer Development	Product Management
Direct Test In Market	Linear Step Approach to Market
Engineering	
Agile development	Waterfall Development

Build product interactively and incrementally	Fully specify product before build phase
Organisation	
Agile development teams	Department by function
Hiring based on learning, flexibility and speed	Hiring based on experience and ability to execute
Financial reporting	
Key metrics driven	Accounting
Customer acquisition cost, lifetime customer value, churn or application popularity	Income statement, balance sheet, cash flow statement
Failure	
Expected	Exception
Multiple iterations of ideas (and accompanying failures) and pivoting away from the ideas that do not work.	Fix by firing executives
Speed	
Rapid	Measured
Operates on medium quality data	Operates on high quality data

For an in-depth break down of each LSU feature listed in Table 3, refer to Appendix A.

2.6.2.1 Applying the LSU business approach to the SSA market space

The lean start-up business approach aligns with effectual reasoning. Effectual reasoning refers to a type of business approach wherein the entrepreneur does not start with a specific goal in mind, but rather start with a given set of means at hand and allow the goals to form over time (Sarasvathy, 2001).

Dr Sarasvathy characterises effectual reasoning in a business start-up context in the following bullet points:

- Lower cost of failure.
- Able to gain market experience on the go.
- Slower to the market than traditional models, but does offer more options.
- The approach is based on its own strengths and capabilities, gained from effectual reasoning.
- This approach works better in innovative and lesser known markets.

The key characteristics of the SSA market space as identified by the literature review:

- Fragmented an unknown market space.
- Low mobile broadband and smart device adoption rates create a development window wherein a linear step approach model has enough time to self-adjust to the African market.
- Little to none foreign or local source of angel investment exist.
- Need for sustainable business development is undermined by lack of business knowledge among entrepreneurs.
- Unpredictable market space reduces forecasts for income, profits and cash flow.

Given the key characteristics listed above, entrepreneur Victor Agolla proposes the LSU business model approach, as opposed to the hit-or-miss proposition that a conventional business plan suggests (Agolla, 2015).

2.7 Definition and summary of drivers

A “driver” is defined by the Oxford Dictionary as: “A factor which causes a particular phenomenon to happen or develop” (Oxford, 2013b). In the case of this research, the factor mentioned in this definition refers to the drivers that had a direct or indirect effect on the outcome of a system. A system is defined as: “an integrated composite of people, products and processes that provide a capability to satisfy a stated need or objective” (Oxford, 2013b). The researcher used a system methodology to identify all of the relevant study drivers. The system is bound by any factor that causes a particular phenomenon in MAD in SSA. The identification process of drivers required the researcher to first define the bounds of the system and then consider the bound system from the following components:

1. Application development - system component: An application development project was broken down into a work breakdown structure to identify all contributing elements. Refer to Appendix F for the application creation work breakdown structure.
2. Lean start-up canvas - system component: The lean start-up canvas was used as the evaluation framework for the business component of the application deployment system. Refer to Appendix E for a table listing the elements of the lean start-up canvas.
3. External factors – system component: The external factor component of the application deployment system consisted off uncontrollable drivers (from a mobile application deployment perspective). Given the potential scope of this component, there existed (at the time of writing) no framework for this system component. The researcher used insight gained from the literature review to identify drivers for the external factors system component.

To ensure that all drivers were identified, the researcher looked at mobile application deployment through the proxy of each of the listed system components, as shown in the following figure.

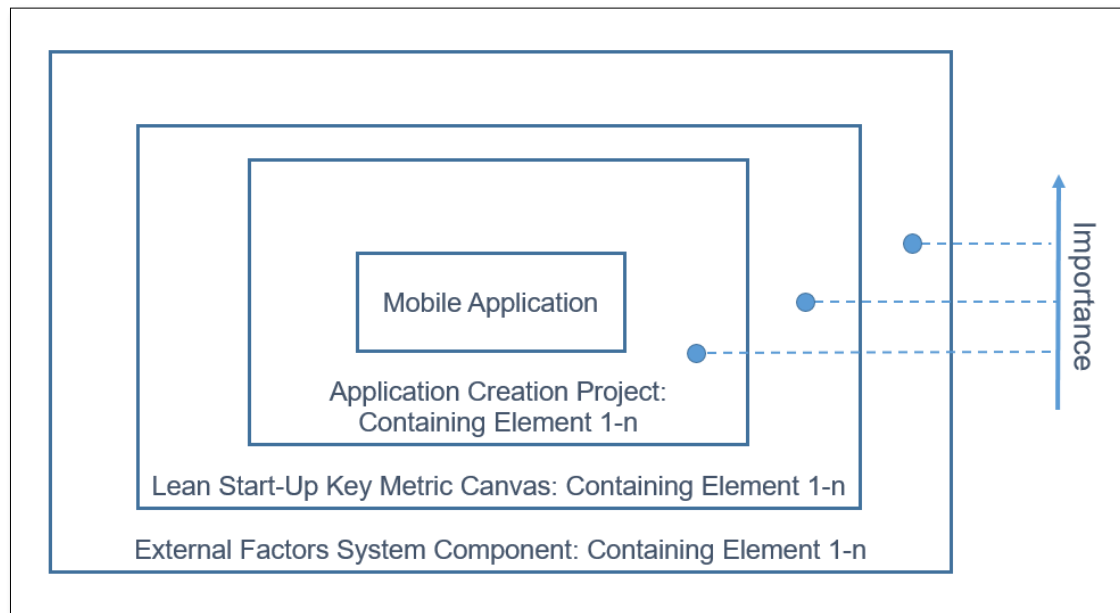


Figure 15: Application deployment system components

Each of the system components were identified from literature. From the figure it can be seen that each component has a different importance. The system components are assigned a level of importance based on the monetary value each component's driver requires to fundamentally change.

The researcher used the term "element" to describe a key feature or requirements of a given system component, as shown in Figure 15. Each element of the three components of the application deployment system was evaluated, summarised and rephrased into the drivers listed in Table 3. For a mapping between driver and system components refer to Appendix G.

The identified drivers are presented and ranked in the following figure:

Table 3: Research drivers summarised

Driver	System Component
(EF.1) African Market: The African application economy is different, compared to, for example the US. Mobile applications in SSA are developed only to service small population groups or as utility services to already existing service and products. Mobile applications in SSA are not developed as standalone services or products.	External Factors
(EF.2) Mobile Device Technology: Smartphone (as a platform for mobile applications) adoption rate will only justify business viability once smartphones penetrate the majority of the SSA market space.	External Factors
(EF.3) Mobile Network Coverage: Network coverage required for mobile connectivity.	External Factors
(EF.4) Cost of Mobile Device Ownership: The total cost of mobile ownership (i.e. device purchase, mobile operator costs and powering the device).	External Factors
(EF.5) Electricity Requirements: Electricity as requirement for mobile device operation.	External Factors
(EF.6) User Technology Literacy: Digital literacy of the African population.	External Factors
(EF.7) Governing Tax Policies: Taxes imposed on mobile network operators.	External Factors
(EF.8) Feature phones (non-smartphone) applications (for example: m-pesa or mxit) as alternative to smartphone based applications.	External Factors

(EF.9) Platform modularisation: Mobile portal provisioning, platform operation, service provision and service aggregation split (decentralised) across multiple contributing entities as opposed to a given mobile network operator (for example MTN), owning and controlling all the mentioned services from one centralised point.	External factors
(ACP.1) Content localisation: Content provided to user in local language.	Application creation project
(LSU.1) Capital requirements: Source of capital or investments.	Lean start-up key metric canvas
(LSU.2) Time to market: The amount of time spent to develop mobile application and deploy to the market (build, measure and learn cycle).	Application creation project and lean start-up key metric canvas
(EF.10) Market fragmentation: The African market space contains a diverse range of cultures, demographic groups and income segments.	External factors
(ACP.2) Developers skills: Programming and designing mobile applications.	Application creation project
(LSU.2) Entrepreneurial skills: Level of business knowledge for mobile application entrepreneurs.	Lean start-up key metric canvas

[EF-External Factor Number, ACP – Application Creation Project Number, LSU – Lean Start-Up Number]

2.8 Conclusion

This chapter started off by describing the main revenue models for mobile application deployment. The chapter continued by discussing the external SSA market factors that influence mobile application deployment and development. Factors that influence a mobile application business, that lie in the control of a business start-up were also discussed. The LSU business approach which makes up the basis of the research hypothesis was also described in Chapter 2. The chapter was concluded by summarising and grouping the main drivers of MAD in SSA (as identified from literature). The next chapter structures an experimental framework from which these drivers' impact can be tested. Chapter 3 also tests the research hypothesis.

3. RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The research design and methodology chapter describes the design of a structured plan, which includes the experimental assumptions made (as it builds from the research strategy), study respondent selection criteria, data collection and finally the data analysis techniques applied to the data extracted from the experiment (Kumar, 2005:5). This chapter starts off by justifying the researcher's approach to the experimental baseline selection and use of study drivers. The chapter then continues to list the relevant study respondents selected for the research and concludes the chapter by outlining the research design requirements specified above.

3.2 Design philosophy and assumptions

At the time of writing, mobile applications had arguably refined how most people interact with their mobile phones. The platform from which these applications were marketed and sold created a \$34.2 billion industry by 2015 (Jackson, 2016), from which goods and services could be sold. With the SSA market continuously searching for disruptive innovation (Ojoma, 2016) and with the continent's mobile application related revenue only contributing a small fraction of the international market, led to the research question for this dissertation: What could be done to increase the success rate (disruptive innovation) of MAD in SSA?

From Chapter 1, the overall objectives for this research are:

Primary objective – Identify and rank the critical success factors required for MAD in SSA.

Secondary objective – Prove or disprove the research hypothesis. From Chapter 1, it was hypothesised that the LSU business model approach could increase the success rate of MAD in SSA.

The following two points were used to categorise and measure the factors effecting MAD in SSA respectively:

- Drivers: As defined in Chapter 2, the drivers (in the context of this research) referred to any factor that had a direct or indirect effect on the outcome of MAD in SSA. It was seen from the literature review that the drivers made the SSA market space a challenging and relatively unknown domain for MAD. The drivers identified in Chapter 2 originated from various sectors with different levels of impact on the MAD in SSA. The impact indifference required the drivers to be ranked to understand the relative weight each driver contributed to the primary research objective.

- Baseline for drivers: From Chapter 1 it was seen that the LSU model aligned better to the requirements of a business start-up in SSA than that of a conventional business plan (Netessine & Popescu, 2014), which led to the research hypothesis. Testing the research hypothesis required the baseline to be structured around the LSU business model framework. Integrating the research hypothesis as baseline for the driver measurement enabled the researcher to test the research hypothesis (secondary objective) at the hand of the primary objective.

The measurement of the drivers and testing of the hypothesis required a quantitative and qualitative research strategy. The design thereof is described in the following sections.

3.3 Research strategy – quantitative and qualitative

Both quantitative and qualitative methods of experimental research were applied in this study. Quantitative research refers to a numerical presentation of observations with the objective of explaining the phenomenon that the observations represent (Sukamolson, 2016). The research drivers were firstly identified from the literature review. The identified drivers were next ranked. The ranking process consisted of assigning priority and controllability to the drivers in a quantitative manner. The drivers were then presented to the study respondents for ranking according to the driver's priority and controllability.

Qualitative research refers to a study that focuses on the observation and interpretation of what a study respondent has on a research concept (Kumar, 2005:13). A qualitative method, wherein the researcher invited the study respondents to offer their own drivers, was also included in the research for supplemental purposes. The qualitative approach facilitated the experiment by creating a feedback system, wherein a study respondent not only ranked the pre-identified drivers, but also offered his / her own drivers. The completion of the study response required the study respondents to rank the pre-identified drivers, add additional drivers and rank the additional drivers.

In addition to the qualitative element of the research, follow-up interviews were conducted. Only a subset of all the identified drivers (i.e. drivers identified from the literature review) was selected for the follow-up interviews. The drivers selected for the follow-up interviews consisted of the top 20% of drivers per system component.

3.4 Non-experimental design

Non-experimental design is used in research, when the relevant predictor concepts cannot be manipulated (Kumar, 2005:113). The research thus relied on the interpretation, observation and interaction with study respondents to come to a logical conclusion. This approach required the researcher to first investigate the state of the problem, identify sources and finally the cause. This enabled the researcher to connect the cause to the outcome. Non-experimental design was used in this research given that the drivers that had an impact on the SSA market space could not be controlled by the researcher.

From the research question: What could be done to increase the success rate (disruptive innovation) of MAD in SSA, one option was to identify the drivers of MAD in SSA. In addition to identifying the drivers of MAD in SSA, a suitable framework was also required to navigate a business through the effects of these drivers. From the research hypothesis, the LSU business model framework was suggested. The non-experimental element of the research consisted of study respondents, providing feedback (from their own perspective) on MAD drivers in SSA and LSU as an alternative business approach for MAD in SSA. The study respondents used in this research was representative of the technology hubs and the information technology sector.

3.5 Study respondent selection

For the researcher to first answer the research question and second prove the research hypothesis, the appropriate study respondents needed to be selected. The following lists the research respondent requirements (identified by the researcher) to answer the research question and prove the research hypothesis.

Research question requirements – Study respondents required knowledge or experience in the following areas:

- a. The cost of mobile phone ownership in SSA.
- b. The mobile application platform as a source of revenue.
- c. The state of the SSA mobile application market.
- d. The current reason for MAD failure in SSA.
- e. The software development process.
- f. The software deployment process.

Research hypothesis requirements – study respondents required knowledge or experience in:

- a. The LSU business approach (as applied to MAD).

3.5.1 Source of study respondents

A hub includes the following attributes (Toivonen & Friederici, 2016):

- Hosts a community of collaborative individuals with entrepreneurship at the core of the system.
- Attracts individuals with diverse backgrounds, contributing a diverse pool of knowledge.
- Facilitates creativity in the physical and digital space.
- Focuses entrepreneurship to one space, which enables investors to connect with entrepreneurs.

A technology hub was chosen as a primary source of study respondents for this research, as it hosts individuals that would be able to provide insight pertaining to MAD in SSA, which could lead to the answering of the research question and prove the research hypothesis.

In addition to technology hubs, the researcher also contacted information technology (IT) consulting companies. IT companies were included in the group of research respondents contacted, as these entities did not work with MAD, but rather general software development and deployment. This enabled the researcher to gather the perspective of representatives from mobile application deployment or development companies as well as non-application deployment or development companies (but still within the IT sector), removing biasedness to MAD from the experiment.

Technology hubs and IT based companies situated in Johannesburg and Cape Town, South Africa were contacted for study respondents (Appendix D contains a full list of study respondents and their contact details).

3.6 Research sampling technique

Purposive sampling is a nonprobability sampling technique, wherein study respondents are chosen deliberately, due to the abilities they pose (Etikan *et al.*, 2015). Purposive sampling was used for this experiment. Companies' representative of technology hubs and the general IT sector were randomly contacted and asked to take part in the study. The following figure outlines the approach used:

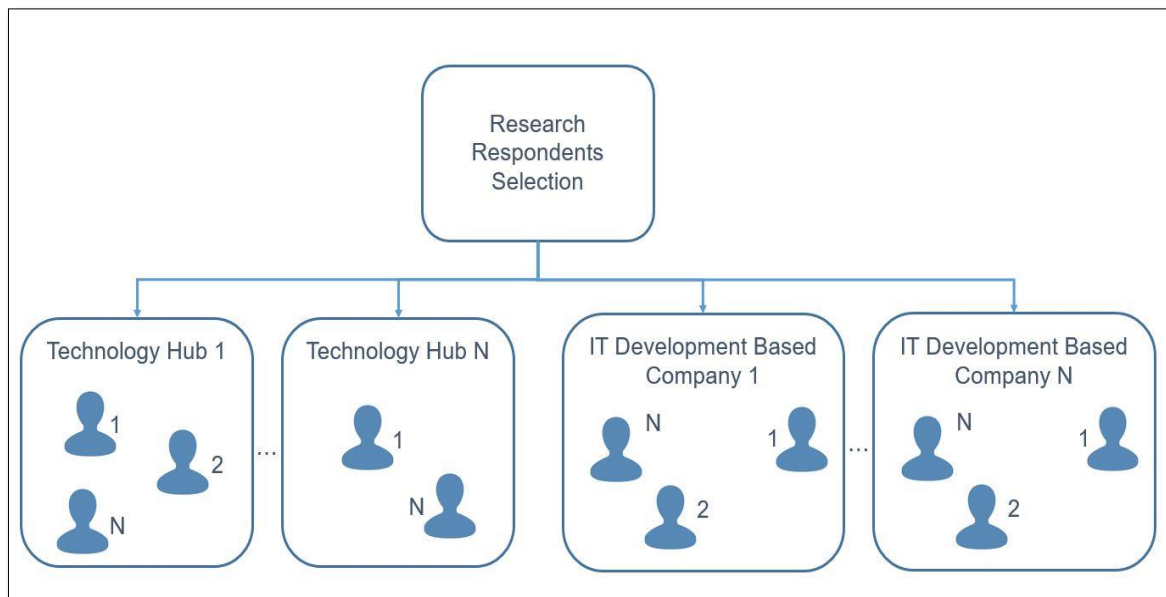


Figure 16: Questionnaire distribution process

As indicated by the above figure, one respondent per technology hub or IT based company was contacted and asked to take part in the research (direct contributing – personnel that qualified for the study as outlined by section 3.5 – study respondent selection) workers. In addition to the initial contact, the researcher requested that the primary contact communicated the research to random co-workers, which also qualified for the study, based on the criteria outlined in section 3.5. The questionnaire was available for completion over a period of eight weeks whereafter the submissions of the questionnaire were closed. Reminder e-mails were sent to the study respondents if no feedback was received after four weeks.

Due to the lack of scientific papers (for comparison purposes), the researcher did not settle on a pre-determined number of study respondents, but rather tried to contact as many potential study respondents as possible.

3.7 Questionnaires and follow-up interviews

The survey as a research tool enables the researcher to gather information regarding the particular state of a given subject (Rugg & Petre, 2007:60). This medium is broken into two methods:

- Questionnaire distributed to the study respondents. A questionnaire is a set of questions divided into either open-ended or closed questions.
- Interviews conducted with the study respondents. An interviewed based approach uses oral discussion to communicate and exchange information.

This research used both approaches. Firstly, using a questionnaire enabled the researcher to cast his net over a wider audience which would have otherwise been limited to a smaller research respondent group. Secondly, interviews were conducted to follow-up on the information gathered by the questionnaire.

3.7.1 Questionnaire design

The questionnaire design process is outlined in the following figure. The important process elements are discussed in the following sections

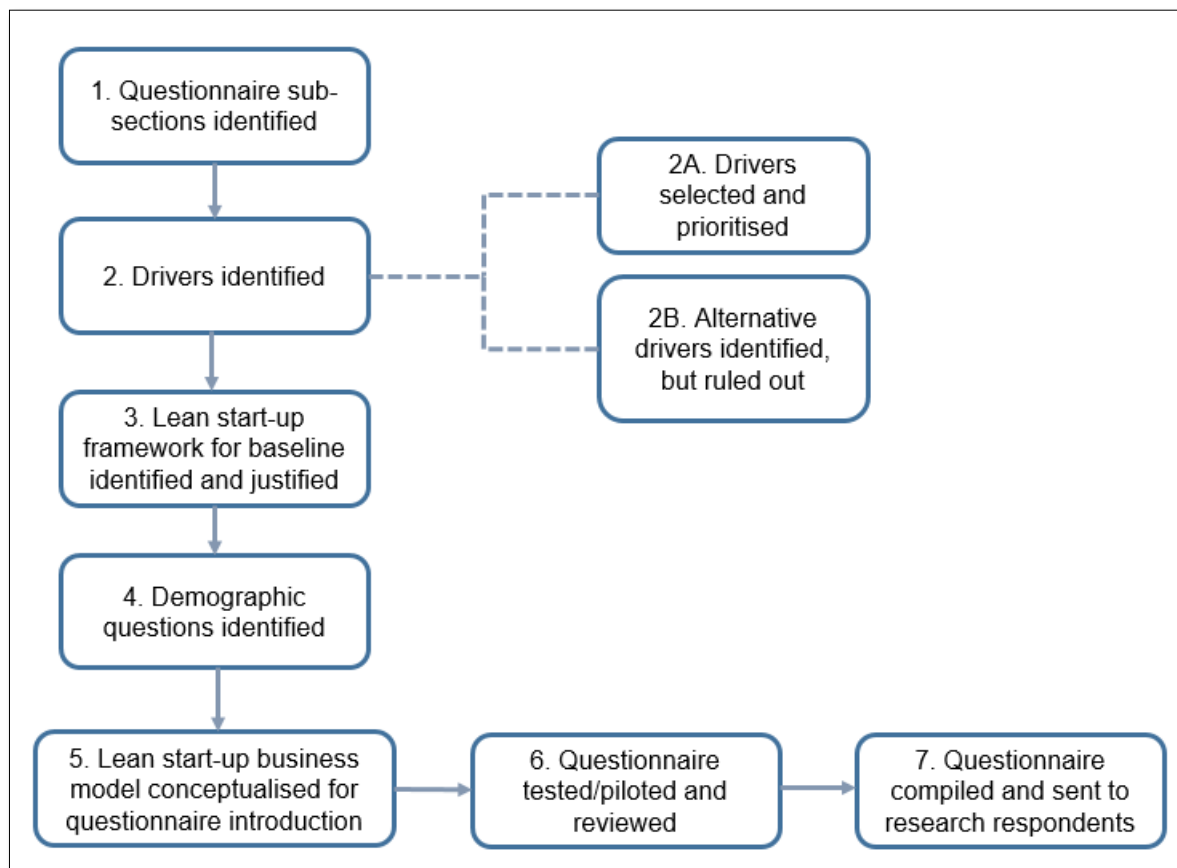


Figure 17: Questionnaire design process

3.7.1.1 Questionnaire subsection identified

The questionnaire was broken down into the following sections:

1. General information: Consisting of the research respondents name, surname and willingness to participate in the research.
2. Background: This section gives the study respondents context about the research question and hypothesis.

3. Biographic information: Utility data was collected from the study respondents, including age, gender, nationality, etc.
4. Personal opinion of the research question: The study respondents were presented with statements relating to MAD and SSA requirements. The study respondents were then requested to rank each statement in terms of the relation each statement had to MAD or SSA.
5. Personal opinion on the research hypothesis: The study respondents were presented with the features of the LSU features and asked to rank these features in terms of the relevance to MAD in SSA.
6. Drivers of MAD in SSA: The study respondents were then presented with the pre-identified study drivers and asked to rank the drivers in terms of the priority and controllability a driver had on MAD in SSA.
7. Additional drivers of MAD in SSA: The final section required the study respondent to add his / her own drivers and rank these drivers in terms of priority and controllability for MAD in SSA.

Appendix H includes the questionnaire as it was presented to the study respondents.

3.7.1.2 Lean start-up framework for baseline identified and justified

The research objective for this research tried to identify, understand and describe the critical success factors (truly market disruptive) required for MAD in SSA. The research objective was guided by a business model and measured through drivers of the mobile application market in SSA. The research deliverable was thus a business model framework. The research hypothesis suggested a LSU model approach, which was used as a baseline framework for the drivers. Establishing a business model baseline enabled the researcher to create a research instrument which was used to measure the driver's impact and controllability.

As seen from the literature review, the SSA market can be characterised by market fragmentation, weak telecommunication infrastructure and high cost of device ownership and lack of basic utility services like electricity. The research hypothesis suggests the LSU business model as an alternative business approach that could lead to a higher success rate of MAD in SSA. For this reason, the LSU features were included and tested in the questionnaire. As reference from the literature review, the following table lists the features of the lean start-up business model:

Table 4: Lean start-up canvas

Lean	Traditional
Strategy	
Business Model	Business Plan
Hypothesis Driven	Implementation Driven
New Product Process	
Customer Development	Product Management
Direct Test In Market	Linear Step Approach to Market
Engineering	
Agile development	Waterfall Development
Build product interactively and incrementally	Fully specify product before build phase
Organisation	
Agile development teams	Department by function
Hiring based on learning flexibility and speed	Hiring based on experience and ability to execute
Financial Reporting	
Key Metrics Driven	Accounting
Customer acquisition cost, lifetime customer value, churn or application popularity	Income statement, balance sheet, cash flow statement
Failure	
Expected	Exception
Multiple iterations of ideas (and accompanying failures) and pivoting away from the ideas that do not work.	Fix by firing executives
Speed	
Rapid	Measured
Operates on medium quality data	Operates on high quality data

3.7.2 General questionnaire considerations

The goal of the questionnaire was to collect information from the study respondents. The collection of research data adds value to the research by leveraging the study respondents' experience from their respective industries (Rugg & Petre, 2007: 60). To gain maximum insight from the study respondents, the questionnaire needed to be designed logically and clearly. The design principles followed for the questionnaire are given in the following list (Rugg & Petre, 2007: 141):

- Questions were stated clearly and not in a leading nature.
- Simple terminology was used. If a question did contain more complex terminology, sufficient background context was provided in the questionnaire information leading up to the question.
- Questions added to the questionnaire were relevant and not of common knowledge.
- The questionnaire was reviewed by six external participants (see Appendix C for details of the six external participants and their feedback provided). The researcher used the insight gained from the pilot respondents to adjust the questionnaire so that it maintained the following:
 - a. A clear description of research background, hypothesis and question.
 - b. Logical questioning with the intent of clearly communicating questions.
 - c. Question descriptions articulated in a manner that enabled the study respondents to complete the questioning without additional assistance.
 - d. Avoided terminology that might be difficult to interpret.
- The questionnaire was programmed by the NWU statistical consultation services.
- The questionnaire was hosted on Google forms.
- The study respondents were contacted, presented with an introduction letter and a link to the online questionnaire.

3.7.2.1 Questioning Scale

Likert scaling is a non-comparative scaling method and is one dimensional in nature (Bertram, 2016). Likert scaling was used as a research tool to measure the latent constructs required to extract information from research respondents from a non-experimental perspective.

The following table lists the scaling used per section of the questionnaire:

Table 5: Likert scaling used in questionnaire

Section 4: Respondent opinion on the research question	Option 1	No relation
	Option 5	Totally relatable
Section 4: Respondent opinion on the research hypothesis	Option 1	No relevance
	Option 5	Significant relevance
Section 5 – Drivers of mobile application deployment in SSA	Option 1	Lowest priority
	Option 5	Highest priority
	Option 1	Controllable
	Option 2	Uncontrollable

3.7.3 Follow-up interview design

The follow-up interviews were conducted to supplement and verify the information collected from the questionnaire. For the design of the follow-up interview only a subset of the ranked drivers were selected. Selecting only a subset of the drivers enabled the researcher to expand into the detail of the selected drivers as they govern the dynamics of the SSA mobile application market space. The sub-group selection process consisted of two steps.

The drivers were firstly grouped into three system components (refer to section 3.8 Drivers identified and ranked): External factors, application creation project and lean start-up key metric start-up). The distribution of the drivers is given in the following table:

Table 6: System component - distribution

System Component	Component Driver Total	Percentage of Total (%)
Lean Start-Up Key Metric Start-Up	3	18.75
Application Creation Project	3	18.75
External factors	10	62.5
Total	16	100

The original distribution of system components were to be mirrored in the final selection. The second part of the selection process involved Pareto's 80-20 principle whereby it was assumed that 20% of the drivers identified by the research contributed 80% to the outcome of successful MAD in SSA (Goergescu-Roegen, 1935). Only the highest ranked drivers per system component (representing the top 20%) were selected for the follow-up interviews. Factoring Table 6 with the 80-20 principle resulted in the following:

Table 7: Driver selection: follow-up interview

System Component	Component Driver Total	Percentage of Total (%)	20% of Component Driver Total (Rounding upwards)
Lean Start-Up Key Metric Start-Up	3	18.75	1
Application Creation Project	3	18.75	1
External factors	10	62.5	2
Total	16	100	4

3.7.3.1 Additional follow-up interview design features

The goal of the follow-up interviews was to confirm and expand on the ranked driver responses, collected from the questionnaire. The following bullet points outline the common design rules followed for the follow-up interviews design:

- The interviews were kept as short as possible (10 to 20 mins.), while still extracting quality information. This was done to accommodate the schedule of the interviewees.
- The interviews were conducted telephonically. This enabled the researcher to interview the respondents from several parts of the country.
- Follow-up interviewees were selected based on the role that they played in their organisations.

The following figure outlines the general flow of the follow-up interviews:

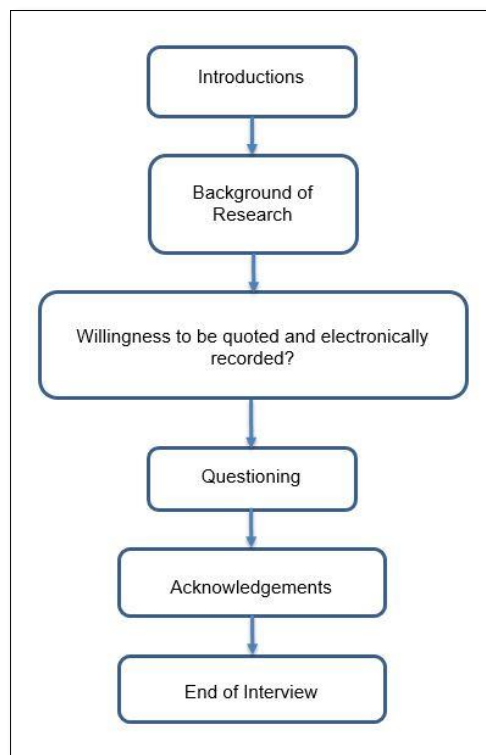


Figure 18: Follow-up interview process

The follow-up interview respondent selection and response is discussed in Chapter 4.

3.8 Drivers rules for ranking

After the drivers were identified, it needed to be ranked according to controllability and priority. Figure 20 illustrates the rules applied to the ranking process:

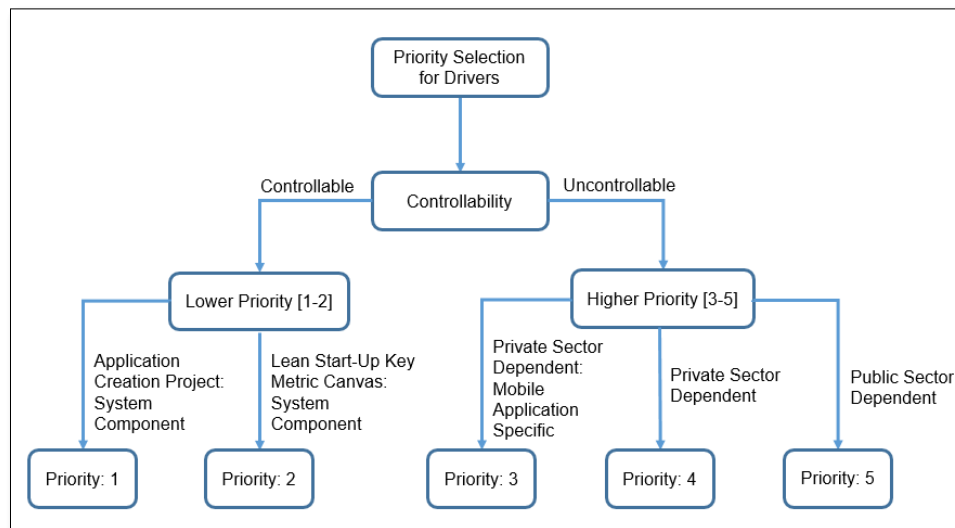


Figure 19: Ranking of controllability and priority

Drivers identified from the literature review were ranked by the researcher to group and organise the drivers according to the relative impact each driver has on MAD in SSA. This enabled the researcher to conclude and make recommendations based on a comparison between the researcher's ranking and the study respondents' ranking of the drivers

Incontrollable: All drivers inheriting from the external factors system component were assigned incontrollable. These drivers cannot be controlled by a start-up business, for example the electricity infrastructure in rural SSA regions. Once a driver has been labelled uncontrollable, it could be assigned a priority from three to five, depending on what sector the driver represented.

Controllable: Drivers originating from either application creation or the lean start-up canvas components could only be assigned a priority of one or two. Priority one was assigned to application creation originating drivers and lean start-up originating drivers a priority of 2.

3.9 Criteria for quality

3.9.1 Reliability and validity

There exists a parallel between the research instrument implemented and the idea of reliability (Rugg & Petre, 2007:226). Reliability can thus be interpreted as a descriptive instrument of a given research instrument. The dimensions among which reliability is measured include the following:

- Accuracy
- Precision

The research instrument's reliability works in a direct relation to the underlying dimensions. This means that a greater degree of accuracy and precision will result in increased reliability for a given research instrument. Measuring the application of these dimensions on a research instrument generally sources from the following parameters:

- How a research question is created
- How the interviewer states the research question (leading or passive)
- Experimental is set-up
- Interviewee state of mind
- Experimental environment
- Exposure of interviewer to interviewee subjects during questioning
- Interviewee answer consistency – regression effect

The concept of validity can now be introduced, as the ability of a given research instrument to record the measurement for what it was intended for (Kumar, 2005:153). The researcher thus has an incentive to increase the validity of the research instrument.

The drive for increased validity can be accomplished through the following portals:

- Data relevance: To the subject and suited for research questioning
- Research instrument reliability: Gaining insight and perspective from various sources.

3.9.2 Ethics

Any form of data collection or field research conducted needed to be performed in a manner that was consistent with ethical behaviour. Ethical behaviour includes the moral and responsible obligation of the researcher towards the study respondents (Kumar, 2005:241). The successful compliance of ethical behaviour by the researcher will see the research complete two requirements:

- The researcher to obtain a written consent from the university's school of engineering.
- The second requirement is performed on the study respondents. These include the following:
 - Informed consent from the study respondents.
 - Willingness to participant.
 - Anonymity of study respondents.
 - Confidentiality of information.
 - Honesty of information supplied.
 - Any form of risk exposure (counter party or direct).

By aligning with these principles it ensures ethical behaviour for all parties involved (directly and indirectly involved) in the research.

3.9.3 Informed consent and willingness of study respondents

All study respondents were contacted via phone to gain their consent for participation in this research. If the person could not be telephonically contacted, an e-mail was used as a portion of the study respondents were situated in other countries. Once the consent had been obtained, the next step was to supply the respondent with the questionnaire, which included the following in the introduction:

- The research question and relevant objectives.
- The research hypothesis.
- Interview / questionnaire completion procedure.
- In what context the raw research data was used for.
- Information gathered was to be kept confidential.

It was continuously communicated (to the study respondents) that the study was completely voluntary and that, should the study respondents feel that he / she wanted to withdraw from the study, that they could do so at any time (Kumar, 2005:244).

3.9.4 Protection against harm

The study was allowed to be performed under the assumption that no harm would come to any of the study respondents during the progression of the study (Kumar, 2005:245). This could only have been applied through mutual honesty and ethical behaviour of both the researcher and the study respondents. Failing to do so (from the latter) would result in disqualification from the study. It also included (from the researcher's perspective) the treatment of study respondents; fairly and equally. The study aim would have been made clear to the study respondents, from the first encounter (either by e-mail, telephonically or during the interview). This was done to reduce the risk of miscommunication and unwanted outcome thereof.

3.9.5 Confidentiality and anonymity

As stated before, confidentiality and anonymity were considered of high importance during the study (Kumar, 2005:246). To adhere to this rule and eliminate biasness, the research randomly assigned numbers to each study respondent that completed the questionnaire. This enabled the researchers to analyse a given data source (i.e. numbered study respondent) from an unbiased perspective. Any feedback provided back to the study respondent was also done via the above described system. Raw study data obtained in the form of questionnaires, interview notes or audio

recordings were discarded safely. Any study result (or raw data) was withheld from third parties (including other study respondents), unless approved by the study respondents.

3.10 Data collection

Raw data can be collected by various means. These may include interviews (audio recordings and notes), questionnaires, observations made by the researcher and existing documentation provided by the study respondents (Kumar, 2005:244). This research focused predominantly on questionnaires as medium of data collection, with supplemental follow-up interviews. The questionnaires were hosted on Google forms. The Google forms questionnaire was programmed by the NWU statistical consultation services. The survey was accessed via an internet link, which if clicked on, navigated to the survey (hosted online). The survey link was distributed to the study respondents via e-mail. Survey output was provided in the form of a raw data excel dump, which could then be used for data analysis by the researcher.

3.11 Conclusion

The research design and methodology chapter summarised the drivers identified and described the selection process thereof. The design philosophy and assumption sub-chapter coupled the research question and hypothesis from Chapter 1 to the drivers identified from Chapter 2. Research tools (questionnaire and follow-up interviews) were then designed and pilot tested to measure these drivers through the proxy of the research question, hypothesis and drivers. The researcher's suggested business model framework (research hypothesis) was used as baseline reference, from which the drivers could be measured. Chapter 3 was concluded with additional research considerations, for example study respondent selection, criteria for quality and data collection methods. The experimental results are presented in Chapter 4.

4. EXPERIMENTAL RESULTS

Chapter 4 starts off by ranking (as per rules defined in Chapter 3) the drivers, identified from the literature review. The second part of the chapter presents the qualitative and quantitative data gathered from the questionnaire and follow-up interviews. The response gathered from the questionnaire are discussed and presented according to the following topics:

- The sample size.
- A view of the demographic distribution of the study respondents.
- A view of the study respondents' opinion of the research question.
- The ranking of each feature relating to the research hypothesis.
- The ranking of each driver.
- In addition, a view of the study respondents provided drivers and the ranking thereof.

The chapter then continues by presenting the feedback gathered from the follow-up interviews.

4.1 Drivers prioritised

Drivers identified from the literature review were ranked by the researcher to group and organise the drivers according to the relative impact each driver had on MAD in SSA. The researcher ranked the drivers based on priority, controllability (as per rules defined in Chapter 3.8) and mapped each driver to a specific system component (as per Appendix G). The results are shown in the following table:

Table 8: Study drivers ranked

Driver	Priority	Controllability	System Component
(EF.1) African Market: The African application economy is different, compared to, for example the US. Mobile applications in SSA are developed only to service small population groups or as utility services to already existing service and products. Mobile applications in SSA are not developed as standalone service or products.	3	Uncontrollable	External Factors

(EF.2) Mobile Device Technology: Smartphone (as a platform for mobile applications) adoption rate will only justify business viability once smartphones penetrate the majority of the SSA market space.	4	Uncontrollable	External Factors
(EF.3) Mobile Network Coverage: Network coverage required for mobile connectivity.	4	Uncontrollable	External Factors
(EF.4) Cost of Mobile Device Ownership: The total cost of mobile ownership (i.e. device purchase, mobile operator costs and powering the device).	4	Uncontrollable	External Factors
(EF.5) Electricity Requirements: Electricity as requirement for mobile device operation.	5	Uncontrollable	External Factors
(EF.6) User Technology Literacy: Digital literacy of the African population.	5	Uncontrollable	External Factors
(EF.7) Governing Tax Policies: Taxes imposed on mobile network operators.	5	Uncontrollable	External Factors
(EF.8) Feature phones (non-smartphone) applications (for example: m-pesa or mxit) as alternative to smartphone based applications.	3	Uncontrollable	External Factors
(EF.9) Platformisation: Mobile portal provisioning, platform operation, service provision and service aggregation split (decentralised) across multiple contributing entities as opposed to a given mobile network operator (for example MTN), owning and controlling all the mentioned services from one centralised point.	4	Uncontrollable	External Factors

(ACP.1) Content Localisation: Content provided to user in local language.	1	Controllable	Application Creation Project
(LSU.1) Capital Requirements: Source of capital or investments.	2	Controllable	Lean Start-Up Key Metric Canvas
(LSU.2) Time to Market: The amount of time spent to develop mobile application and deploy to the market (Build, Measure and Learn Cycle).	2	Controllable	Application Creation Project and Lean Start-Up Key Metric Canvas
(EF.10) Market Fragmentation: The African market space contains a diverse range of cultures, demographic groups and income segments.	3	Uncontrollable	External Factors
(ACP.2) Developers Skills: Programming and designing mobile applications.	1	Controllable	Application Creation Project
(LSU.3) Entrepreneurial Skills: Level of business knowledge for mobile application entrepreneurs.	2	Controllable	Lean Start-Up Key Metric Canvas

4.2 Sample size

From Chapter 3.5, purposive random sampling was used to identify the respondents for this study. The study used technology hubs and IT interfacing companies as the source of the respondents. The questionnaire was sent to the following entities:

- Five innovation hubs were contacted to be part of the research.
- 21 companies that interact with the IT sector were contacted to be part of the research.

Table 9 below represents the total number of distributed and received questionnaires:

Table 9: Response of questionnaire

Questionnaire Distributed / Received	Count of Questionnaire Received	Percentage of Questionnaire Received
Distributed	34	32.2%
Received	11	-

One person per source (innovation hub or IT consulting company) was contacted and invited to take part in the research. In addition, the primary contact was requested to forward the questionnaire on to staff members that qualified to be part of the research as outlined by Chapter 3.5. The questionnaire was available for completion over a period of eight weeks, whereafter the submissions portal (i.e. Google forms) of the questionnaire was closed. Reminder e-mails were sent to the study respondents if no feedback was received after four weeks. A total of 34 questionnaires were distributed to innovation hubs and IT consulting companies. A total of 11 questionnaires were received, representing a response rate of 32.2%.

Questionnaire response

Section one and two of the questionnaire provided the respondent with an introduction to the researcher and the research. Following the introduction, the questionnaire required the respondent to indicate whether he / she would be willing to take part in the research. In addition to only taking part in the research, the respondents could also select to take part in the experiment, but be kept anonymous. The respondents also had the option not to take part in the research. If the respondents indicated that they did not want to take part in the research, they were requested to provide a reason.

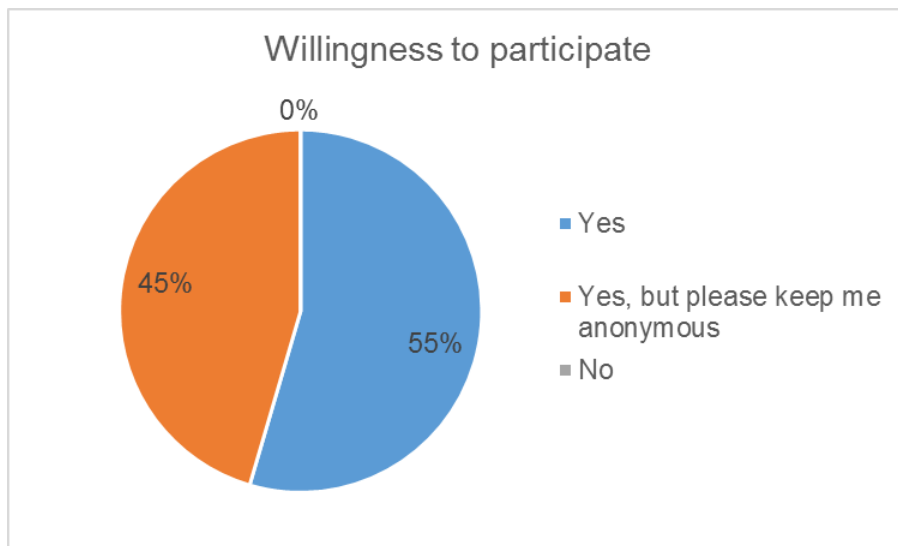


Figure 20: Willingness to participate

Seven respondents, representing 55% of the respondent base indicated that they would take part in the research and four respondents indicated that they would take part, but asked to be kept anonymous. It can be seen from Figure 21 that no study respondents indicated that they would not be taking part in the questionnaire, although the response rate for the questionnaire was 32.2%. The researcher assumed that individuals, who were not willing to participate in the research, did not access the questionnaire and indicated it in such a way.

4.3 Demographic information of study respondents

Section three of the questionnaire collected the demographic information of the study respondents. The demographic information collected from the study respondents included gender, nationality, sectors represented, experience in IT related projects, occupation and qualifications.

Gender of respondents

Figure 22 below represents the gender proportions of the completed questionnaire. A total of ten, representing 91% of the respondents were male, with only 1 female respondent (representing 9% of the respondents). The male respondents outnumbered the female respondents 10:1.

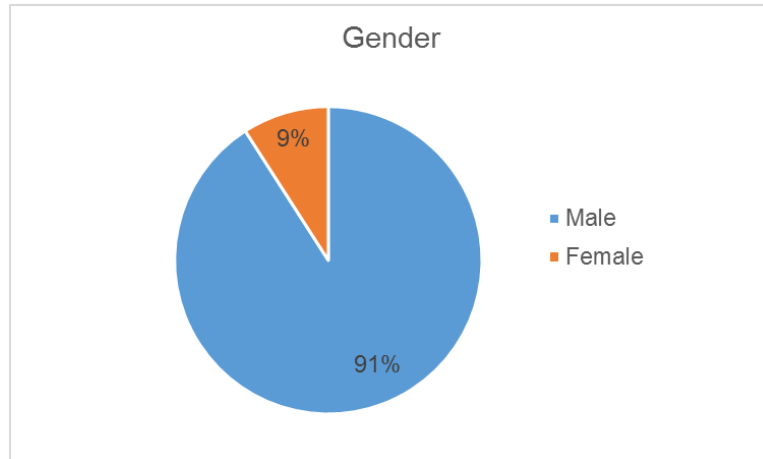


Figure 21: Study respondents' gender proportions

Nationality of respondents

From Chapter 3.7, a questionnaire was used in this research in an attempt to “cast the response net” of the research over a larger audience and given that the research seeks to identify the drivers of MAD in SSA, it was important to incorporate the perspectives of respondents representative of a number of SSA countries into the experiment. Figure 23 indicates that 18% (2 respondents) of the study respondents were not South African, with the balance – 82% (9 respondents), being South African respondents.

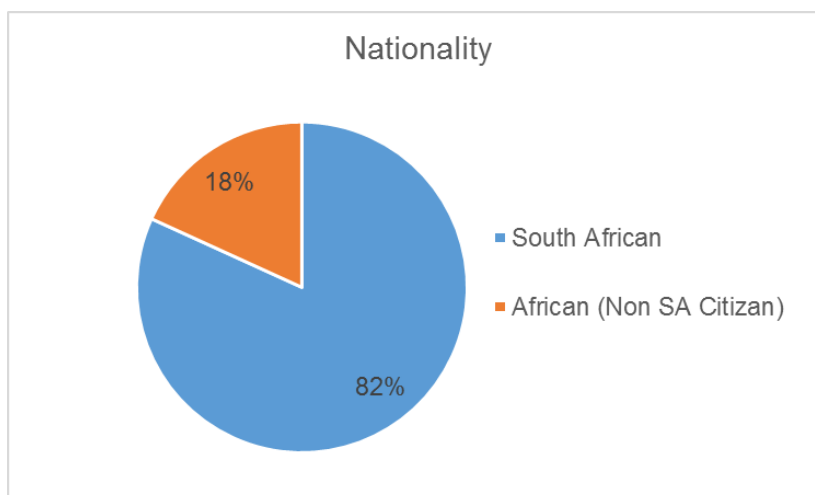


Figure 22: Study respondents' nationality

Experience of study respondents

Figure 24 represents the respondents' experience in IT related projects. Given the extensive list of requirements required for qualifying to be a study respondent (outlined in Chapter 3.5) and the diverse set of LSU features (ranging from technical and business features) tested in the questionnaire, the researcher collected study respondents' IT related project experience (as general IT related experience), rather than basing the respondents' experience on only one of the study requirement- or LSU feature.

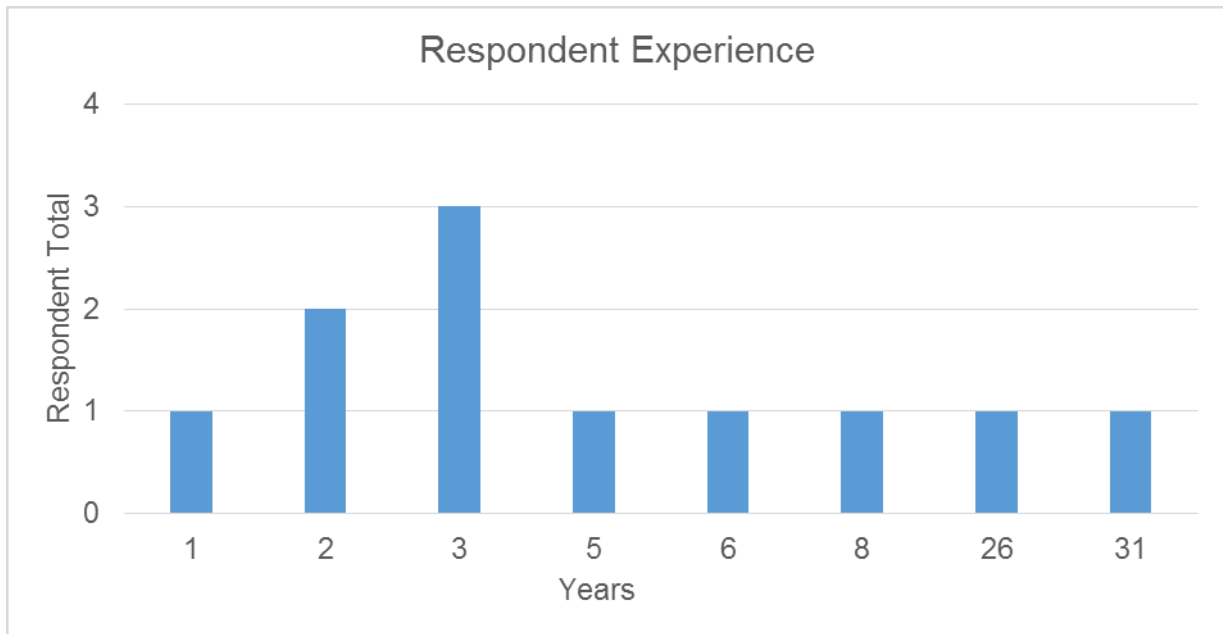


Figure 23: Study respondents' experience

Seven (63%) of the respondents had IT related project experience of five or less years. Two respondents (18%) had between five and ten years of experience in IT related projects and two respondents (18%) had over 20 years of experience.

Occupations represented

Figure 25 provides a view of the various occupations each of the respondents held. A diverse mix of occupations (within the IT sector), were represented in the study. The majority (7, representing 64% of the respondents) of respondents described themselves as developers.

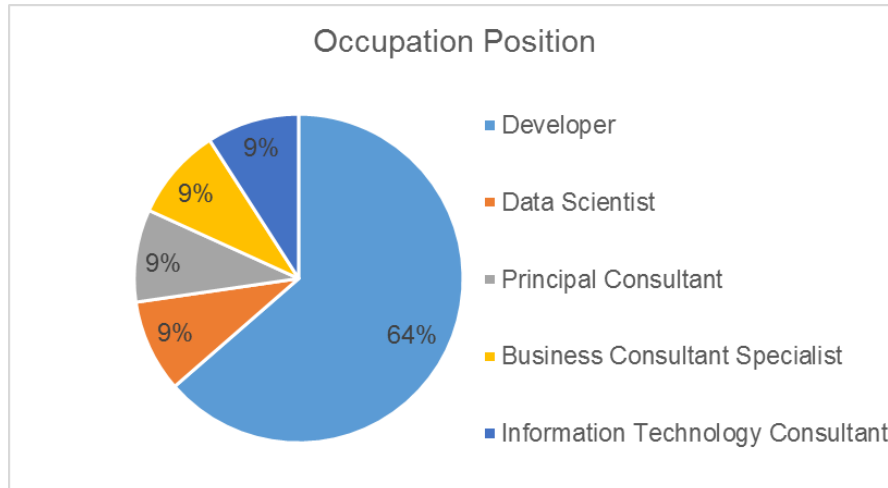


Figure 24: Study respondents' occupation

Qualification represented in the experiment

The qualifications (per respondent) are presented in Figure 26. From the figure it can be seen that 46% (5 respondents) of the study respondents hold a post graduate degree, with 36% (4 respondents) that hold a degree. This means that 82% (9 respondents) of the study respondents received higher education. The remaining 18% (2 respondents) had a diploma or Grade 12.

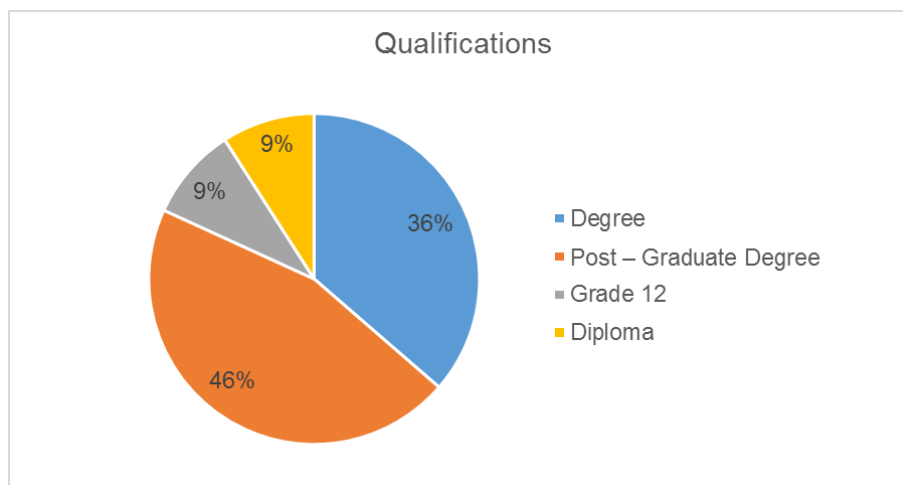


Figure 25: Study respondents' qualification

4.4 Research question response

Table 10 represents the respondent's opinion of the research question. The questionnaire required the respondents to rank pre-defined statements (identified from the literature review) according to the relation each statement had to MAD in SSA. The rating scale had five degrees. Table 10 shows the ranked response to each statement as a percentage proportion of the respondent base.

Table 10: Respondent response - research question

	Relation Scale: 1 - No Relation 5 - Totally Relatable				
	Percentage of Respondents				
	1: Relation Weight	2: Relation Weight	3: Relation Weight	4: Relation Weight	5: Relation Weight
Basic mobile phone requirements: for example the infrastructure that supplies electricity or network signal needs to improve, before Africa can truly operate in the digital realm.	0%	9.1%	18.2%	18.2%	54.5%
Technical skills development: programming and designing mobile applications.	0%	0%	27.3%	45.5%	27.3%
Business acumen development: that will enable an entrepreneur to scale and develop a mobile application to a sustainable business.	0%	0%	45.5%	36.4%	18.2%
Venture capital: funding that will enable emerging businesses to scale and	0%	0%	45.5%	36.4%	18.2%

develop into a self-sustaining business.					
Business model: rather than using revenue predicting business plan, use a business model that assumes nothing and self-adjusts into the SSA market space.	0%	18.2%	36.4%	18.2%	27.3%
Knowledge of the SSA market challenges, dynamics and needs.	0%	9.1%	9.1%	36.4%	45.5%

Figure 27 weighs (refer to Appendix K for calculation detail) each of the statements in reference to one another. It can be seen that the “Basic mobile phone requirements” and the “Knowledge of the SSA market” statements ranked among the most relatable to MAD in SSA.

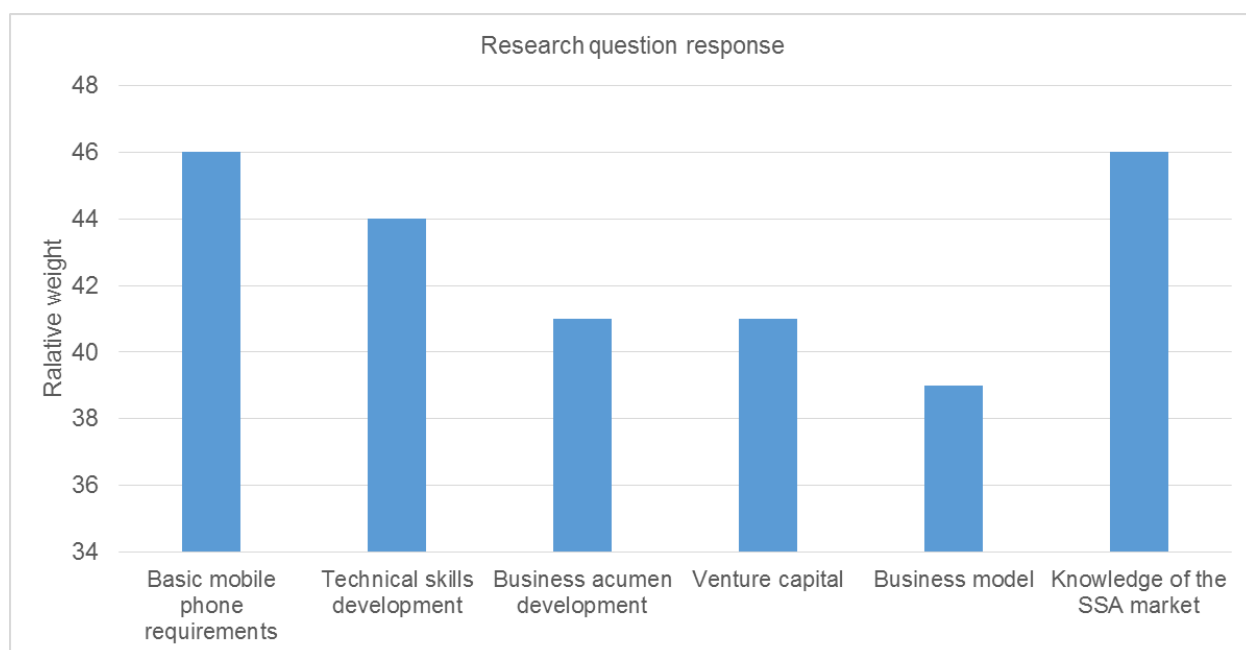


Figure 26: Research question response

4.5 Research hypothesis response

Table 11 represents the respondents' opinion of the research hypothesis. The questionnaire required the respondents to rank the LSU features according to the relevance each statement had to MAD in SSA. The rating scale had five degrees. Table 11 shows the ranked response to each LSU feature as a percentage proportion of the respondent base.

Table 11: Respondent response - research hypothesis

	Relevance Scale: 1 - No Relevance 5 – Significant Relevance				
	Percentage of Respondents				
	1: Relevance Weight	2: Relevance Weight	3: Relevance Weight	4: Relevance Weight	5: Relevance Weight
(1) Strategy					
Business Model Driven	0%	0%	54.5%	27.3%	18.2%
Hypothesis Driven	0%	18.2%	36.4%	45.5%	0%
Customer Development	0%	0%	18.2%	36.4%	45.5%
Direct Test in Market	0%	0%	0%	54.5%	45.5%
(2) Engineering					
Agile Development	0%	0%	18.2%	54.5%	27.3%
Build product interactively and incrementally	9.1%	0%	18.2%	54.5%	27.3%
(3) Organisation					

Agile development teams	0%	0%	0%	45.5%	54.5%
Hiring based in learning flexibility and speed	0%	9.1%	27.3%	54.5%	9.1%
(4) Financial Reporting					
Customer acquisition cost, lifetime customer value, churn or application popularity.	0%	0%	30%	40%	30%
(5) Failure					
Expected	0%	9.1%	36.4%	27.3%	27.3%
Multiple iterations of ideas (and accompanying failures) and pivoting away from the ideas that do not work	0%	0%	0%	60%	0%
(6) Speed					
Rapid	0%	9.1%	27.3%	18.2%	45.5%
Operates on medium quality data	0%	27.3%	45.5%	18.2%	9.1%

Figure 28 weighs (refer to Appendix K for calculation detail) each of the LSU in reference to one another. It can be seen that the “Agile Development Teams”, “Direct Test in Market” and “Customer Development” represented the LSU that were most relevant to MAD in SSA. The “Hypothesis Driven” and the “Medium Quality Data” LSU had the lowest relevance.

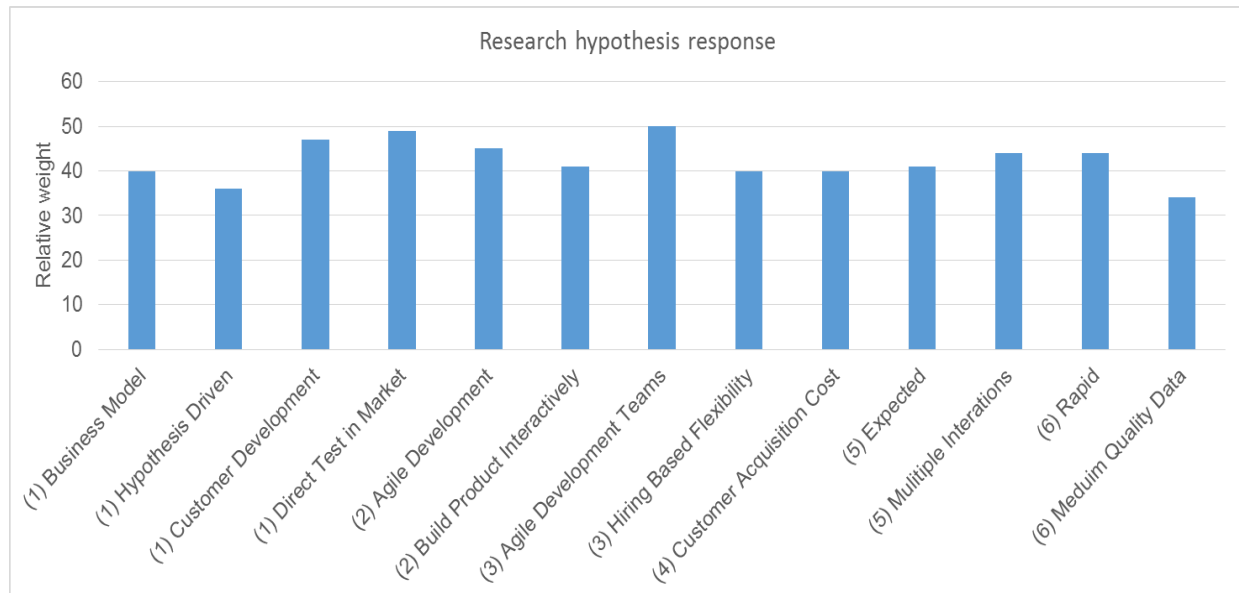


Figure 27: Research hypothesis response

4.6 Research drivers response

Table 12 represents the drivers ranked as per respondents. The questionnaire required the respondents to rank the drivers according to the priority each driver occupied on MAD in SSA. The rating scale had five degrees. In addition, the questionnaire required the respondents to rank the controllability of each driver. The controllability scale had two dimensions: controllable and uncontrollable. Table 12 shows the ranked response (priority and controllability) to each driver as a percentage proportion of the respondent base.

Table 12: Drivers ranked

Drivers	Priority Scale: 1 – Lowest Priority 5 – Highest Priority				
	Percentage of Respondents				
	1: Priority Weight	2: Priority Weight	3: Priority Weight	4: Priority Weight	5: Priority Weight
1.) African market: The African application economy is different, compared to, for example the US. Mobile applications in SSA are developed only to service small population groups or as utility services to already existing services and products. Mobile applications in SSA are not developed as standalone service or products.	0%	20%	30%	50%	0%
	Controllable: 60%				
	Uncontrollable: 40%				
2.) Mobile device technology: Smartphone (as a platform for mobile applications) adoption rate will only justify business viability once smartphones penetrate the majority of the SSA market space.	0%	9.1%	36.4%	27.3%	27.3%
	Controllable: 18.2%				
	Uncontrollable: 81.8%				
3.) Mobile network coverage: Network coverage required for mobile connectivity.	0%	9.1%	18.2%	18.2%	54.5%
	Controllable: 63.6%				
	Uncontrollable: 36.4%				

4.) Cost of mobile device ownership: The total cost of mobile ownership (i.e. device purchase, mobile operator costs and powering the device).	0%	0%	9.1%	63.6%	27.3%
	Controllable: 45.5% Uncontrollable: 54.5%				
5.) Electricity requirements: Electricity as requirement for mobile device operation.	9.1%	18.2%	9.1%	45.5%	18.2%
	Controllable: 45.5% Uncontrollable: 54.5%				
6.) User technology literacy: Digital literacy of the African population.	0%	18.2%	0	45.5%	36.4%
	Controllable: 63.6% Uncontrollable: 36.4%				
7.) Governing tax policies: Taxes imposed on mobile network operators.	18.2%	18.2%	45.5%	18.2%	0%
	Controllable: 27.3% Uncontrollable: 72.7%				
8.) Feature phones (non-smartphone) applications (for example: m-pesa or mxit) as alternative to smartphone based applications.	18.2%	18.2%	18.2%	27.3%	18.2%
	Controllable: 90.1% Uncontrollable: 9.1%				
9.) Platformitisation: Mobile portal provisioning, platform operation, service provision and service aggregation split (decentralised) across multiple contributing entities as opposed to a given mobile network operator (for example MTN), owning and controlling all the mentioned services from one centralised point.	0%	27.3%	18.2%	45.5%	9.1%
	Controllable: 81.8% Uncontrollable: 18.2%				
10.) Content localisation: Content provided to the user in a local language.	9.1%	18.2%	18.2%	27.3%	27.3%
	Controllable: 81.8% Uncontrollable: 18.2%				

11.) Capital requirements: Source of capital or investments.	0%	18.2%	18.2%	45.5%	18.2%
	Controllable: 90.9% Uncontrollable: 9.1%				
12.) Time to market: The amount of time spent to develop mobile applications and deploy it to the market (build, measure and learn cycle).	0%	0%	36.4%	18.2%	45.5%
	Controllable: 81.8% Uncontrollable: 18.2%				
13.) Market fragmentation: The African market space contains a diverse range of cultures, demographic groups and income segments.	0%	9.1%	36.4%	45.5%	9.1%
	Controllable: 45.5% Uncontrollable: 54.5%				
14.) Developer skills: Programming and designing mobile applications.	0%	9.1%	27.3%	9.1%	54.5%
	Controllable: 100% Uncontrollable: 0%				
15.) Entrepreneurial skills: Level of business knowledge for mobile application entrepreneurs.	0%	9.1%	36.4%	36.4%	18.2%
	Controllable: 81.8% Uncontrollable: 18.2%				

Figure 29 weighs (refer to Appendix K for calculation detail) each of the research drivers in reference to one another. It can be seen that the “Mobile network coverage (63% controllable)”, “Cost of mobile device ownership (45% controllable)” and “Developer skills (100% controllable)” represented the study drivers with the highest priority to MAD in SSA. The “Governing tax policies” driver had the lowest priority (27% controllable).

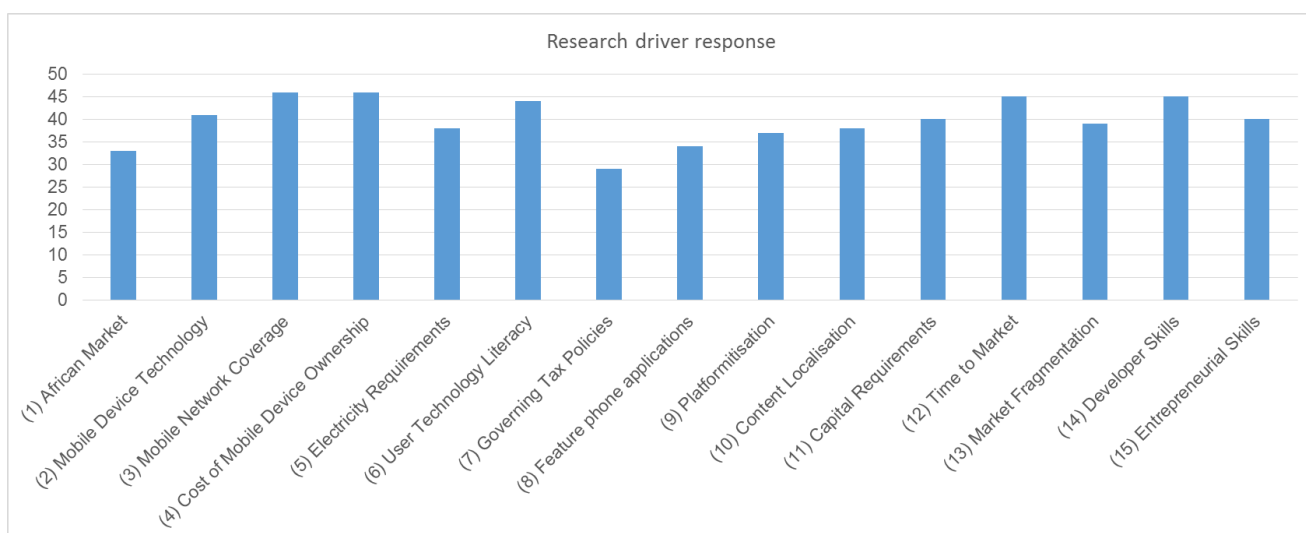


Figure 28: Research driver response

4.7 Study respondents supplied drivers

In addition to ranking the pre-identified drivers, the questionnaire respondents completed also requested to supply and rank (according to priority) their own drivers of MAD in SSA. The following table lists the respondent identified drivers. All of the drivers were ranked with a high priority (i.e. at least a priority of 4).

Table 13: Study respondent supplied drivers

Driver Description	Priority : 1-No Priority to 5-Highest Priority	Controllable or Incontrollable
Developing secure applications	5	Controllable
Simplicity of use	4	Controllable
Technology trust - due to low technology understanding, users might not feel comfortable to use apps especially when money is concerned	5	Uncontrollable

Getting critical mass - for most applications such as payment apps, a critical mass is required for the app to work, such as vendors adding the payment option or customers willing to pay for the app	5	Uncontrollable
E-learning	4	Controllable
Exposure at primary and secondary school levels	4	Controllable
Integrate applications with activities that every person needs to perform e.g. POS applications at supermarkets where consumers can pay for groceries	4	Controllable

4.8 Follow-up interview response

The follow-up interviews formed part of the qualitative part of the experiment. Only a subset of the drivers was selected for these interviews (outlined in Chapter 3.7.2) and is listed in the following bullet points:

- Capital requirements: Source of capital investments.
- Developer skills: Programming and designing mobile applications.
- User technology literacy: Digital literacy of the SSA population.
- Governing tax policies: Taxes imposed on mobile network operators.

The questions posted to the follow-up interview respondents are given in the following bullet points:

1. Does the SSA market space have the necessary technical skills to develop a mobile application that could sustain a business as the primary source of revenue?
2. Does the SSA market space have the same sources of capital investment than for example the US? If not, is it reasonable to assume that a business model for the SSA market space should be able to operate with reduced pools of input investment capital?

3. With low levels of literacy in the large part of SSA, will users be able to interact with a mobile application?
4. Mobile applications are hosted on smartphones; these smartphones communicate with the internet (on behalf of the application) through data exchange. Telecommunication companies provide bandwidth for wireless data transfer and subsequently set the price for these services. Do SSA governments impose excessive tax on telecommunication companies?

A total of three respondents were contacted for follow-up interviews. The follow-up interviews included individuals representative of an innovation hub and specialists in regulatory and compliance advice for the electronic communication industry. The respondents are listed in the following bullet points:

- Mr Adrian Schofield: Manager, Applied Research Unit, Johannesburg Centre for Software Engineering - Wits University Tshimologong: Digital Innovation Precinct Johannesburg.
- Mr Dominic Cull: Ellipsis Regulatory Solutions, Internet Service Provider Association – Cape Town.
- Mr Anton Kotze: Director, Ellipsis Regulatory Solutions, Internet Service Provider Association – Johannesburg.

The discussion of each driver is given in the following points. Please note that the following is a summary of the discussion and that the author took extra care in conveying the context and facts of the respondents' response.

Developer skills: Programming and designing mobile applications.

The question posed to the respondent: "Does the SSA market space have the necessary technical skills to develop a mobile application that could sustain a business as the primary source of revenue?"

Mr Schofield's response:

"Yes, SSA does have the technical skills, but these skills are not as broadly based as it should be. The challenge with this is that individuals that do have the necessary skills are in very high demand. This reduces the time that these developers have to their disposal for working on their own entrepreneurial based projects. In addition, it is a lot less risky to do work for a constant source of income, than trying to make a business out of your own idea."

Mr Cull's response:

"Absolutely, it comes down to what sets SSA apart. The SSA mobile application market space has different requirements than that of the US for example. SSA is an emerging and growing market. Given this, it places SSA based developers in a unique position; to develop mobile applications that work in the SSA market space. This incentivises individuals to become SSA based mobile application developers, in turn driving progress for the developer's skill level in SSA."

Mr Kotze's response:

Not across all of SSA, but definitely concentrated in certain countries for example Kenya (Eastern Africa), Nigeria (Western Africa) and South Africa (Southern Africa). Another perspective to take into account is what drives the skills development in SSA. MAD in SSA can also be outsourced to India, wherein the software can be developed based on crowd sourcing (i.e. parts of the software development process are handed to different teams for development). This significantly reduces the price of development, decreasing incentives for businesses to develop the required skills locally. However this does not mean that SSA does not drive skills development. MTN for example hosts a yearly mobile application awards event, offering prizes to mobile application developers.

Capital requirements: Source of capital or investments

The question posed to the respondent: "Does the SSA market space have the same sources of capital investment than for example the US? If not, is it reasonable to assume that a business model for the SSA market space should be able to operate with reduced pools of input investment capital?"

Mr Schofield's response:

"The venture capital culture in the US comes from a couple of 100 years of being traders and willing to invest in a capitalist driven economy. SSA comes from being exploited rather being the exploiters. SSA does not have indigenes pools of capital that can be used for investment with the goal of gaining a return. There does exist some examples in SSA of individuals that have created enormous wealth for themselves, but unlike the states, this capital is not used to invest in the next generation of entrepreneurs."

"Another perspective to take into account is what has worked in SSA thus far. SME businesses in SSA are supported by families and communities working together, which supports the business

of being in business. This translates into lower capital requirements. These support structures are key to small businesses in SSA. “

Mr Cull’s response:

“No, we do not have the same levels of source capital available, compared to the US. It is important to note that SSA makes use of bottom-up development, as opposed to top down development, used in the US. In SSA, business cases are built and tested on a much smaller localised level. SSA’s strengths lie in growing solutions through communities (the solution should also serve those communities). Given this, there are a lot of potential for lean bottom-up development in SSA. ”

Mr Kotze’s response:

“SSA does have capital investment companies, but most investments flow to the ICT infrastructure, rather than application development (as a value added component of the internet). Capital investment is definitely more scarce in SSA than in for example the states. Investors in SSA want to see a working business before they will invest in a business (i.e. mobile application users) and not a concept.”

User Technology Literacy: Digital literacy of the SSA population

The question posed to the respondent: “With low levels of literacy in the large part of SSA, will users be able to interact with a mobile application?”

Mr Schofield’s response:

“No, the required literacy levels are currently not at a point that would enable users to interact with most mobile applications. That however, does not mean that the illiterate SSA population could not be educated to use mobile applications. It’s a case of chicken or egg. Accepting the theory that better access to information through technology results in a better growth rate for economies; then educational systems need to implement familiarity with technology at the earliest possible age. SSA governments have a responsibility to spread access to this basic education as widely as possible.”

Mr Cull’s response:

“Absolutely, mobile applications are very intuitive, but this does not mean that digital literacy development should not be a high priority in SSA.” Mr Kotze’s response:

“Smartphone’s proliferation levels are low in rural areas of Africa (10 to 12% of South Africa). Feature phones (that do not support mobile applications) are still relied on for the majority of telephone-based communication in SSA. Given the low rate of smartphone penetration in SSA, one can assume that there isn’t any interaction with mobile applications in most of the SSA countries. This however, does not mean that the digital literacy, required for the operation of mobile applications on smartphones, is not there. Currently (Mr Kotze made an assumption), mobile application related digital literacy is close to non-existing in rural areas.”

Governmental taxation on telecommunication companies

The question posed to the respondent: “Mobile applications are hosted on smartphones; these smartphones communicate with the internet (on behalf of the application) through data exchange. Telecommunication companies provide bandwidth for wireless data transfer and subsequently set the price for these services. Do SSA governments impose excessive tax on telecommunication companies?”

Mr Schofield’s response:

“SSA governments find it too easy to rake in the sales of spectrum and tax on revenues and tax on hardware etc., rather than thinking longer term, about the beneficial effects of keeping it as affordable (lowering the entry barrier to telecommunication in SSA) as possible for the end user. From a different perspective, telecommunication companies have succeeded in putting communication technology into the hands of millions of individuals. The challenges are in finding the correct balance between sales (advantage to the telecommunication company) and network coverage in the most rural areas of SSA (advantage to the end user). Going forward, governments and telecommunication companies should rather focus on working together with an eye on future sustainability.”

Mr Cull’s response:

“There definitely exists a failure in regulation, but telecommunication companies are not taxed any more than other corporate entities. The cost of taxation is cast onto the end user. One should also consider that taxes or levies are imposed by governments on these entities to avoid modern day capitalism. Another dimension to consider is what the telecommunication companies have done to enable individuals to communicate by telephone. The telecommunication companies are responsible for rolling out telecommunication infrastructure to the most rural parts of SSA.”

Mr Kotze's response:

"Taxes imposed on telecommunication companies in SSA are not taxed any more than other corporate entities. The largest "government paid cost", comes from spectrum (which is not a tax, but rather classified as a frequency fee. An asset rented from the government). Referring to the administrative incentive pricing (AIP) model philosophy: "Spectrum belongs to the government and should be used to the benefit of the public. It is not an asset to acquire to hoard and use for your own profit seeking. It is not there to be monopolised" (DTPS, 2016:81). Spectrum fees are kept expensive to prevent telecommunication companies from buying unused spectrum and manipulate the market. So by keeping the spectrum fees high it forces telecommunication companies to use the allocated spectrum as efficiently as possible. This efficient usage of spectrum benefits the end user by reducing the underlying cost. So the ultimate cost of spectrum is used by the government to reduce the cost of cell phone network services."

4.9 Conclusion

From the results presented in Chapter 4, it can be seen that all of the experiment related objectives (outlined in Chapter 1) for this research were achieved. The drivers identified in the literature review and identified from the study respondents were ranked. The research question and hypothesis were also evaluated by the study respondents. The chapter was concluded with a view of the follow-up interview responses.

The following points summarise the results of the study drivers and / or LSU features evaluated during the experiment:

- Research question highest ranked response: Basic mobile phone requirements and knowledge of the SSA market.
- Research hypothesis highest ranked response: Agile development teams and direct test in the market.
- Highest ranked drivers (literature review identified and respondents provided): Cost of mobile device ownership, mobile network coverage, developer skills, critical mass requirements, technology trust and development of secure applications.

In addition, from the follow-up interviews the following points summarise the feedback received from the interview (Please note that this summary reflects the opinion of most of the respondents):

- Programming and designing mobile applications: Yes, SSA does have the necessary technical skills to develop mobile applications, but these skills are localised to specific regions and come at a price.

- Capital requirements: Source of capital or investments: No, SSA does not have the same sources of capital compared to for example the US, but SSA have always relied on a different (much less upfront capital requirement) business model that does not source capital from capital investment companies.
- User technology literacy: Digital literacy of the SSA population: Not conclusive. It depends on the area: rural or urban. Digital literacy is at a higher level in urban areas, compared to rural areas. The rural areas do not have the necessary digital literacy to operate mobile applications, mainly due to the fact that these areas have not been exposed to mobile applications before. This however does not mean that rural areas cannot be educated to use mobile applications.
- Governmental taxation on telecommunication companies: Telecommunication companies are not taxed any more than other companies in SSA. The largest government regulated expense (for a telecommunication company) comes in the form of spectrum. The official philosophy for the use of spectrum is that it should be used to benefit the end user. This, however, does not mean that governments in SSA do not enjoy the high spectrum fees, imposed on telecommunication companies. Telecommunication companies have contributed value to the SSA development, by rolling out network coverage to rural areas of SSA.

By enriching the data, summarising and presenting the findings, the research process was completed. The following step in the research was to discuss the findings by concluding and recommending in Chapter 5, based on the insight gained from the literature review and experiment.

5. Conclusions and Recommendations

This chapter starts off by interpreting the feedback obtained from each of the experimental tools. This includes the feedback received from the questionnaire and follow-up interview regarding the research question, driver and hypothesis. The chapter also summarises and discusses the completion of the research objectives and hypothesis (as first described in Chapter 1). The chapter is then concluded by providing recommendations based on the learnings gained from the research.

5.1 Experimentation feedback discussion

5.1.1 Research question response discussion

From Chapter 4, of the six research question options posed to the respondents, the highest ranked options were ranked equally. These included basic mobile phone requirements and knowledge of the SSA market space (based on the weighted total of the respondent base). The following section describes these two points.

5.1.1.1 Basic mobile phone requirements

According to the mobile application hierarchy of requirements described in Chapter 2, a mobile application is hosted on smartphone devices, which in turn requires basic mobile phone requirements. These requirements might include access to electricity and mobile network coverage (Flora, 2014). This means that a mobile application has a high dependency on basic mobile phone requirements, as basic mobile phone requirements occupy the most fundamental level of the hierarchy of mobile application requirements. The impact of this could be seen from the experimental research question response, wherein 91% of the respondents rated the relation of the basic mobile requirements (as a requirement for MAD in SSA) between 3 and 5. A total of 6 respondents rated this option – “totally relatable” (i.e. a value of 5).

5.1.1.2 Knowledge of the SSA market space

The experimental data showed that 91% of respondents rated the relation of the knowledge of the SSA market space between 3 and 5. A total of 5 (representing 45.5% of the respondent base) respondents rated this option – “totally relatable” (i.e. a value of 5). From Chapter 2, it was seen that by 2016, 62.8% of SSA population was still classified as rural (World Bank, 2014), and that people from SSA have specific requirements in terms of mobile applications and mobile devices. This required a different approach to product development which was confirmed and built on from the follow-up interviews. Mr Cull stated (during the follow-up interviews) that “SSA makes use of bottom-up development, as opposed to top-down development, used in the US.” Bottom-up or

grass roots development relies on a project being developed from information gained from a deployment or ground level (Banks, 2015).

5.1.2 Driver response

The following section explores the developer skills, capital requirements and governmental taxation on telecommunication companies' drivers. These three drivers are discussed by considering the insights drawn from the data collected by experimentation and then supplemented with comments from the follow-up interviews.

5.1.2.1 Developer skills

The majority of the respondent base (representing 91% or 10) ranked the priority of developer skills between 3 and 5. The entire respondent base was of the opinion that development skills in SSA are in the domain of control for mobile application businesses. The high priority of these drivers could be contributed to the high demand for software developers in Africa (Owusu R, 2014). The high demand for software developers was verified in the follow-up interviews. All of the follow-up interviewees agreed that SSA does have the necessary technical skills to do mobile application development. From these interviews it was clear that hiring these individuals would come at a price, given the demand for these skills.

5.1.2.2 Capital requirements

The majority of the respondent base (representing 81.8% or 9) ranked the priority of capital requirements between 3 and 5. In terms of controllability, 91% of the respondent base said that capital requirements are controllable. The high ranking of this driver made sense, given the scariness of venture capital in SSA. As was discussed in Chapter 2, in 2016, venture capital and angel investment still only accounted for 12% of investments available to start-up businesses in SSA. This meant that business founders were still mostly dependent on their own capital, bootstrapping or grants (Kazeem, 2016). The lack of traditional capital investment in SSA and alternative sources of capital were confirmed in the follow-up interviews.

All of the follow-up interviewees stated that SSA does not have the same level of investment capital compared to for example the US. This does not mean that entrepreneurs will not have investment capital available for their businesses. As Mr Schofield said: "you have to relate the capital requirements argument back to what works and what does not work in SSA. SSA relies on small communities supporting the business of being in business with one another. This requires much less upfront investment capital." In addition, innovation hubs have in recent years emerged in SSA. According to a report released by the World Bank, SSA had a total of 117 technology hubs by 2016 (Kelly *et al.*, 2016). Although innovation hubs do not offer investment

capital, it does connect entrepreneurs with potential investors. This means whether community involvement (lowering upfront capital requirement) or innovation hubs (facilitating communication between entrepreneur and investors), SSA entrepreneurs do have options available for funding their businesses.

5.1.2.3 Governmental taxation on telecommunication companies

The majority of the research respondents ranked the priority of government imposed taxes on telecommunication companies low (81.9%, representing 9 of the respondents). In terms of controllability, 72.7% of the respondent base said that the taxes imposed on these companies are uncontrollable. The experimental results were contradictory of what was seen in the literature review. Fees paid by telecommunication companies to governments were high, but the difference came in the form of non-tax related fees paid to governments. This experimental response was verified during the follow-up interviews.

Response from the interviewees indicated that telecommunication companies are not taxed any more than companies represented from other economic sectors. The follow-up interview responses were motivated from a telecommunication company and governmental perspective. According to Mr Schofield governments find it too easy to profit from the sales of spectrum, but at the same time, higher spectrum costs benefit the end user, as it forces telecommunication companies to utilise its allocated spectrum as efficiently as possible. This in turn drives down associated service prices. Mr Cull noted that telecommunication companies (in SSA) are revenue motivated, driving the cost of service delivery beyond affordability for most individuals in SSA. Mr Cull continued by noting that these higher costs are due to failure in regulation. From another perspective, there was a consensus among the interviewees that telecommunication companies have worked hard to connect the rural areas of SSA to a mobile network. The conclusion from the follow-up interviews was that governments and telecommunication companies should work together towards driving down the cost of mobile service delivery for people. This will (from the follow-up interviews) increase affordability of mobile devices and services, which increases the market for potential mobile application users.

5.1.3 Study driver response discussion

The experiment allowed for research respondents to provide and rank their own drivers. The ranked study respondent drivers were developing secure mobile application and building technology trust. The following section discusses this study respondent provided driver.

5.1.3.1 Developing secure mobile applications and technology trust

Mr Schofield and Mr Kotze both stated that digital literacy (in rural areas of SSA) is not currently at a level that would enable individuals to interact with mobile applications. The researcher refers to the rural areas (as opposed to urban areas), given that the majority of the SSA population is classified as rural (World Bank, 2014) and therefore represents the larger part of the MAD market. Both Mr Schofield and Mr Kotze continued by stating that, although the digital literacy levels in 2016 were not at the required level for mobile application utilisation, it did not however mean that individuals could not be educated to use the mobile applications platform. In addition, Mr Schofield and Mr Kotze expanded their digital literacy arguments by stating that individuals should be exposed to digital literacy at the earliest possible age, by integrating it with an education system. This would drive adoption rates of technology in communities. Taking Mr Schofield and Mr Kotze's feedback into account, one can easily see that, for mobile applications to become an everyday part of life for individuals in rural areas of SSA, a relationship between individual and technology needs to be built up. This relationship can only be sustainable if the underlying technology instils trust in the user. Technology trust is built on developing secure applications.

5.1.4 Research hypothesis response discussion

As discussed in Chapter 2, the LSU business model framework features can be broken down into the following groups: strategy, engineering, organisation, financial reporting, failure and speed (Ries, 2011). The highest experimental respondent ranked group, by relevance (based on the weighted total of the respondent base), was the organisational group. The organisational group consists of the agile development teams and hiring based on flexibility LSU features (Ries, 2011). This group also represented the highest ranked LSU feature, namely agile development teams. The following two sections describe the two highest ranked LSU features with supplementing comments from the follow-up interviews.

5.1.4.1 Direct test in market

The experimental data showed that all of the 11 respondents rated the relevance of the direct test in the SSA market space between 4 and 5. A total of 5 (representing 45.5% of the respondent base) respondents rated this option – “significantly relatable” (i.e. a value of 5). The importance of direct test in market was confirmed during the follow-up interviews, wherein Mr Cull stated that “SSA is an emerging and growing market. Given this, it places SSA based developers and business researchers in a unique position; to develop mobile applications that work in the SSA market space.” Testing and then implementing a business model in SSA is much different to implementing a business model in a developed market. Studying the emerging markets upfront and creating a strategy for execution simply does not work. Adjustments based on lessons

learned from operating in the market and interacting with the target customer trumps the best thought-out business plan, developed upfront (Eyring *et al.*, 2011). From this it can be seen that the direct test in market LSU features are well suited to the SSA market space (as an emerging market for MAD).

5.1.4.2 Agile development

The experimental feedback showed that all of the 11 respondents rated the relevance of the agile development feature between 3 and 5. Agile development can be characterised (among other) by the principles listed in the following bullet points (Rigby *et al.*, 2016):

- Customer preferences and solution options change frequently.
- End solution to a problem is unknown during the progression of the project.
- A feedback loop exists wherein constant feedback from the customer is received.

These three principles are aligned with the experimental feedback received from the study respondents' feedback regarding the research question - knowledge of the SSA market. It was discussed that SSA makes use of grass roots development wherein feedback from the customer is used to adjust and adapt the product to market requirements. This bottom-up development approach fits into the scope change functionality of agile development. In addition, the constant validation of an agile based project creates a feedback system wherein the project constantly receives information from the market (Rigby *et al.*, 2016).

5.2. What could be done to increase the success rate of MAD in SSA?

Answering this question required the researcher to identify the drivers of MAD in SSA. These drivers were then ranked and mapped to a system component. Mapping each driver to a system component (refer to Appendix G for mapping) enabled the researcher to group the drivers based on whether it interacted directly or indirectly with a mobile application. Drivers that interacted directly with the application (inheriting from the Application Creation Project system component) could be viewed from a MAD perspective, as the control of these drivers fell in the domain of a business' start-up. Indirect interacting drivers (inheriting from the external factors system component) were viewed from a macro perspective (i.e. in the controlling domain of governments and telecommunication companies). The following figure contextualises and extends the idea of direct and indirect interaction with the MAD process.

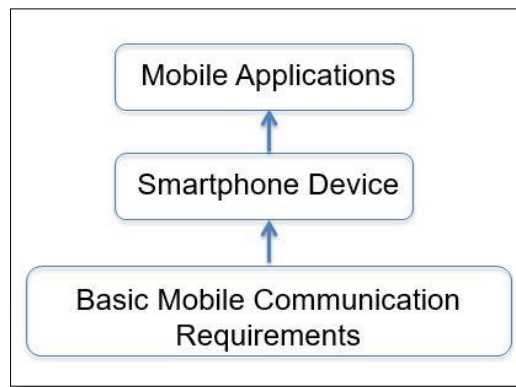


Figure 29: Mobile application hierarchy of requirements

The above figure represents the extended hierarchy of requirements for mobile applications. Starting from the bottom of the figure and working upwards, it represents functional requirements. For example, a mobile application requires a smartphone to function. A smartphone is serviced by a mobile network (i.e. basic mobile communication requirements). Mobile networks infrastructure can be rolled out and used to capacity on the business assumption that a sufficient total of individuals have adopted mobile network technology for that area. The point of this figure was to illustrate that a mobile application requires various underlying components, working together (relying on one another to function). These components have different levels of controllability and thus contribute to different levels of relative weight to the success of MAD. The components are dependent on one another and can only contribute if all of the components are working together. Answering the research question then relies on considering the problem from a business enabled perspective and external factor (for example governmental or telecommunication company) enabled perspective.

The direct interacting drivers, interfaces directly with the mobile application and smartphone device element (depicted in Figure 30 above) are listed and discussed in the following bullet points:

- **Developer skills:** From the follow-up interviews it was clear that SSA business start-ups have mobile application developers to their disposal, but the skills come at a cost, due to high demand. This was also seen from the driver and hypothesis response, which both contained a high rated technical feature (i.e. driver: developer skills and LSU feature: agile development).
- **Content localisation and digital literacy:** SSA represents a diverse group of cultures. Given the low digital and literacy levels in SSA, localising content on mobile application, lowers the entry barrier to mobile application adoption (Chhatpar & Fabricant, 2014). This however should not be a limiting factor for mobile application developers, as Mr Cull stated in his follow-up interview that mobile applications are very intuitive and requires a low level

of literacy to operate. Mobile applications should be developed with the assumption that users will have low levels of literacy. Mr Cull continued by saying that localisation the content of mobile applications to African languages could accelerate adoption rates.

The indirect interacting drivers, contributing to the basic mobile communication requirements element of the chain, (depicted in Figure 30 above) are listed and discussed in the following bullet points:

- **Mobile device technology:** Mobile application hardware requirements come in the form of smartphones. The mobile application target market is thus limited by the level of smartphone penetration in SSA. By 2015, SSA had a smartphone penetration level of 20%. This figure is set to reach 83% by 2021 (Ericsson, 2015). Smartphones have up until 2016, not been affordable enough to be purchased by the low income population group of SSA. Given that the low income population group represents the large part of SSA, manufacturers should produce cheaper smartphones. Companies for like Huawei, Alcatel and Lenovo had already started to produce low cost smartphones targeted at the low income population.
- **Governing tax policies:** From the follow-up interviews it was clear that telecommunication companies are not taxed any more than companies represented by other sectors. This, however, did not mean that governments did not profit from the sales of, for example, spectrum. The telecommunication industry in SSA is not without its problems with regards to regulation. What was evident from the experimental data and follow-up interviews, was that for a sustainable future, government and telecommunication companies have to work together by:
 - a. Lowering cost of service (including voice calls, sms and data) delivered to the end user.
 - b. Continue to improve and expand the reach of mobile networks in SSA.

5.3 Achievement of research objectives

The main research objective was to identify and rank the critical success factors required for MAD in SSA. Based on the research findings made from the identification and ranking of the research question and drivers, the success factors include:

- Mobile smartphone penetration rates in SSA.
- Knowledge of the SSA mobile application market requirements.
- Availability of mobile application developers.
- Digital literacy levels of the SSA population.
- Mobile device and network services costs.

- Sources of business start-up capital.

The secondary research objective was to test the research hypothesis, which included the LSU business model approach that could be a better suited business model for MAD in SSA. From the research findings it could be seen that each of the 13 LSU features had high (3 to 5) relevance to the SSA market space. The highest ranked LSU features included the direct test in the market and agile development teams. This was confirmed in the follow-up interviews.

From the research it was seen that the SSA market space did not come without its ICT related challenges. Improving digital literacy, lowering the cost of mobile devices and mobile service delivery as well as to develop software development skills could all accelerate the development of the critical success factors of MAD in Africa. In addition, the research also found that for the period 2016 to 2020 that SSA was set to undergo a rapid transformation of its ICT sector. This transformation would benefit MAD in SSA.

In conclusion, based on the research findings the author is left to believe that the LSU business model approach could result in a higher success rate for mobile application deployment (MAD) in the SSA market space. The SSA market (at the time of writing) had the necessary skills to develop a mobile application (and the means to deploy), but as stated by Mr Kotze: “was limited to where the lights were on.”

5.4 Research recommendations

The research aim was to recommend a business model that could be used as framework for MAD in SSA. It was hypothesised that a LSU business model could be used as a better suited business approach for MAD in SSA. The LSU tested favourable among the questionnaire and follow-up interview respondents. It was concluded that the LSU business model framework could work well for MAD in SSA. However, additional research showed that the LSU model does have potential disadvantages, listed in the following:

- The idea of a MVP will not work for all mobile application types. Peer-to-peer funds remittance mobile applications are a good example of this. This type of mobile application will have to be presented to customers as a fully functional product for testing, at which point it is not considered a MVP anymore (Hussein, 2015).
- The LSU business model's principles require a business to learn by experimenting and learning directly from its customers. When the experimental data disproves the business hypothesis, the business should pivot away from the business idea and adjust to a new product idea. This requires well designed experiments that will allow businesses to make quality decisions, based on the data acquired from the experiment. The problem comes in when the experimentation is not designed well enough to reflect the opinion of

customers, even more so when the product have the potential to be market disruptive. In these situations premature pivoting takes place, wherein perseverance could have led to an innovative product (Hussein, 2015).

5.4.1 Additional recommendations

After the experiment was concluded, the researcher identified the following points that could have added additional value to the research. These points are listed as follows:

- Questionnaire respondent size: The response received from the questionnaire limited the research from a statistical point of view. Other than emailing respondents, an alternative approach would be to contact the potential study respondents via social media.
- Questionnaire verification: In addition to the follow-up interview, a second round of questionnaires (based on the feedback received from the first round of questionnaires) could have been sent out, to verify the feedback received from the first round.

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Appendixes

Appendix A – Lean start up key metrics

Table 14: Lean start up key metrics

Key Partners	
	Identify key partners
	Identify key suppliers
	Identify key resources, acquired from partners
	Identify key activities partners perform
Key Activities	
	What key activities does the value proposition require?
	Identify distribution channels
	Customer relationships?
	Identify revenue streams
Key Resources	
	What key resources does the value proposition require?
	Identify distribution channels
	Customer relationships?
	Identify revenue streams
Cost Structure	
	Identify the highest costs inherent to the business model
	Which key resources are most expensive?
	Which key activities are most expensive?
Value Proposition	
	What value does the product offer the customer?
	Which one of the customer's problems are we helping so solve?
	What bundles of products services are we offering to each segment?
	Which customer needs are we satisfying?
	What is the minimum viable product?
Revenue Streams	
	Identify for what value the customer is willing to pay
	Identify for the customer already pays
	What is the revenue model?

	What are the pricing tactics?
Channels	
	Identify through which channels the customer want to be reached
	How do current companies reach the customer now?
	Which channels work best?
	Which channels are most cost effective?
	How the channels are integrated with the customer's routines?
Customer Relationships	
	How a relationship is obtained, kept and grow more?
	Which customers relationships have we established?
	How are they implemented to the business model?
	How costly are the customer relationships
Customer Segments	
	For whom are we creating revenue?
	Who are the most important customers?
	What is the customer archetype?

Appendix B – Research tools characteristics comparison

Table 15: Research tools characteristics comparison

Research Tool			
Survey Techniques	Interviews	Verbally	Direct Questioning
	Distributing Questionnaire	Non Verbal Questionnaire	Complete questions personally
	Advantage	Disadvantage	
Direct Questioning	Thorough completed Questionnaire	Researcher presence	
Personal Completion of Questionnaire	Researcher presence can have effect on answers	Incomplete questionnaires	

Appendix C – Pilot questionnaire respondent details and comments

The following table lists the respondents used to evaluate and pilot the questionnaire.

Table 16: Pilot questionnaire respondent information

Name of Pilot Questionnaire Respondent	Qualifications	Current Position
Mrs Iliska van Niekerk	BSc. BMI - Quantitative Risk Management BSc. Hons. BMI Quantitative Risk Management MSc. BMI Qualitative Risk Management	FNB – Dynamic Decisioning: Analyst
Mrs Carlien Kruger	BSc. BMI - Quantitative Risk Management BSc. Hons. BMI Quantitative Risk Management MSc. BMI Qualitative Risk Management	FNB – Dynamic Decisioning: Team Leader – Senior Quantitative Analyst
Mr Marcel Prins	BSc. BMI - Quantitative Risk Management BSc. Hons. BMI Quantitative Risk Management MSc. BMI Qualitative Risk Management	KPMG – Quantitative Risk Analyst
Mrs Suzanne Prins	B.Com - Economics and International Trade B.Hons. – Economics	Sage – Payroll Consultant
Mrs Marlize Pretorius	BSc. BMI - Quantitative Risk Management BSc. Hons. BMI Quantitative Risk Management MSc. BMI Qualitative Risk Management	NWU – Statistical Consultation Services: Subject Specialist

The key review points raised from the feedback is given in the following bullet points:

- The questionnaire- introduction paragraph was to be updated to place more emphasis on the research- question and hypothesis.
- Overview paragraph (originally part of section two) was to be removed as it did not add value to the overall summary of the questionnaire.
- Overly complex terminology could potentially lead to irritation among study respondents, which could result in uncompleted questionnaires. The suggestion was to replace these words, with descriptions or simpler terminology that the study respondent could easily understand.
- The questionnaire's tables contained reference columns that the researcher thought could aid raking of control drivers. The pilot questionnaire respondents felt that it made the questioning too complex and interrupted the flow of the questionnaire.
- Two control driver - descriptions were flagged as vague and required refinement.
- Section 6 required the study participant to add their own control drivers to the control drivers identified from the literature review (in section 5). The second part of the question required the study participants to rank the added control drivers according to the control drivers listed in section 5. The pilot questionnaire respondents found the original question description complex and required simplification.
- The research hypothesis statement articulation was required to be updated to emphasize the fact that a business model was not used to test the hypothesis, but rather the study respondent's opinion of the lean start up business approach was used to prove or disprove the research hypothesis.
- Biographic questions: Occupation, Current Position and Qualifications were originally left as open ended answering boxes (alternative to a drop down list containing a pre-defined list of options). The layout of the answering mechanism was to be updated to drop down lists. This reduced the time spent on processing the raw data.
- The earliest version of the questionnaire required the study participants to rank the lean start-up approach definitions (in section 4), according to importance relevant to each option. The statistical services consultant noted that this approach was statistically limiting. It was suggested that each option be ranked independently on a scale. The subsequent sections were aligned to this scaling approach.
- The questionnaire required the study respondent to rank the controllability of each control driver on a 5 degree scale. It was noted that the scale had too much optionality with the following question asked: "What justifies a ranking of 3 rather than 4, for a given control driver's controllability?" It was suggested that the controllability dimension to be removed. The researcher argued that the dimension did add value, by supplementing the priority

scale. Drivers that had equally scored priority dimensions could be assigned a higher position (relative to other control drivers) based on the controllability for the given driver.

Appendix D – Study respondents details

The following table list the study respondent's contact details, contacted to be part of the research.

Table 17: Questionnaire respondent contact details

Entity and/or Individual Name	Email Address	Cell phone Number	Response Received
SAVCA	info@savca.co.za		No Response to date
Grind Stone	grindstone@knifecap.com		No Response to date
Knife Capital	info@knifecap.com		No Response to date
InnoTech	michal@citi.org.za		No Response to date
Soft start Business & Technology Incubator	bizsparksa@microsoft.com		No Response to date
CiTi	naz@citi.org.za		No Response to date
CiTi	michal@citi.org.za		No Response to date
CiTi	tebogo@capaciti.org.za		No Response to date
Yosal Technologies	info@yosaltechnologies.com		Referred to potential study respondent
Zartner Technology	info@zartner.co.za		No Response to date
kliqconcepts	pheello@kliqconcepts.co.za		No Response to date
kliqconcepts	obakeng@kliqconcepts.co.za		No Response to date
Modular Innovations	HDarwish@modular-innovations.com		Response Received
Pierre Marias - Invesco	Pierrem@live.co.za		Response Received
Danie Viljoen - BCX	Daniel.viljoen@bcx.co.za		Response Received
Lighthouse digital	info@lighthousedigital.co.za		No Response to date
The Innovation Hub	rkomane@theinnovationhub.com		No Response to date
The Innovation Hub	smngadi@theinnovationhub.com		No Response to date
Tshimologong Innovation Hub	info.wiser@wits.ac.za		No Response to date

Tshimologong Innovation Hub	adrian.schofield@wits.ac.za		Response Received for follow-up Interview
Ellipsis Regulatory Solutions	Dominic@ellipsis.co.za		Response Received for follow-up Interview
Ellipsis Regulatory Solutions	anton@ellipsis.co.za		Response Received for follow-up Interview
Tshimologong Innovation Hub	barry.dwolatzky@wits.ac.za		No Response to date
Tshimologong Innovation Hub	Jassika.Sheikh@wits.ac.za		No Response to date
Tshimologong Innovation Hub	Barry.Myburgh@wits.ac.za		No Response to date
MIT App Inventor Forum	https://groups.google.com/forum/#!categories/mitappinventortest/general-comments-and-discussions		No Response to date
Yonas Habtemariam-Yosal Technologies	Contact made via Hassen Darwish: HDarwish@modular-innovations.com		Response Received
Kobus Hauman-Personal	Contact made via mobile phone	0833090841	Response Received
Ilette Gadney-Private - consulted at Cyest corporation	Contact made via Kobus Hauman	0833090841	Response Received
Francois de Ridder-ICT	Contact made via Kobus Hauman	0833090841	Response Received
Cornelius Viljoen-Life	Contact made via mobile phone	0792520713	Response Received
Charl Jordaan-SAPCONET	Contact made via Pieter Kruger: krugerpieterc@gmail.com		Response Received
Conway Vorster-SAPCONET	Contact made via Pieter Kruger: krugerpieterc@gmail.com		Response Received
Preston Moodley-Developer	preston.moodley@britehouse.co.za		Response Received

Appendix E – Lean start-up canvas system component

The following table lists all the elements of the Lean Start-up canvas system component.

Table 18: Lean start-up canvas system components

1. Key Partners	
	1.a) Identify key partners
	1.b) Identify key suppliers
	1.c) Identify key resources, acquired from partners
	1.d) Identify key activities partners perform
2. Key Activities	
	2.a) What key activities does the value proposition require?
	2.b) Identify distribution channels
	2.c) Customer relationships?
	2.d) Identify revenue streams
3. Key Resources	
	3.a) What key resources does the value proposition require?
	3.b) Identify distribution channels
	3.c) Customer relationships?
	3.d) Identify revenue streams
4. Cost Structure	
	4.a) Identify the highest costs inherent to the business model
	4.b) Which key resources are most expensive?
	4.c) Which key activities are most expensive?
5. Value Proposition	
	5.a) What value does the product offer the customer?
	5.b) Which one of the customer's problems are we helping so solve?
	5.c) What bundles of products services are we offering to each segment?
	5.d) Which customer needs are we satisfying?
	5.e) What is the minimum viable product?
6. Revenue Streams	
	6.a) Identify for what value the customer is willing to pay
	6.b) Identify for the customer already pays
	6.c) What is the revenue model?

	6.d) What are the pricing tactics?
7. Channels	
	7.a) Identify through which channels the customer want to be reached
	7.b) How does current companies reach the customer now?
	7.c) Which channels work best?
	7.d) Which channels are most cost effective?
	7.e) How the channels are integrated with the customer's routines?
8. Customer Relationships	
	8.a) How a relationship is obtained, kept and grow more?
	8.b) Which customers relationships have we established?
	8.c) How are they implemented to the business model?
	8.d) How costly are the customer relationships
9. Customer Segments	
	9.a) For whom are we creating revenue?
	9.b) Who are the most important customers?
	9.c) What are the customer archetype?

Appendix F – Software development work break down structure

The following figure lists all the elements (presented in a work break-down structure) of the application creation project system component.



Figure 30: Software development work break down structure

Appendix G – Mapping between driver and system components

Table 19: Mapping between driver and system components

Driver	System Component or Literature Review Reference	Component Element
African Market: The African application economy is different, compared to, for example the US. Mobile applications in SSA are developed only to service small population groups or as utility services to already existing service and products. Mobile in SSA are not developed as standalone service or products.	• 2.4 Global Application Market • 2.6 African Connectivity/ Infrastructure • 2.7 African Mobile Application Market	External Factors
Mobile Device Technology: Smartphone (as a platform for mobile applications) adoption rate will only justify business viability once smartphones penetrate the majority of the SSA market space.	• 2.6 African Connectivity/ Infrastructure	External Factors
Mobile Network Coverage: Network coverage required for mobile connectivity.	• 2.6 African Connectivity/ Infrastructure	External Factors
Cost of Mobile Device Ownership: The total cost of mobile ownership (i.e. device purchase, mobile operator costs and powering the device).	• 2.6 African Connectivity/ Infrastructure	External Factors
Electricity Requirements: Electricity as requirement for mobile device operation.	• 2.6 African Connectivity/ Infrastructure • 2.7 African Mobile Application Market	External Factors

User Technology Literacy: Digital literacy of the African population.	2.6 African Connectivity/ Infrastructure	External Factors
Governing Tax Policies: Taxes imposed on mobile network operators.	2.6 African Connectivity/ Infrastructure	External Factors
Feature phones (non-smartphone) applications (for example: m-pesa or mxit) as alternative to smartphone based applications.	2.7 African Mobile Application Market	External Factors
Platformisation: Mobile portal provisioning, platform operation, service provision and service aggregation split (decentralised) across multiple contributing entities as opposed to a given mobile network operator (for example MTN), owning and controlling all the mentioned services from one centralised point.	2.4 Platform modularisation	External Factors
Content Localisation: Content provided to user in local language.	2.6 African Connectivity/ Infrastructure	Application Creation Project
Capital Requirements: Source of capital or investments.	1. Key Partners 4. Cost Structure	Lean Start-Up Key Metric Canvas
Time to Market: The total of time spent to develop mobile application and deploy to the market (Build, Measure and Learn Cycle).	2. Key Activities (LSUC) 5. Value Proposition (LSUC) 6. Channels (LSUC) 8. Customer Relations (LSUC)	Application Creation Project (ACP) and Lean Start-Up Key Metric Canvas (LSUC)

	• 1. Requirements Gathering (ACP) • 2. Design (ACP) • 3. Creation (ACP) • 4. Testing (ACP)	
Market Fragmentation: The African market space contains a diverse range of cultures, demographic groups and income segments.	• 2.7 African Mobile Application Market	External Factors
Development Skills: Programming and designing mobile applications.	• 2.7 African Mobile Application Market	Application Creation Project
Entrepreneurial Skills: Level of business knowledge for mobile application entrepreneurs.		Lean Start-Up Key Metric Canvas

Appendix H – Questionnaire

Appendix H contains a copy of the Google forms questionnaire as presented to the study respondents.

Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Dear Study Participant

I'm a post graduate student at the North-West University (NWU). I'm currently working on my Masters in Engineering Development and Management (M.Eng), with Prof. Johan Fick as my study leader. My masters degree dissertation, entitled the "Critical success factors for mobile application deployment in Africa" attempts to deliver a business model, suited to mobile application deployment in the Sub-Saharan African (SSA) market. Key stakeholders represented from technology hubs in Johannesburg and Cape town South Africa were sent this questionnaire. Technology hubs from Kenya and Nigeria were also sent this questionnaire.

You are kindly requested (at your earliest convenience) to complete the questionnaire. The questionnaire should not take longer than 15 minutes. To allow the researcher to process the data from the questionnaire promptly, please return the questionnaire as soon as possible. Please note that all responses will be treated confidentially. The study is completely voluntary and should you feel that you would not want to take part in the study, please indicate so on the second page. The study results will be made available to you upon request.

Your contributions would be highly appreciated and will contribute to the structuring of a business model approach that aspiring entrepreneurs can use to navigate the mobile application start-up business in SSA.

For any required assistance, please feel free to contact Juan van Niekerk at:

Cell: (+27) 72 685 7236

Email: juanvniekerk1988@gmail.com

Kind Regards

Juan van Niekerk (B.Eng. Chem.)

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Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Section 1 – General information

Name and Surname

Your answer

Please specify entity that you represent

Your answer

Willing to participate

- ☐ Yes
- ☐ Yes, but please keep me anonymous
- ☐ No

If No, in previous questions, please comment as to why?

Your answer

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Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Section 2 – Background

The study attempts to answer the research question and prove the research hypothesis, from the information that you've specified in this questionnaire. Your opinion (gathered from the completed questionnaire) will be used to measure the research hypothesis.

THE RESEARCH QUESTION FOR THIS STUDY: With the SSA market continuously searching for disruptive innovation and with the continent's mobile application related revenue only contributing a small total to the international market, what can be done to increase the success rate (to compete on an international level) of mobile application deployment in SSA?

THE RESEARCH HYPOTHESIS: The successful deployment of mobile applications in SSA required a different business approach. It was hypothesised that a lean start-up business model framework could result in a higher success rate for mobile application deployment in the SSA market space.

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Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Section 3 – Biographic information

Age

Your answer _____

Gender

- ☐ Male
- ☐ Female

Nationality

- ☐ African (Non SA Citizen)
- ☐ American
- ☐ Asian
- ☐ Australian
- ☐ European
- ☐ South African
- ☐ Other : _____

Sector

- ☐ Private
- ☐ Public
- ☐ Voluntary

Years Experience

Your answer _____

Occupation Position

- ☐ Engineer
- ☐ Entrepreneur
- ☐ Developer
- ☐ Manager
- ☐ Director
- ☐ Associate
- ☐ Analyst
- ☐ Principle Consultant
- ☐ Professor
- ☐ Business Consultant Specialist
- ☐ Student
- ☐ Other : _____

Qualifications

- ☐ < Grade 12
- ☐ Grade 12
- ☐ Diploma
- ☐ Degree
- ☐ Post – Graduate Degree
- ☐ Other : _____

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Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Section 4 – Your personal opinion on the research: QUESTION

FROM THE RESEARCH QUESTION: "What can be done to increase the success rate (to compete on an international level) of mobile application deployment in SSA?", the researcher has proposed the following suggestions to increase the success rate. Please rank the following postulants as it relates to the SSA market space. Rank from 1 to 5 as described in the following table.

(1 - No Relation to 5 – Totally Relatable)

Basic mobile phone requirements: for example the infrastructure that supplies electricity or network signal needs to improve, before Africa can truly operate in the digital realm.

	1	2	3	4	5	
No Relation	☐	☐	☐	☐	☐	Totally Relatable

Technical skills development: programming and designing mobile applications.

	1	2	3	4	5	
No Relation	☐	☐	☐	☐	☐	Totally Relatable

Business acumen development: that will enable an entrepreneur to scale and develop a mobile application to a sustainable business.

	1	2	3	4	5	
No Relation	☐	☐	☐	☐	☐	Totally Relatable

Venture capital: funding that will enable emerging businesses to scale and develop into a self-sustaining business.

	1	2	3	4	5	
No Relation	☐	☐	☐	☐	☐	Totally Relatable

Business model: rather than using a revenue predicting business plan, use a business model that assumes nothing and self-adjusts into the SSA market space.

	1	2	3	4	5	
No Relation	☐	☐	☐	☐	☐	Totally Relatable

Knowledge of the SSA market challenges, dynamics and needs.

	1	2	3	4	5	
No Relation	☐	☐	☐	☐	☐	Totally Relatable

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Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Section 4 – Your personal opinion on the research: HYPOTHESIS

FROM THE RESEARCH HYPOTHESIS: "A lean start-up business model could result in a higher success rate for mobile application deployment in the SSA market space". Please rank each lean feature in line with the relevance it has on mobile application deployment in the SSA market space. Rank from 1 to 5, described in the following table.

Strategy

Business Model

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Hypothesis Driven

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

New Product Process

Customer Development

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Direct Test in Market

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Engineering

Agile Development

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Build product interactively and incrementally

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

New Product Process

Customer Development

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Direct Test in Market

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Engineering

Agile Development

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Build product interactively and incrementally

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Organisation

Agile development teams

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Hiring based in learning flexibility and speed

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Financial Reporting

Customer acquisition cost, lifetime customer value, churn or application popularity

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Failure

Expected

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Multiple iterations of ideas (and accompanying failures) and pivoting away from the ideas that do not work

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Speed

Rapid

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

Operates on medium quality data

	1	2	3	4	5	
No Relevance	☐	☐	☐	☐	☐	Significant Relevance

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Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Section 5 – Drivers of mobile application deployment in SSA

The driver section requires the participant to answer two dimensions:

1. Prioritise the drivers (1 - No Priority to 5 – Highest Priority).
2. Rate the controllability of the driver (Controllable or Uncontrollable).

If the participant is unable to rate any of the two dimensions (i.e. prioritisation and/or controllability), he/she can comment in the indicated spaces. Please note that both the prioritisation and controllability have to be ranked based on their relevance on mobile application deployment in SSA.

African Market: The African application economy is different, compared to, for example the US. Mobile applications in SSA are developed only to service small population groups or as utility services to already existing service and products. Mobile in SSA are not developed as standalone service or products.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Mobile Device Technology: Smartphone (as a platform for mobile applications) adoption rate will only justify business viability once smartphones penetrate the majority of the SSA market space.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Mobile Network Coverage: Network coverage required for mobile connectivity.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Mobile Device Technology: Smartphone (as a platform for mobile applications) adoption rate will only justify business viability once smartphones penetrate the majority of the SSA market space.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Mobile Network Coverage: Network coverage required for mobile connectivity.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Cost of Mobile Device Ownership: The total cost of mobile ownership (i.e. device purchase, mobile operator costs and powering the device).

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Electricity Requirements: Electricity as requirement for mobile device operation.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

User Technology Literacy: Digital literacy of the African population.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Governing Tax Policies: Taxes imposed on mobile network operators.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Feature phones (non-smartphone) applications (for example: m-pesa or mxit) as alternative to smartphone based applications.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Platformisation: Mobile portal provisioning, platform operation, service provision and service aggregation split (decentralised) across multiple contributing entities as opposed to a given mobile network operator (for example MTN), owning and controlling all the mentioned services from one centralised point.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Content Localisation: Content provided to user in local language.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Capital Requirements: Source of capital or investments.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Time to Market: The amount of time spent to develop mobile application and deploy to the market (Build, Measure and Learn Cycle).

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Market Fragmentation: The African market space contains a diverse range of cultures, demographic groups and income segments.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Developer Skills: Programming and designing mobile applications.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Entrepreneurial Skills: Level of business knowledge for mobile application entrepreneurs.

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

BACK

NEXT



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Questionnaire for the key stakeholders in Mobile Application Deployment in Sub-Sahara Africa

Section 6 – Additional drivers of mobile application deployment in SSA

The control drivers listed in section 5 was identified from literature. If in your professional opinion there are additional control drivers that were not mentioned in section 5, please add them to the following section. As completed in section 5, rank the priority and controllability of the additional control drivers, based on their relevance on mobile application deployment in SSA.

1. Add additional control drivers.
2. Prioritise the control drivers (1 - No Priority to 5 – Highest Priority).
3. Rate the controllability of the control driver (Controllable or Uncontrollable).

Additional Control Driver (1)

Your answer

Priority

	1	2	3	4	5	
Lowest Priority	☐	☐	☐	☐	☐	Highest Priority

Controllability

- ☐ Controllable
- ☐ Uncontrollable

Appendix I – Additional experimental data

The following section contains additional information gathered from the experiment (as extracted from the questionnaire and the follow-up interviews).

I.1 Sectors represented by respondents of questionnaire

90% (10) of the respondents were representative of the private sector, with the balance 10% (1) representative of the voluntary sector.

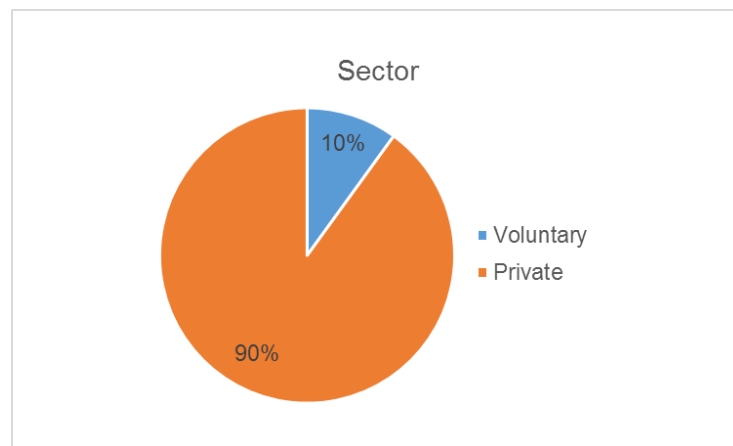


Figure 31: Sector break down (I1)

I.2 Research hypothesis respondent's feedback

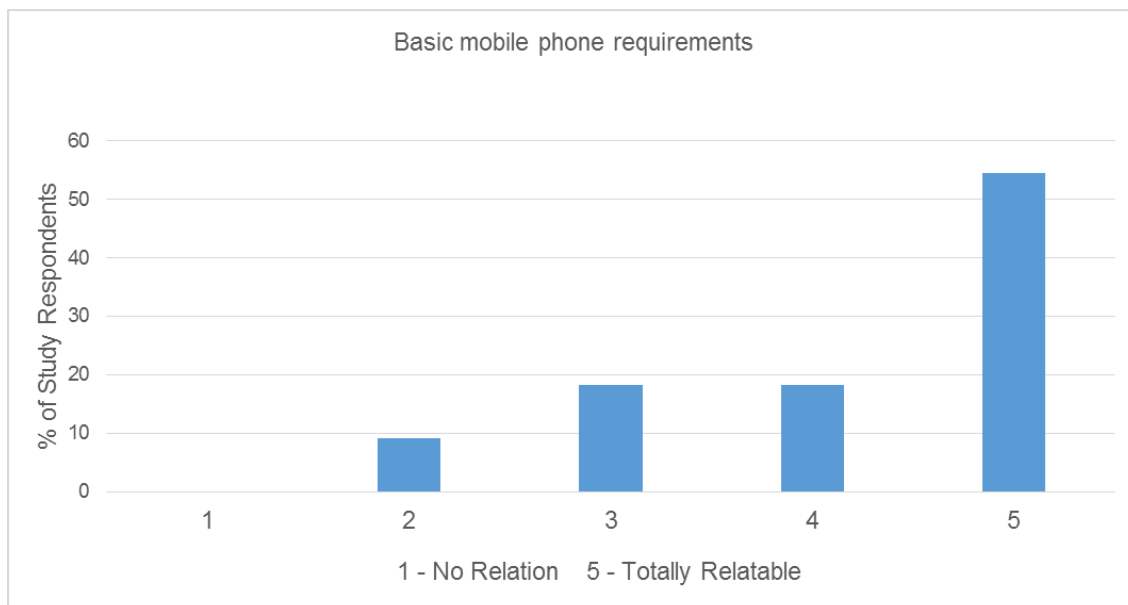


Figure 32: Research hypothesis feedback (I2)

I.3 Technical skills development: programming and designing mobile applications



Figure 33: Technical skills development (I3)

I.4 Business acumen development: that will enable an entrepreneur to scale and develop a mobile application to a sustainable business.

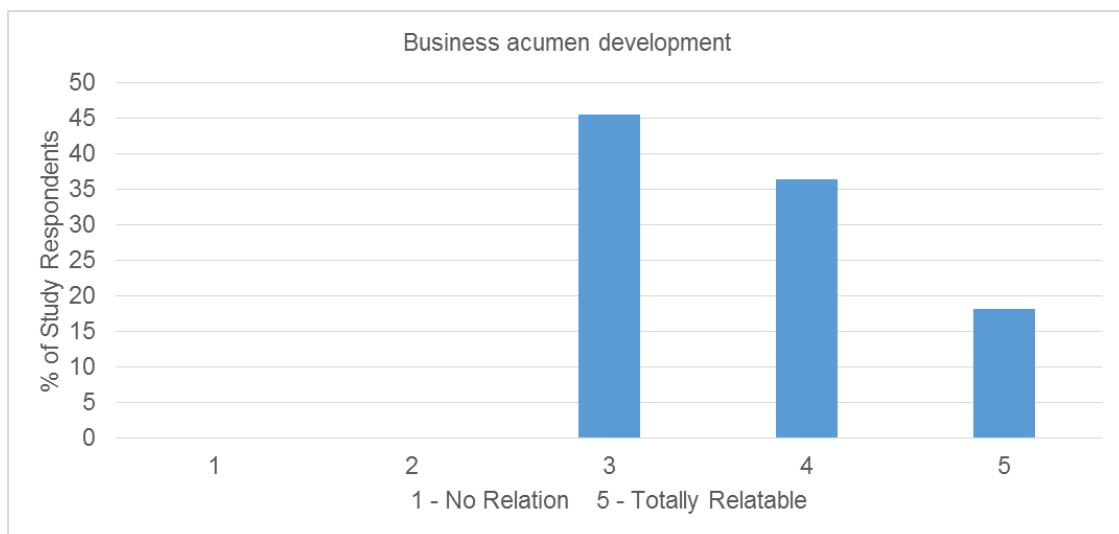


Figure 34: Business acumen development (I4)

I.5 Venture capital: funding that will enable emerging businesses to scale and develop into a self-sustaining business.

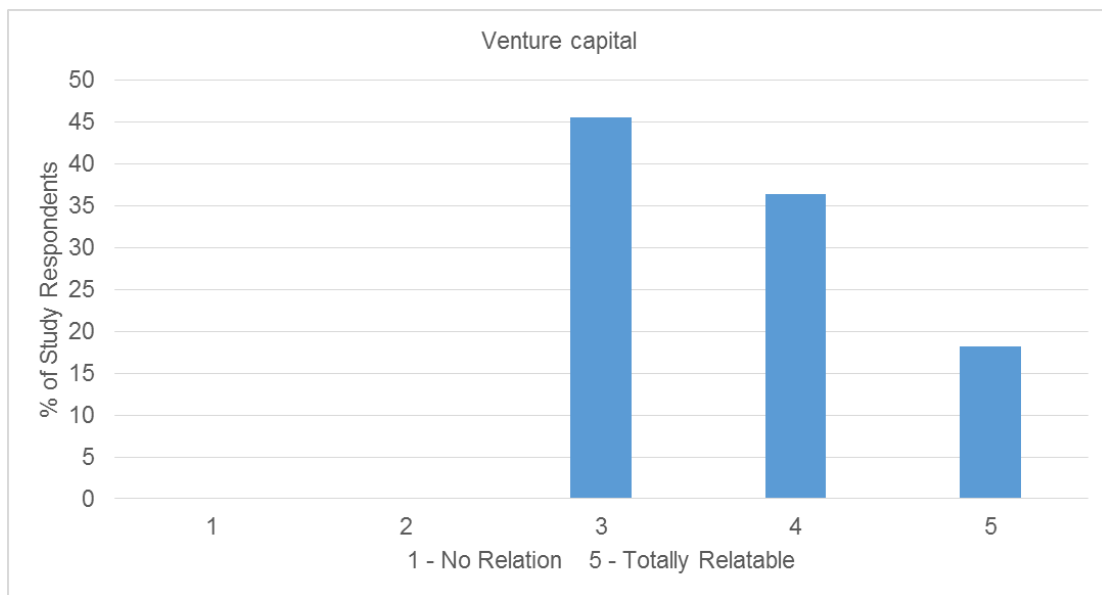


Figure 35: Venture Capital (I5)

I.6 Business model: rather than using a revenue predicting business plan, use a business model that assumes nothing and self-adjusts into the SSA market space.

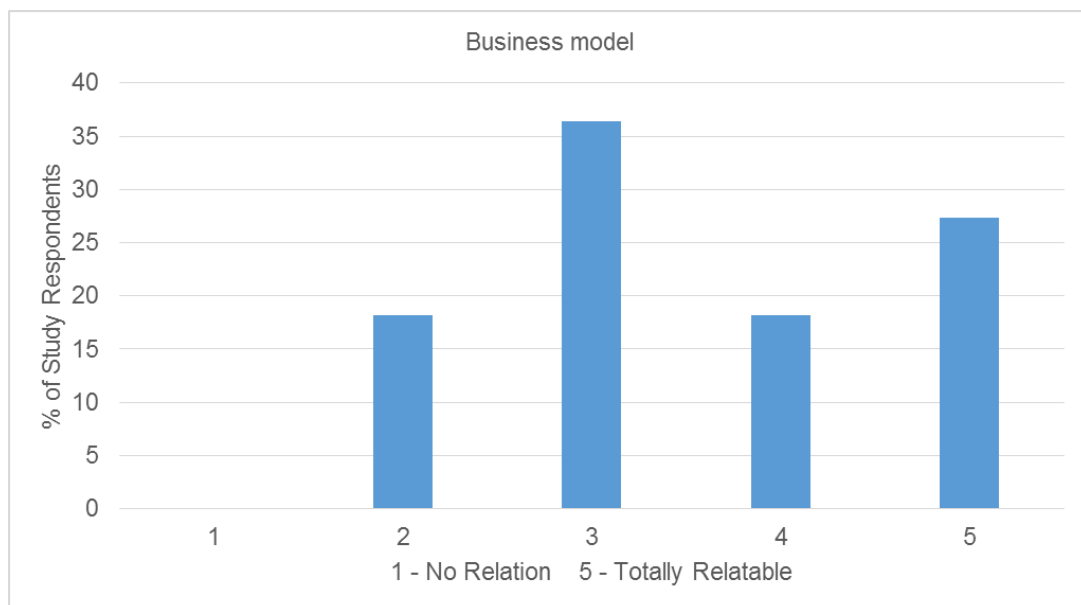


Figure 36: Business model (I6)

I.7 Knowledge of the SSA market challenges, dynamics and needs

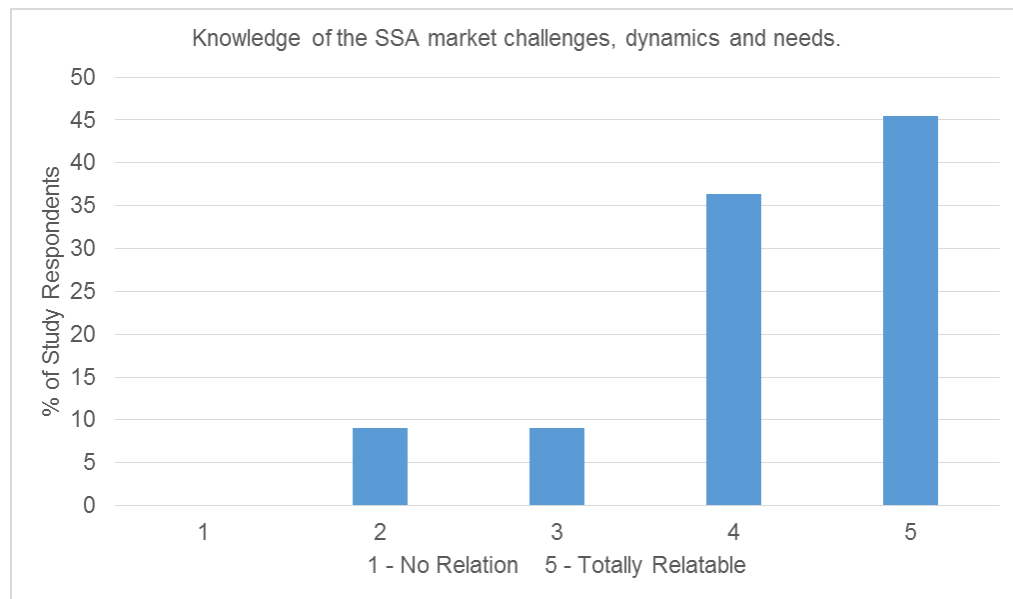


Figure 37: Knowledge of the SSA market challenges, dynamics and needs (I7)

I.8 Business Model

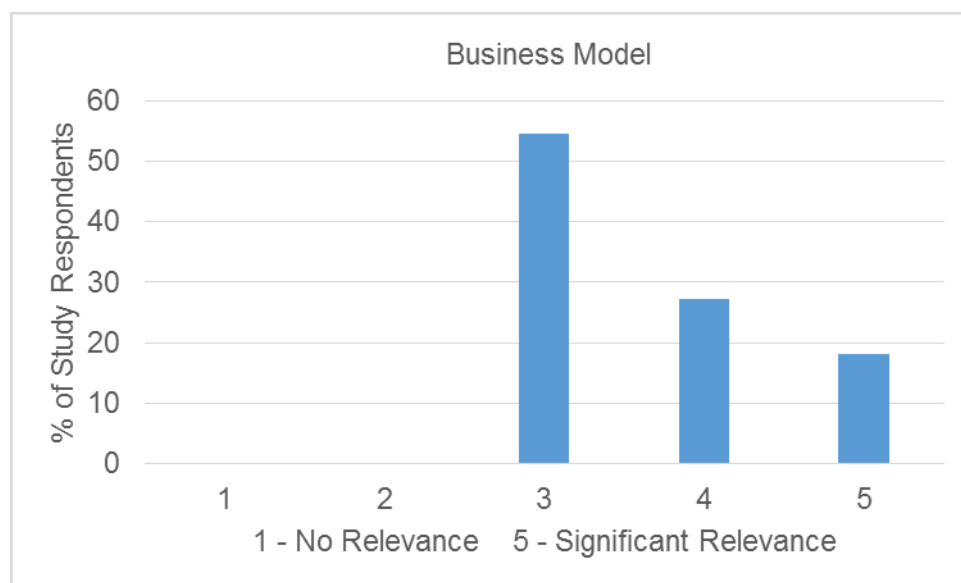


Figure 38: Business model (I8)

I.9 Hypothesis Driven

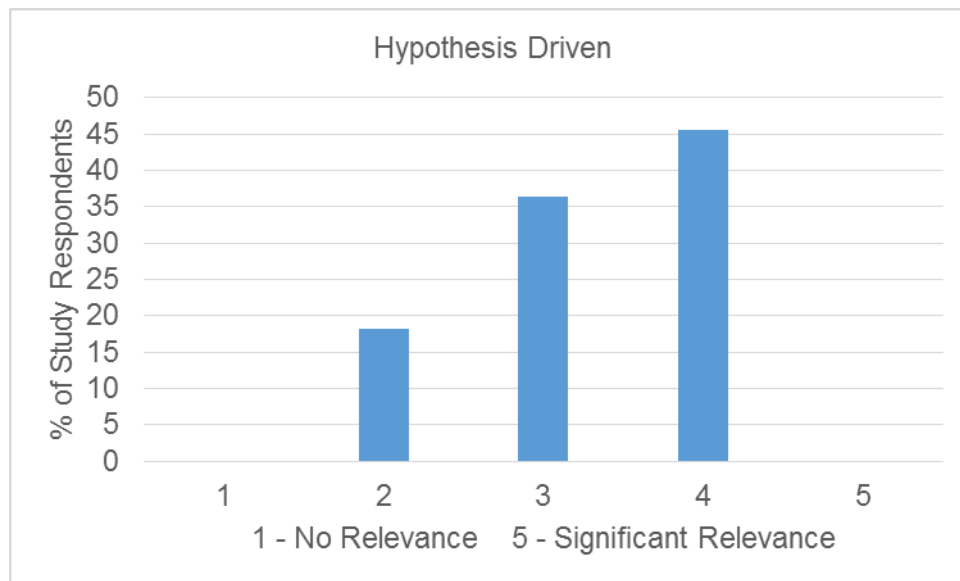


Figure 39: Hypothesis Driven (I9)

I.10 Customer Development



Figure 40: Customer development (I10)

I.11 Direct Test in Market

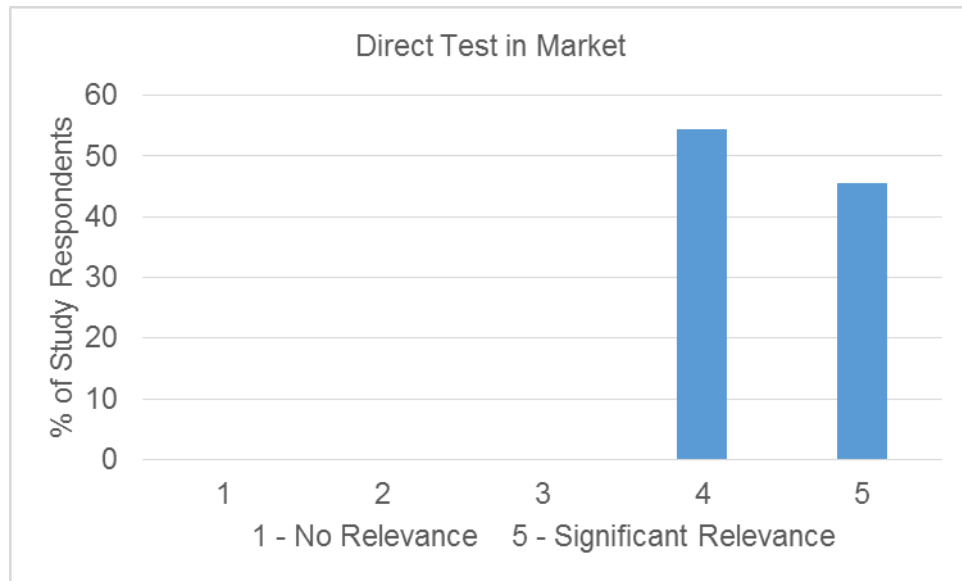


Figure 41: Direct test in market (I11)

Engineering

1.12 Agile Development



Figure 42: Agile development (I12)

I.13 Build product interactively and incrementally

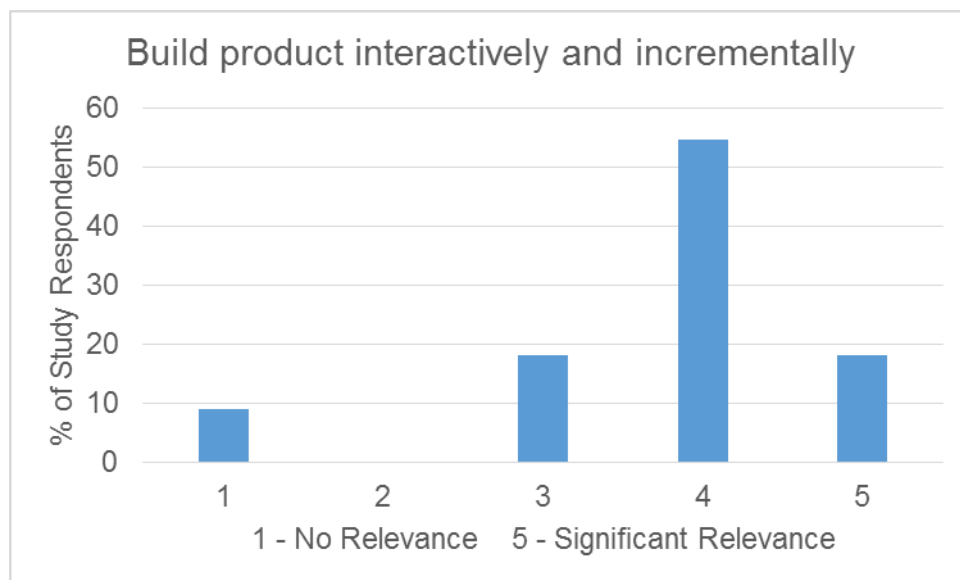


Figure 43: Build product interactively and incrementally (I13)

Organisation

I.14 Agile Development Teams

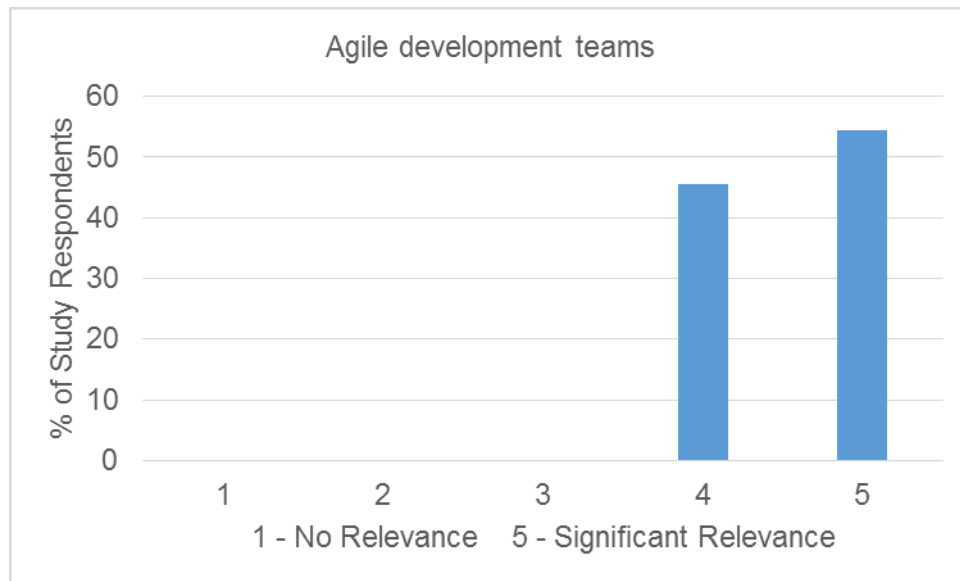


Figure 44: Agile development teams (I14)

I.15 Hiring based in learning flexibility and speed

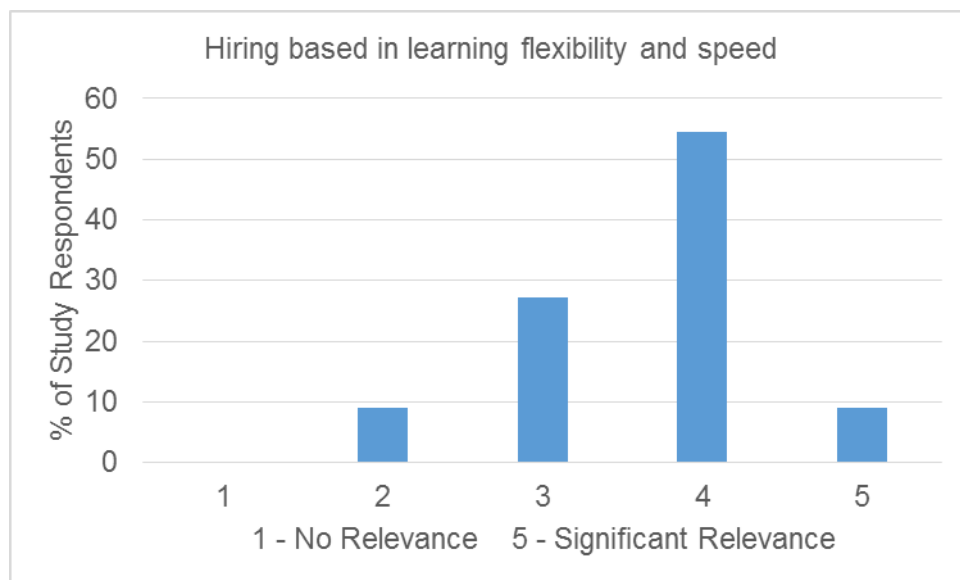


Figure 45: Hiring based in learning flexibility and speed (I15)

Financial reporting

I.16 Customer acquisition cost, lifetime customer value, churn or application popularity

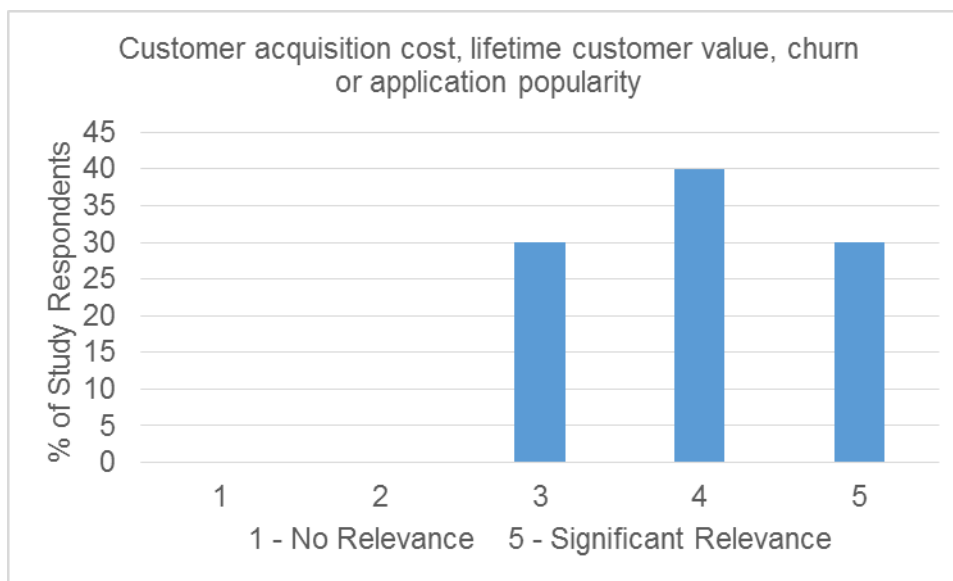


Figure 46: Customer acquisition cost, lifetime customer value, churn or application popularity (I16)

Failure

I.17 Expected

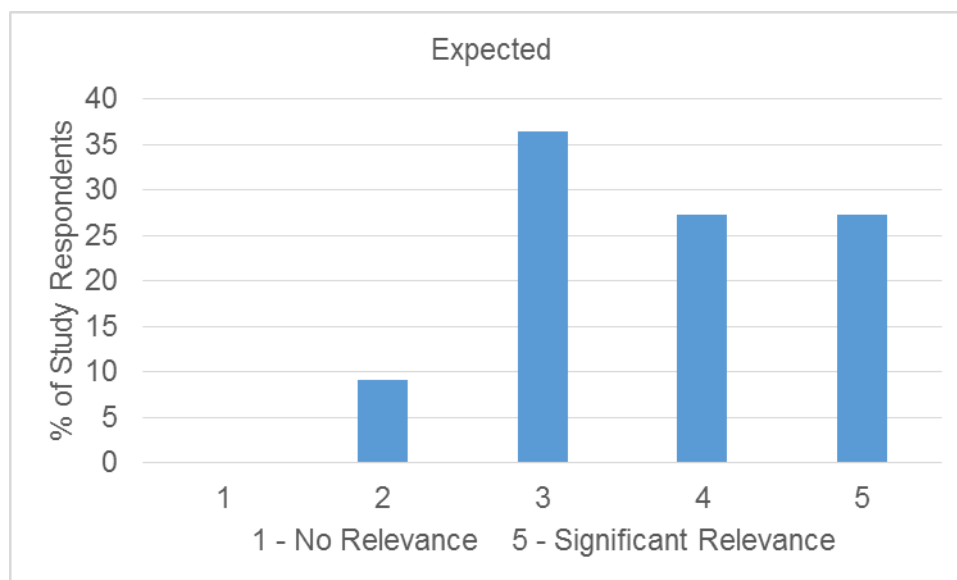


Figure 47: Expected (I17)

I.18 Multiple iterations of ideas (and accompanying failures) and pivoting away from the ideas that do not work

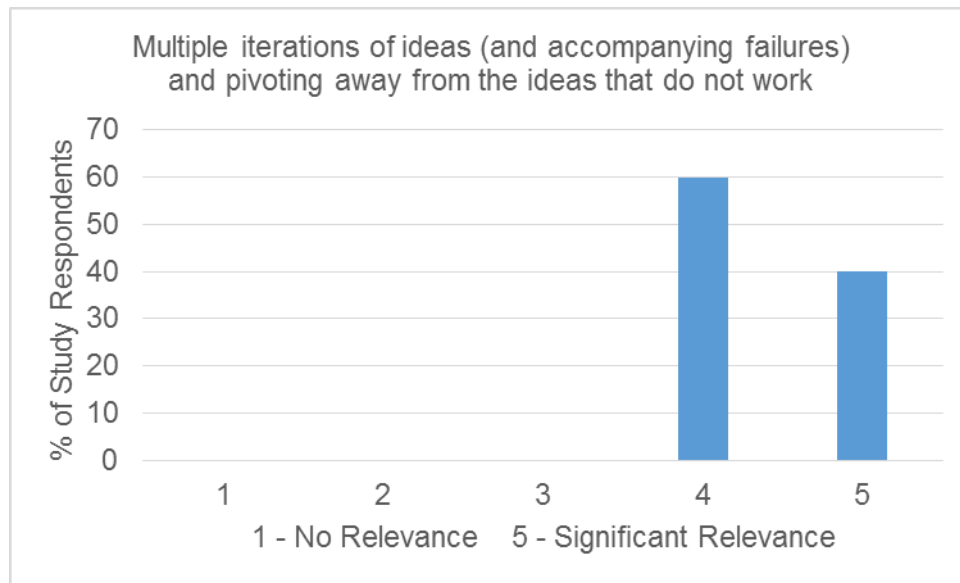


Figure 48: Multiple iterations of ideas (I18)

Speed

I.19 Rapid

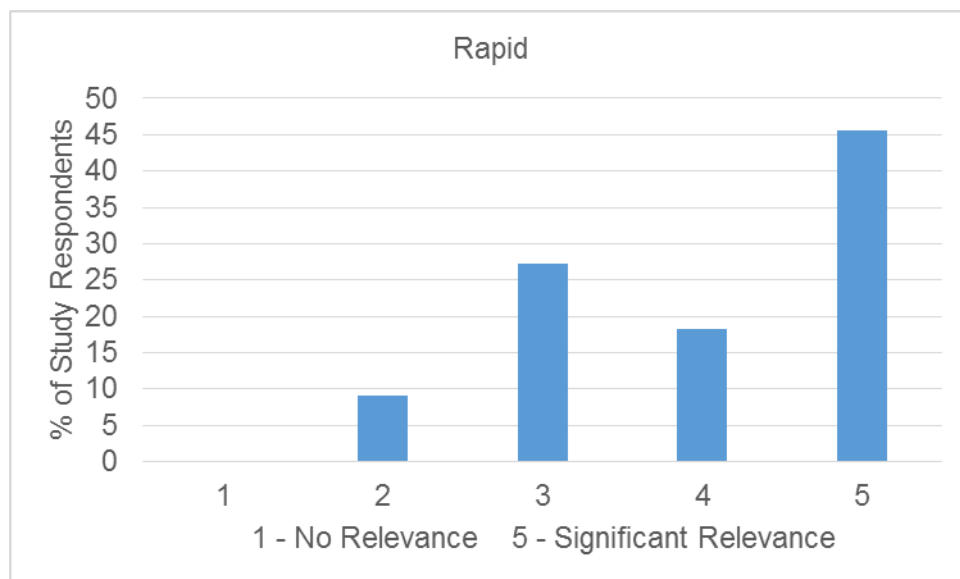


Figure 49: Rapid (I19)

I.20 Operates on medium quality data

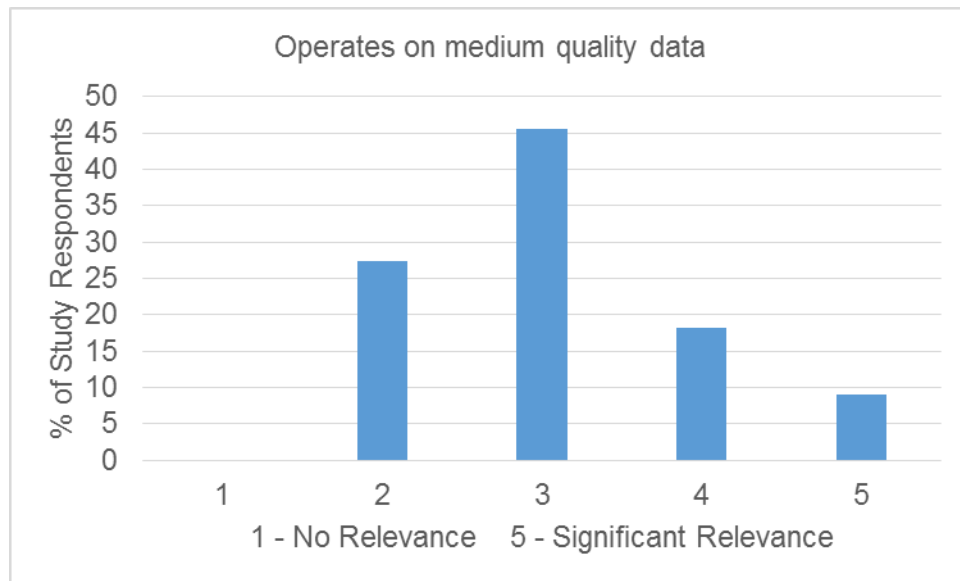


Figure 50: Operates on medium quality data (I20)

Research drivers response

I.21 African Market

The African application economy is different, compared to, for example the US. Mobile applications in SSA are developed only to service small population groups or as utility services to already existing service and products.

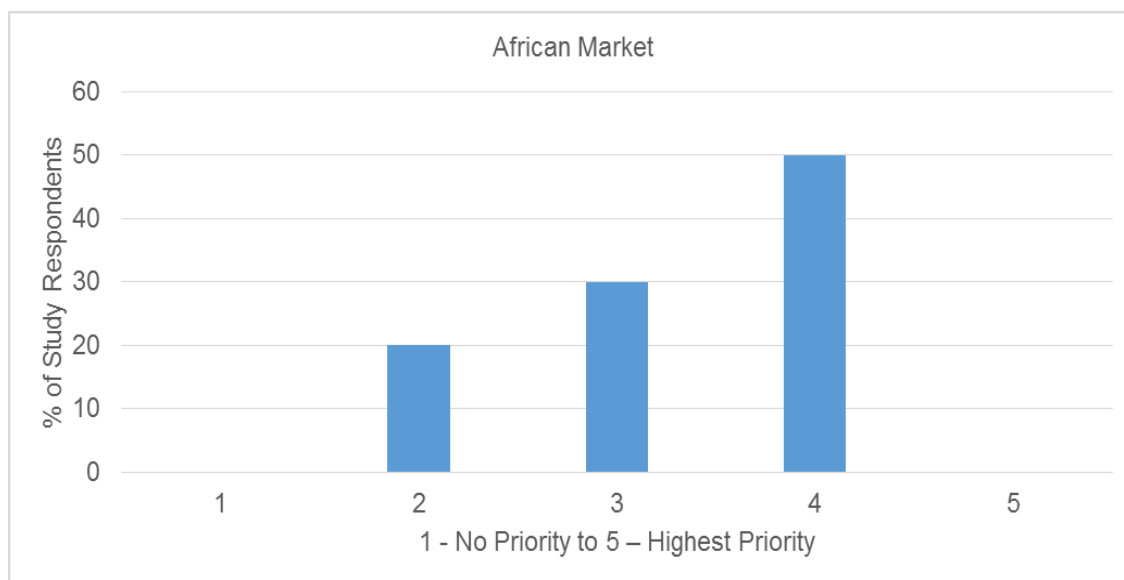


Figure 51: African market (I.21-A)

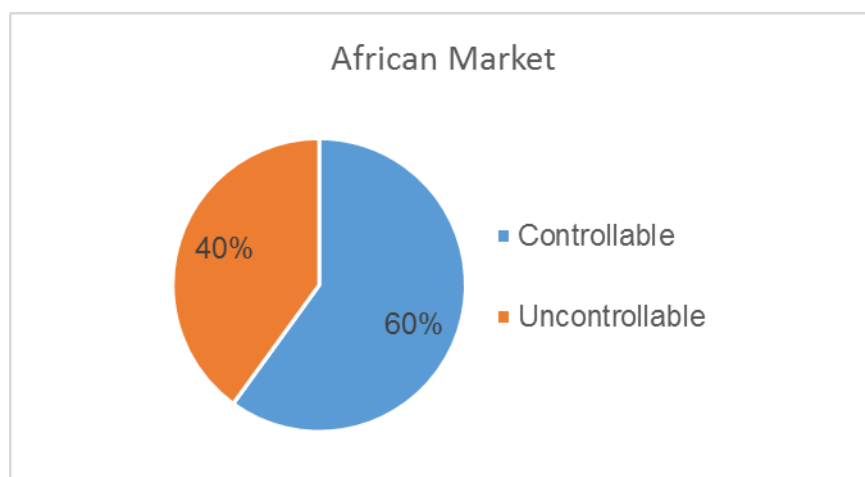


Figure 52: African market (I.21-B)

I.22 Mobile Device Technology

Smartphone (as a platform for mobile applications) adoption rate will only justify business viability once smartphones penetrate the majority of the SSA market space.

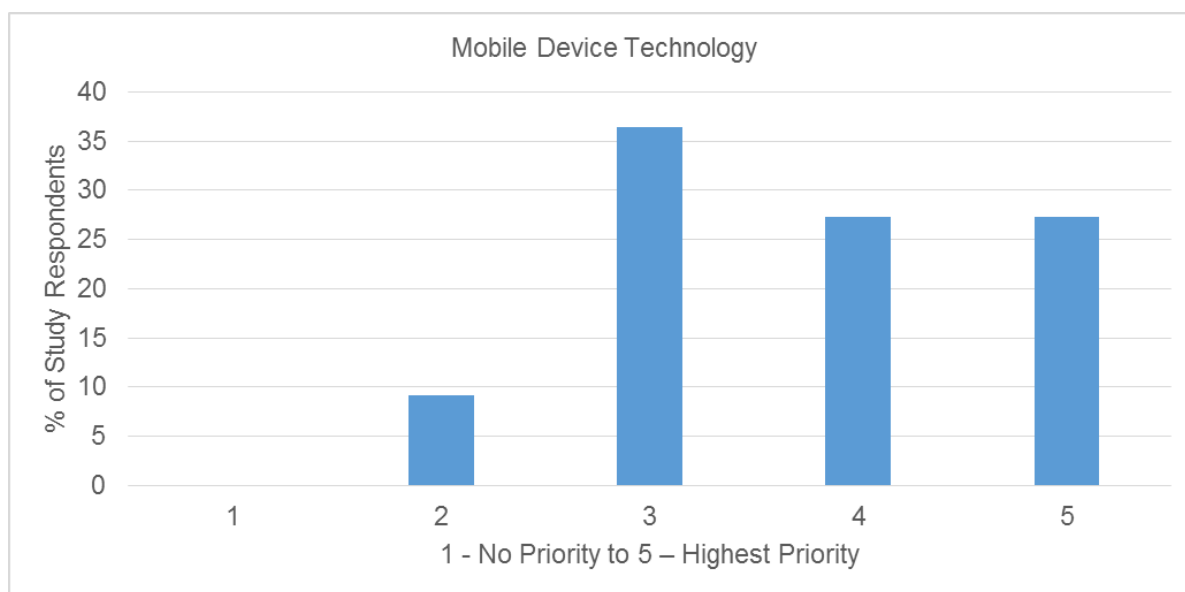


Figure 53: Mobile device technology (I.22-A)

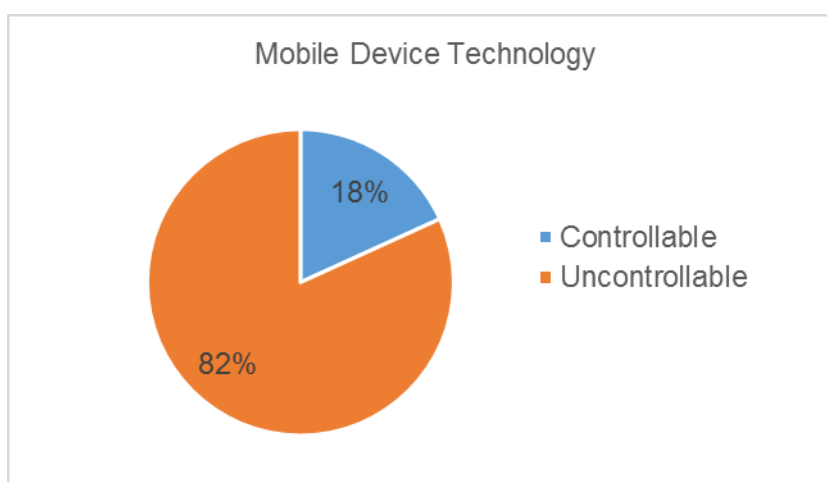


Figure 54: Mobile device technology (I.22-B)

I.23 Mobile Network Coverage

Network coverage required for mobile connectivity.

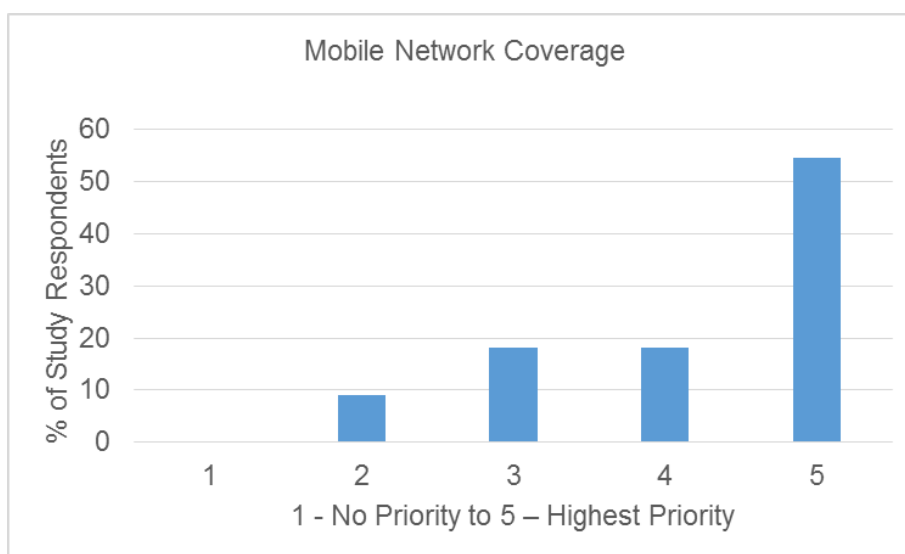


Figure 55: Mobile network coverage (I.23-A)

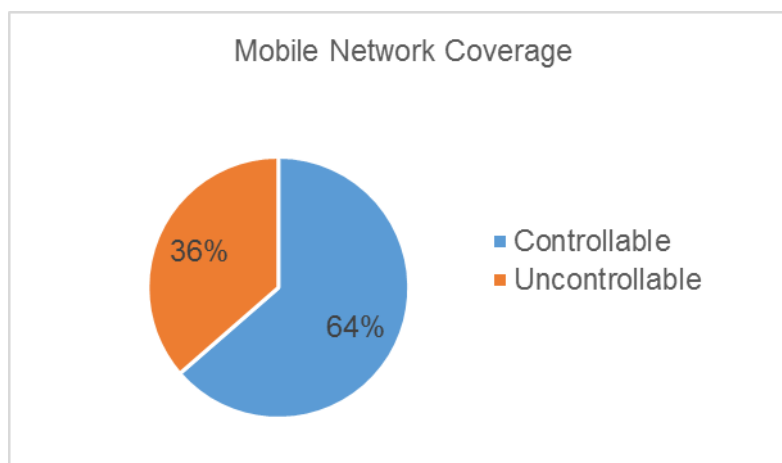


Figure 56: Mobile network coverage (I.23-B)

I.24 Cost of Mobile Device Ownership

The total cost of mobile ownership (i.e. device purchase, mobile operator costs and powering the device).

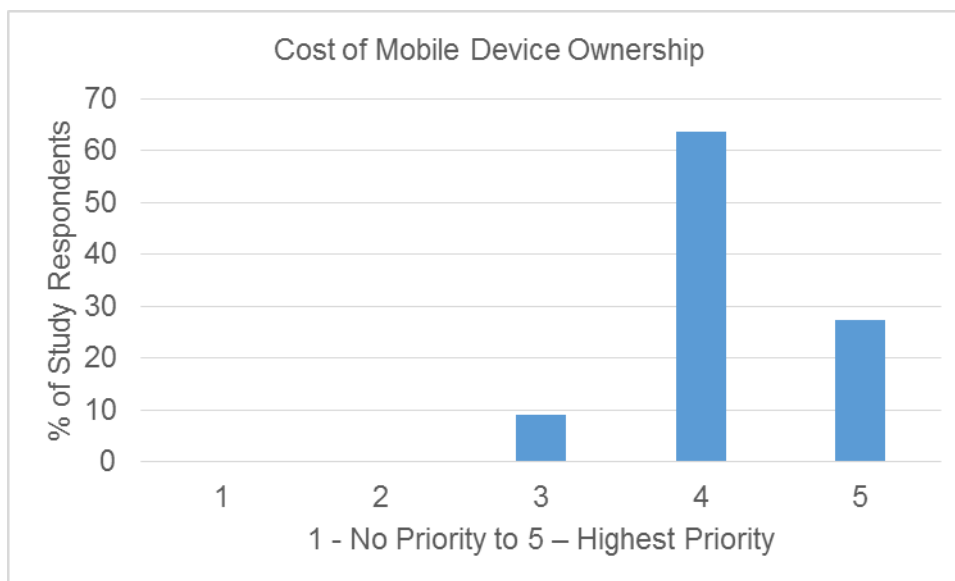


Figure 57: Cost of mobile device ownership (I.24-A)

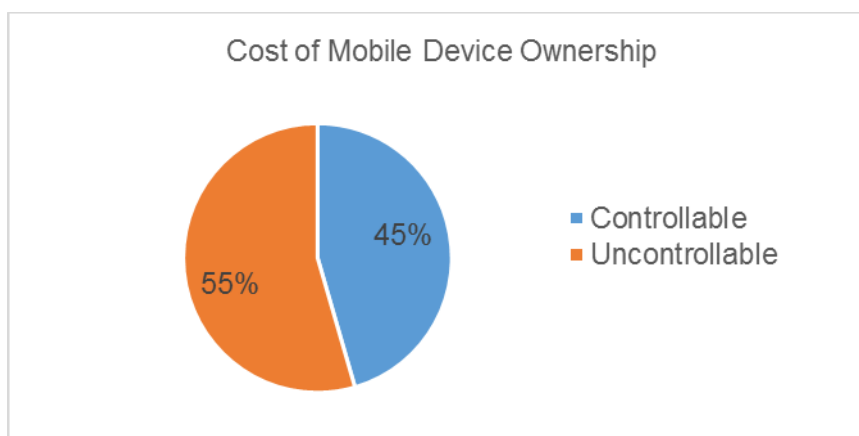


Figure 58: Cost of mobile device ownership (I.24-B)

I.25 Electricity Requirements

Electricity as requirement for mobile device operation.

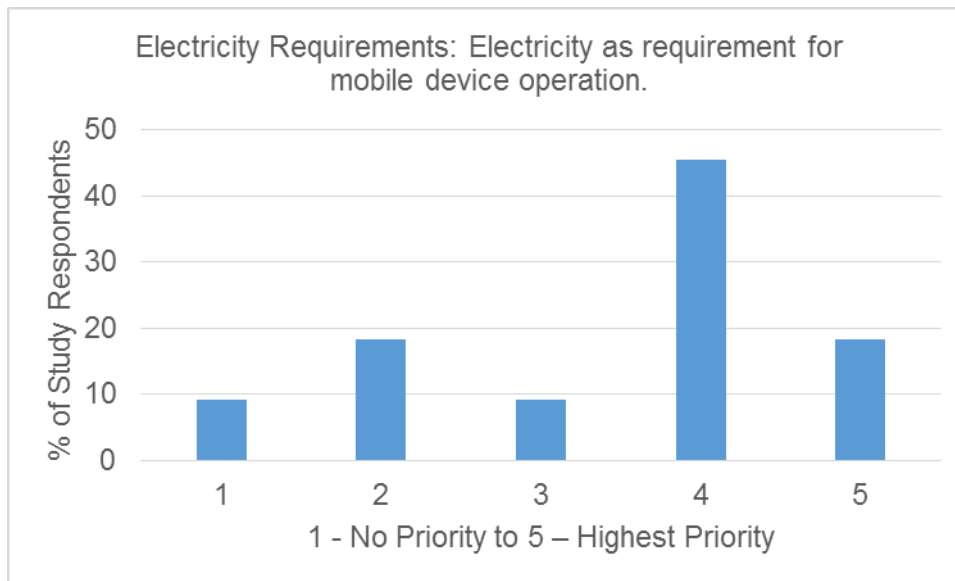


Figure 59: Electricity requirements (I.25-A)

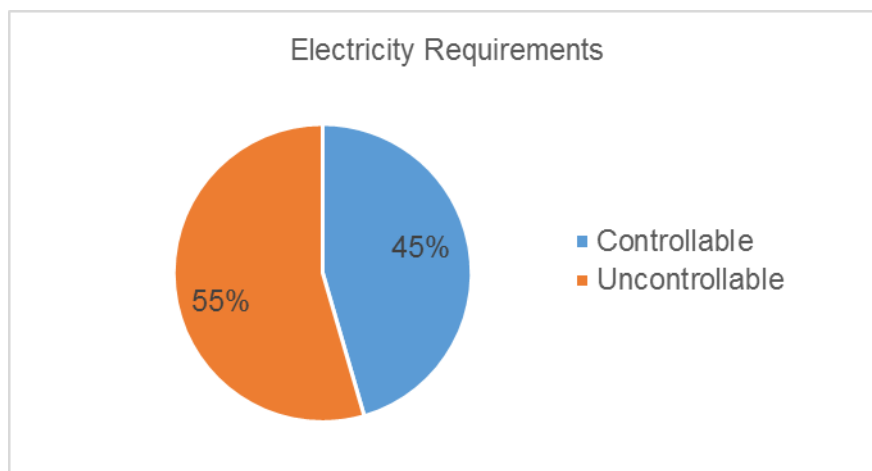


Figure 60: Electricity requirements (I.25-B)

I.26 User Technology Literacy

Digital literacy of the African population.

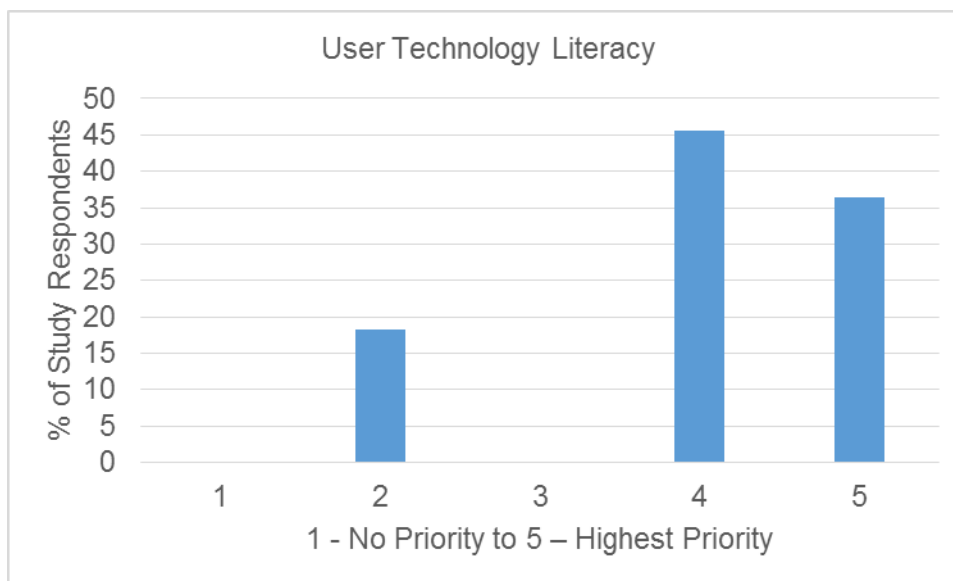


Figure 61: User technology literacy (I.26-A)

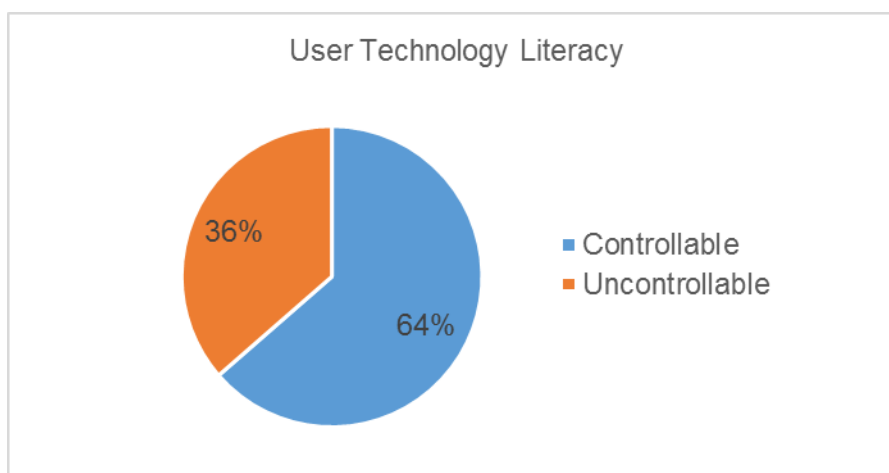


Figure 62: User technology literacy (I.26-B)

I.27 Governing Tax Policies

Taxes imposed on mobile network operators.

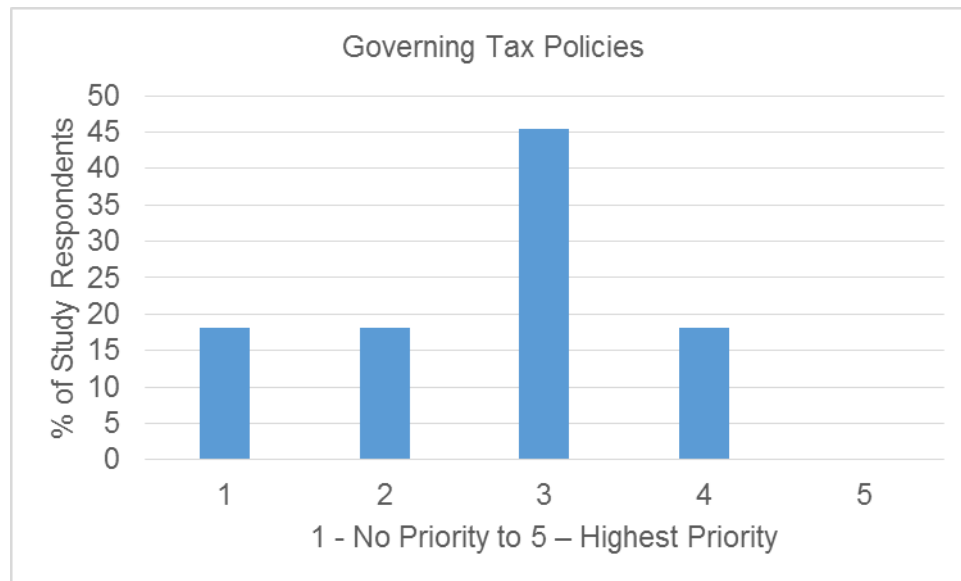


Figure 63: Governing tax policies (I.27-A)

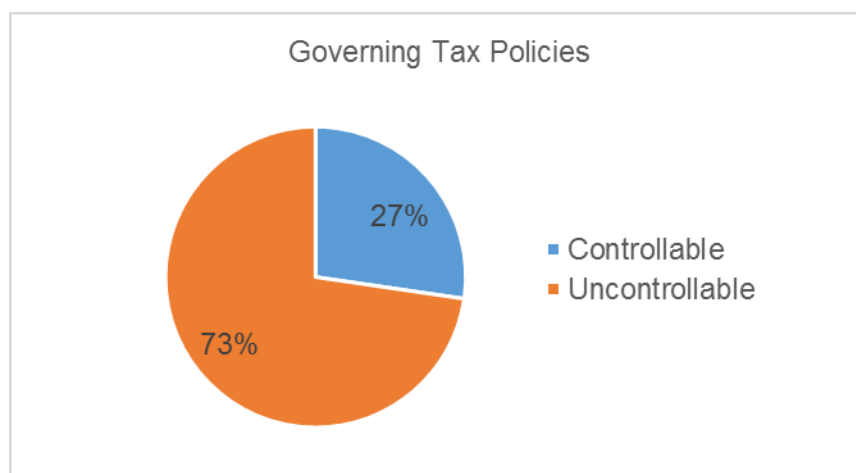


Figure 64: Governing tax policies (I.27-B)

I.28 Feature phones

Feature phones (non-smartphone) applications (for example: m-pesa or mxit) as alternative to smartphone based applications.

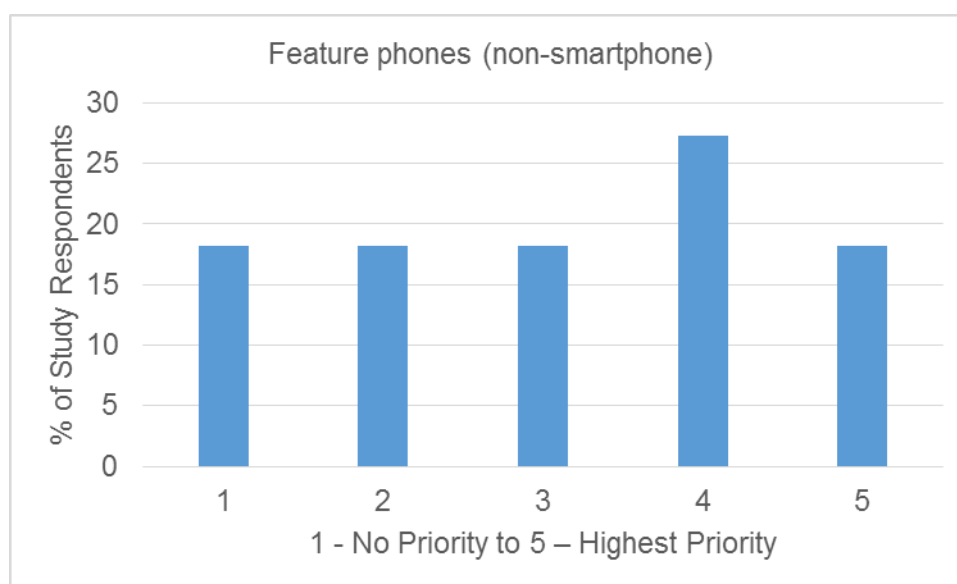


Figure 65: Feature phones (I.28-A)

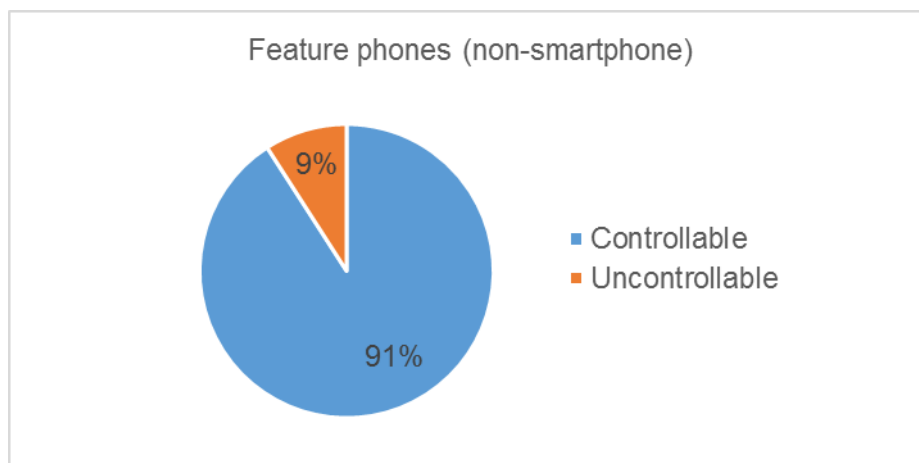


Figure 66: Feature phones (I.28-B)

I.29 Platformitisation

Mobile portal provisioning, platform operation, service provision and service aggregation split (decentralised) across multiple contributing entities as opposed to a given mobile network operator (for example MTN), owning and controlling all the mentioned services from one centralised point.

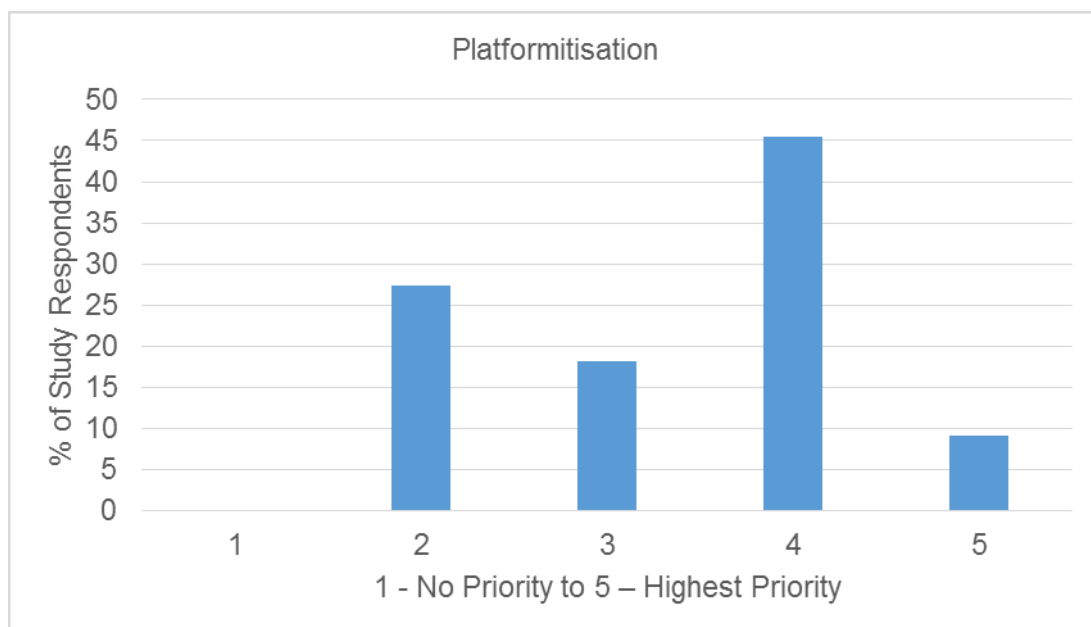


Figure 67: Platformitisation (I.29-A)

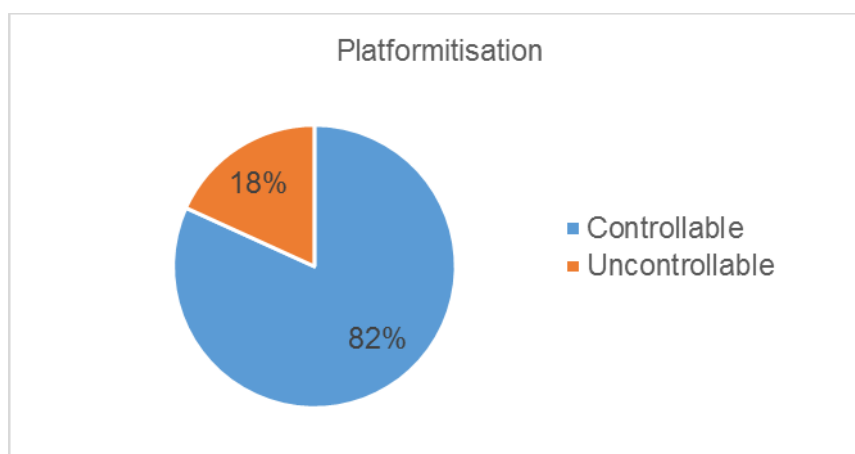


Figure 68: Platformitisation (I.29-B)

I.30 Content Localisation

Content provided to user in local language.

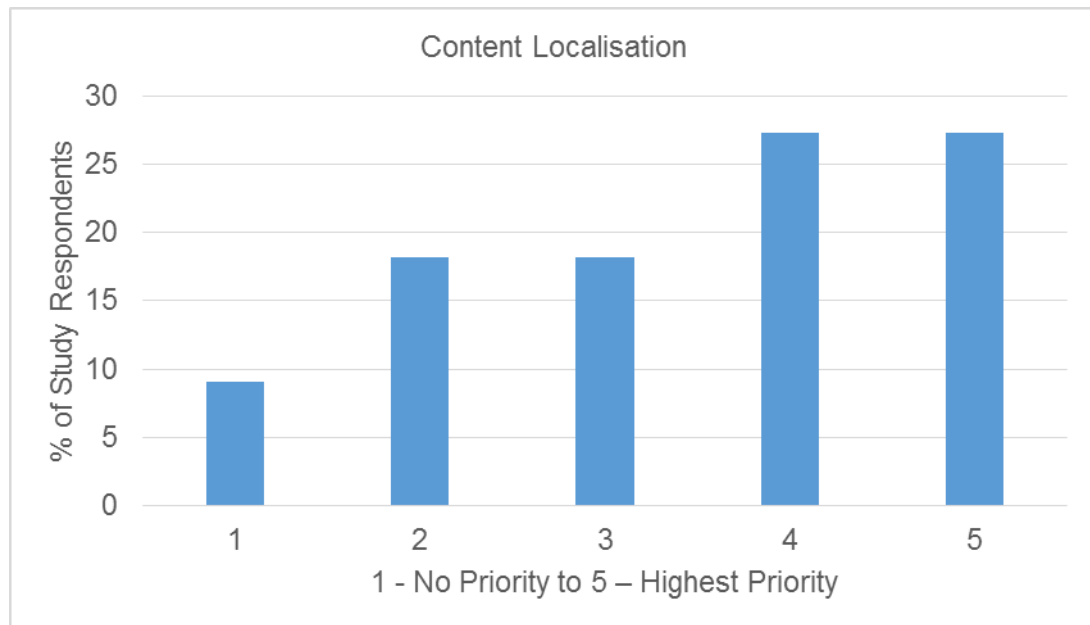


Figure 69: Content localisation (I.30-A)

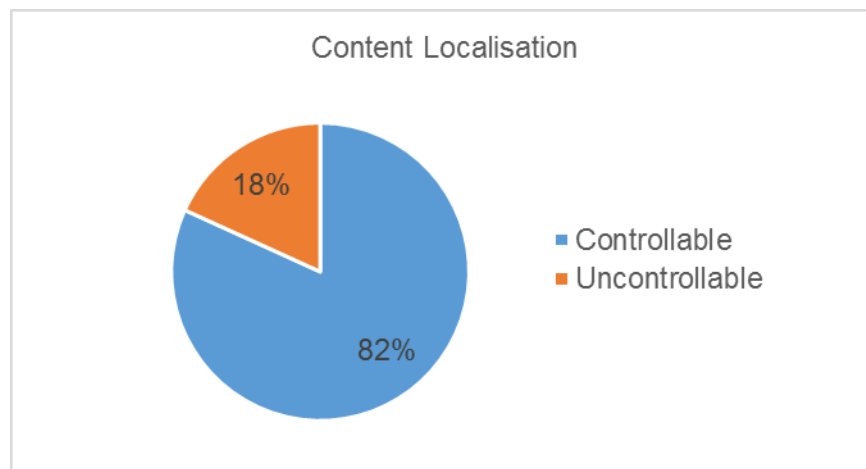


Figure 70: Content localisation (I.30-B)

I.31 Capital Requirements

Source of capital or investments.

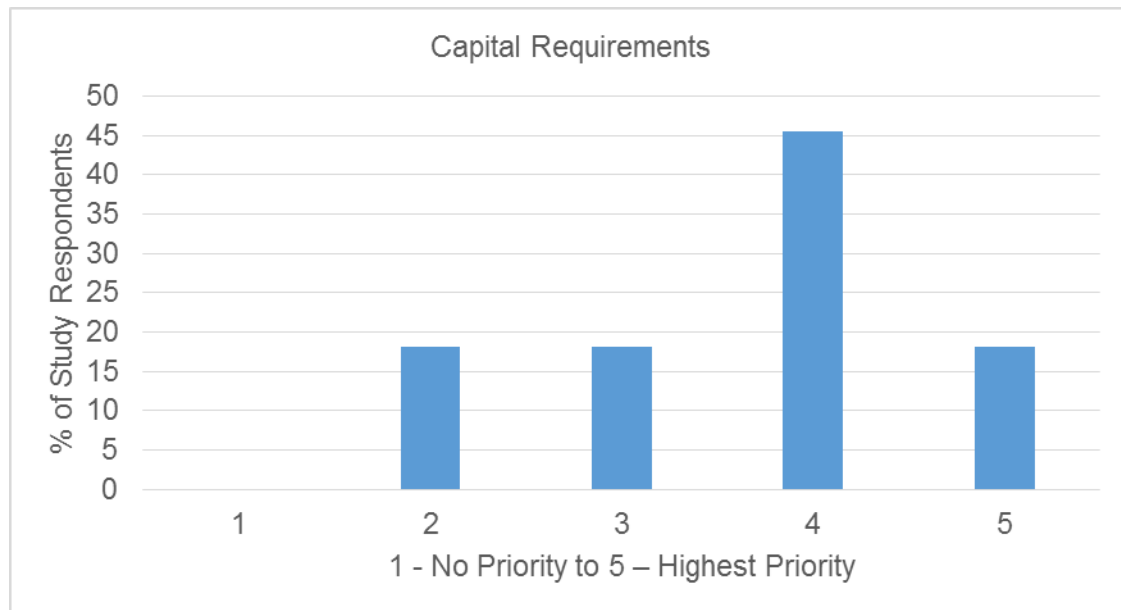


Figure 71: Capital requirements (I.31-A)

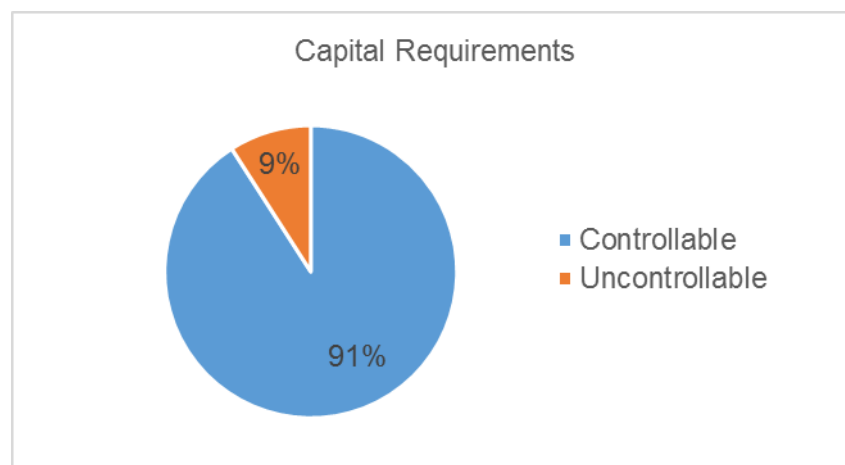


Figure 72: Capital requirements (I.31-B)

I.32 Time to Market

The amount of time spent to develop mobile application and deploy to the market (Build, Measure and Learn Cycle).

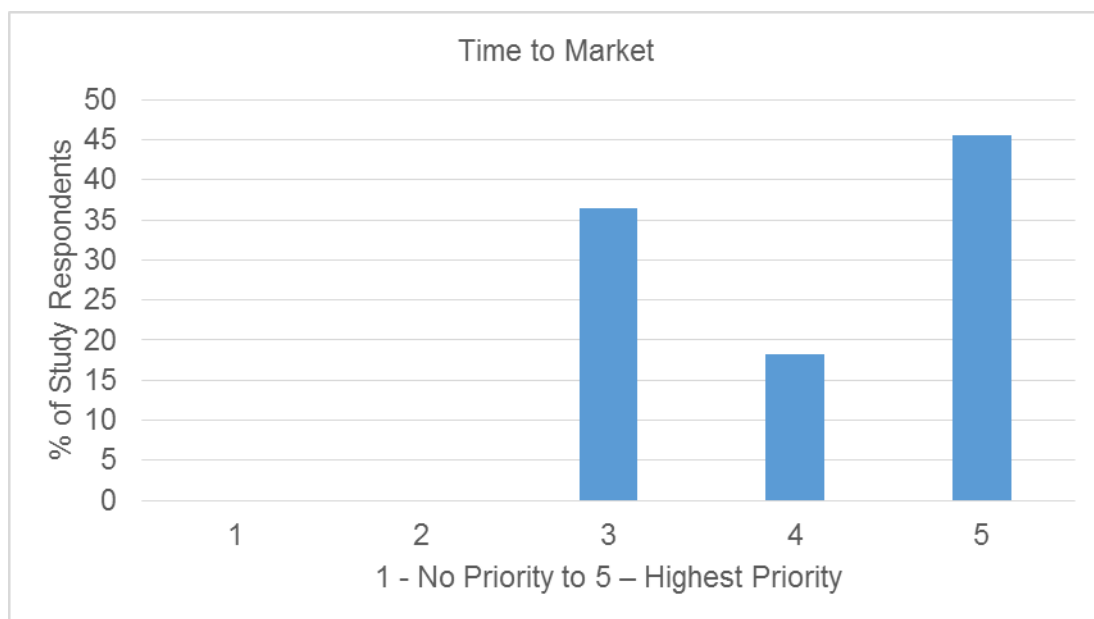


Figure 73: Time to market (I.32-A)

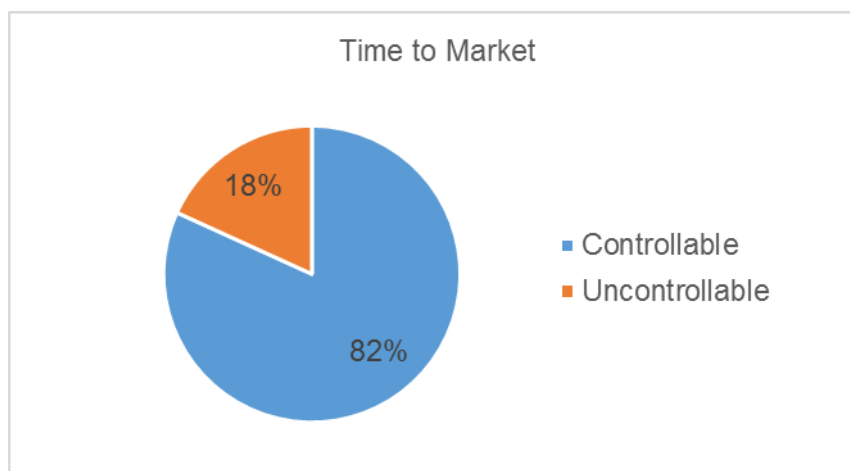


Figure 74: Time to market (I.32-B)

I.33 Market Fragmentation

The African market space contains a diverse range of cultures, demographic groups and income segments.

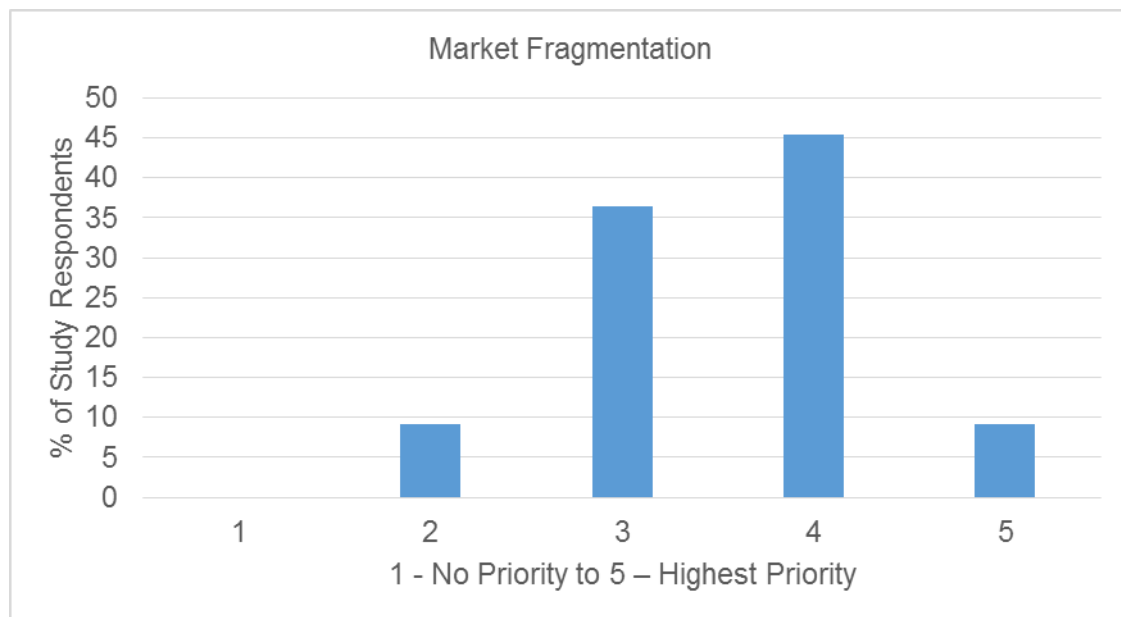


Figure 75: Market fragmentation (I.33-A)

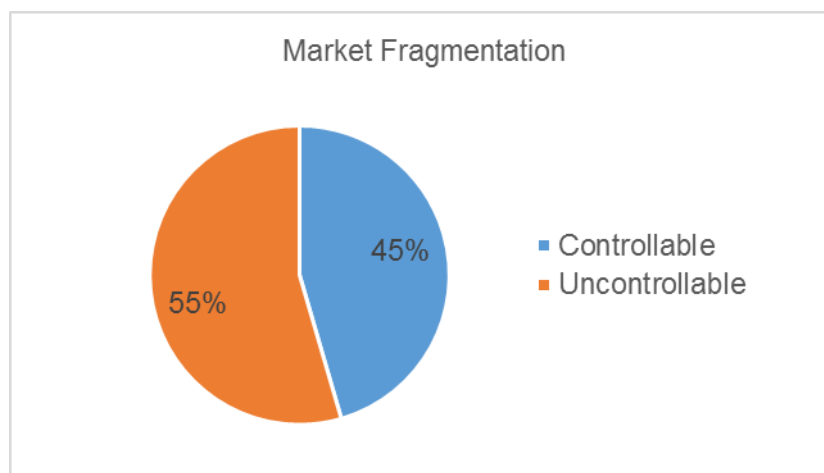


Figure 76: Market fragmentation (I.33-B)

I.34 Developer Skills

Programming and designing mobile applications.



Figure 77: Developer skills priority (I.34-A)

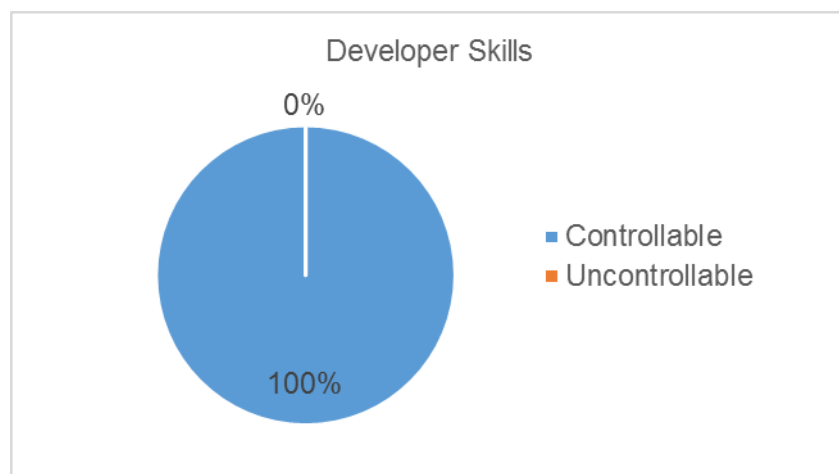


Figure 78: Developer skills controllability (I.34-B)

I.35 Entrepreneurial Skills

Level of business knowledge for mobile application entrepreneurs.

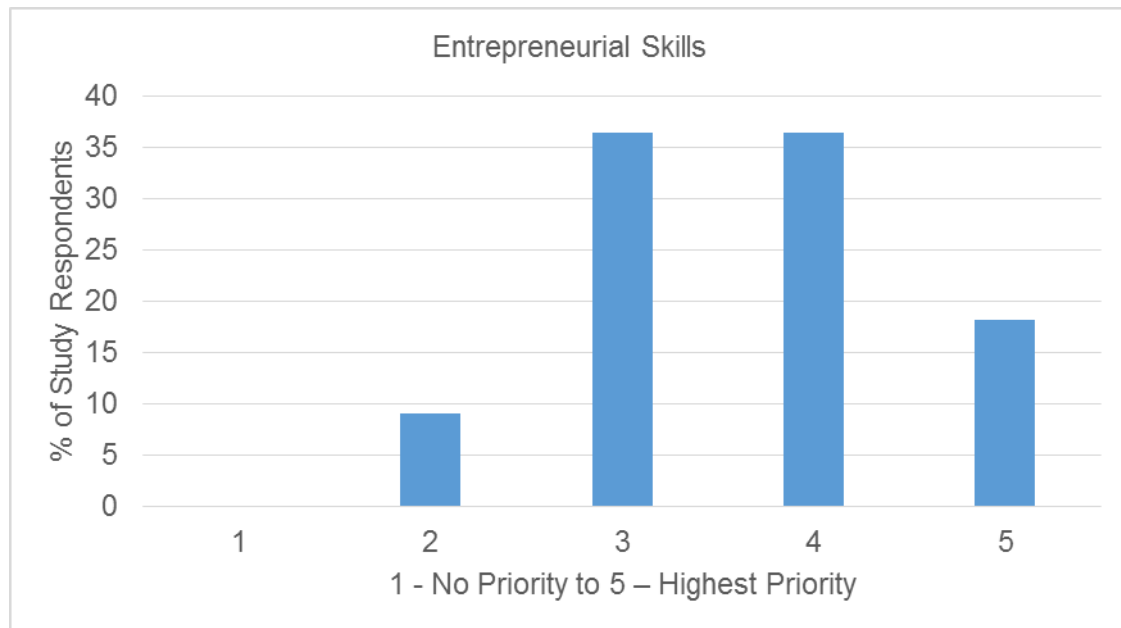


Figure 79: Entrepreneurial skills priority (I.35-A)

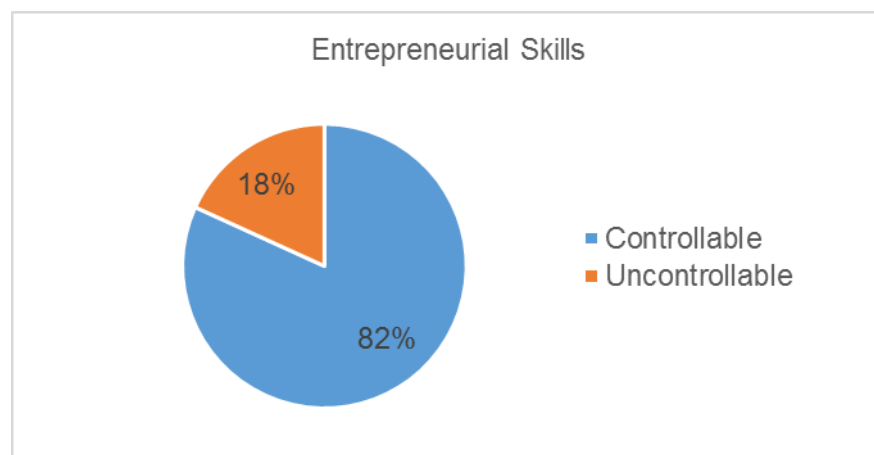


Figure 80: Entrepreneurial skills controllability (I.35-B)

Appendix J – Research work break down structure

To complete the research, the following points were used to break-up the research tasks and road map the study:

Literature review tasks

1. Complete a well-structured and comprehensive literature review on the process of MAD and the LSU business approach. In addition, the literature review would define the concept of a driver (in the context of this study) and finally list the drivers identified for this study.

Research design and methodology tasks

3. Use the LSU as a baseline for the drivers.
4. Rank the priority and controllability of the identified drivers, as they influence MAD in SSA.
5. Design a questionnaire that could be used to gather experimental data.
6. From the returned questionnaire's feedback, design a follow-up interview based on the highest ranked drivers.
7. Describe the study respondent's selection process.
8. Describe the experimental- and data collection methods used.

Experimental results tasks

10. Critically evaluate the above mentioned drivers in terms of priority and controllability.
11. Verify the results.
12. Conclusions and Recommendations
13. Conclude whether the researcher's hypothesis proved correct or incorrect.
14. Recommend (based on the literature review and information gained from the experiment) a suited business model framework for a mobile application business start-up in SSA.

Appendix K – Equations list

1. Weighted total equation used to calculate

$$\text{Weighted Total} = (\text{Ranked Total} \times \text{Scale Value})_1 + (\text{Ranked Total} \times \text{Scale Value})_2 + \dots + n$$

Weighted Total: Respondent total, weighted to scale value

Ranked Total: The total of respondents that ranked an element to a specific scale value

Scale Value: The dimension used assign state to an elements, for example: [1-5] on a relevance scale.

2. Weighted total equation used to calculate

$$\text{Average} = \frac{\text{Total of Elements}}{\text{Number of Elements}}$$

Total of Elements: The sum of each element in the population

Number of Elements: The number of elements in the population.