Stokvels: Bringing Together Borrowers, Savers, and Investors

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Declaration

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Philosophy to the University of Cape Town. It has not before been submitted for any degree or examination.

Signed by candidate

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Abstract

Stokvel, in South Africa, is used as an umbrella term for Rotating Savings and Credit Associations (ROSCAs) and Accumulating Savings and Credit Associations (ASCAs) which are informal financial associations where the members agree to regularly contribute a set amount to a fund.

In South Africa, there are 11.4 million stokvel members which make up about 30% of the adult population. These stokvels save up to R49 billion per year yet, many of the people in these communities that save this money find themselves unable to gain access to credit and savings facilities.

An agile and iterative approach was used to develop a web-based stokvel management application that allows groups to adopt a structure where there are borrowers who pay interest, and savers and investors who will receive interest on their savings.

Four different evaluations were carried out on the system namely, (1) system testing, to evaluate the implemented features and their correctness, (2) a heuristic evaluation with a set of expert evaluators, (3) usability testing and (4) user acceptance testing with potential users of the application. The evaluators and users gave the application a combined score of 76.875, which translates to a good interface on the System Usability Scale. The users accepted the application, however, the system usability testing showed that the interface needed improvement. The system was developed using multiple iterations but time constraints did not allow for multiple iterations of user testing. It is best to have multiple iterations of user testing so that the user experience feedback can be incorporated into the following iterations

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Chapter 1

Introduction

Financial inclusion places emphasis on how financial institutions and markets can be made to work better for poor and low-income communities. However, increased financial inclusion requires understanding how both formal and informal services can be used to meet people's needs (Trust, 2018).

Present-day South Africa is plagued with extreme poverty, high levels of inequality and unemployment (Matuku and Kaseke, 2014). A large number of people in low-income communities in South Africa do not have access to formal banking solutions, such as bank accounts. This results in these people not being able to gain access to credit, savings and investment opportunities (Lukhele, 2018). This forces these destitute communities to rely on informal self-help initiatives in order to access these necessary services. Stokvels, which are informal community-based savings groups, are one of the key initiatives that have been used by a large number of black South Africans (Matuku and Kaseke, 2014).

In South Africa, there are 11.4 million stokvel members which make up about 30% of the adult population. These stokvels save up to R49 billion per year yet, many of the people in these communities that save this money find themselves unable to gain access to credit and savings facilities. In 2010, 33% of the South African adult population did not have a bank account and only 40% had some form of a long-term insurance product (Lukhele, 2018).

1.1 Project Significance

During the apartheid years, black South Africans were excluded from participating in the formal economy, and as a result they were uninformed about the formal financial institutions, such as banking and insurance, which is why the majority of these people resorted to stokvels to access these financial products (Matuku and Kaseke, 2014). The large amounts of money saved by these groups have attracted the attention of many large banking institutions who now have opened club savings accounts. The first stokvel club bank account was opened in 1988 by Perm (Previously the South African Permanent Building Society, a division of the Nedcor-Group, now operating as the Nedbank Group) (Lukhele, 2018). Although these club savings accounts have been in existence for decades they still face criticism of not offering more investment products with higher interest rates. Community leaders have also expressed concerns that the money from these club accounts is used to promote white business, while the members of the stokvels struggle to get home or business loans. Lukhele (2018) writes that these community leaders would like to see the funds being invested in the development of black communities and the financial education of the stokvel members.

A research question was formulated around this problem in order to investigate an approach to solving the problem. The approach aims to use stokvels as a means for community members of disadvantaged communities to gain access to credit and savings opportunities.

1.2 Research Question

Can a stokvel be used as a means for members to access low-interest credit while providing a savings and investment platform for other members?

1.2.1 Project Aims

To build a web application that will allow members of a stokvel group to:

- access low-interest credit by signing up to receive the stokvel money near the beginning of the rotation
- to save money, by signing up to receive the money close to the middle of the cycle, while earning a small amount of interest on their savings
- finally, to invest their money, by signing up to receive the money last or near the end of the cycle, and earning a higher interest on their savings.

The web application will give the users the following functionality:

- sign up as users
- create a stokvel group
- set up a stokvel where either:
  - interest is added to the monthly contribution that group members pay

  - or standard monthly contributions are paid

- join multiple stokvels in order to achieve their financial goals.

1.3 Literature Review

This section reviews previous research that has been done on savings groups in South Africa and other parts of the world. The make up of these groups is discussed, how they have evolved over the years and the types of savings groups that exist today, the rationale for joining one of these groups and the existing applications built to aid in the activities of savings groups. This research is used to understand how the existing knowledge can be built upon.

1.3.1 What is a stokvel?

Stokvel, in South Africa, is used as an umbrella term for Rotating Savings and Credit Associations (ROSCAs) and Accumulating Savings and Credit Associations (ASCAs) which are informal financial (Mulaudzi, 2017) associations where the members agree to regularly contribute a set amount to a fund. This fund, the "pot", will be paid to a member of the group on a rotational basis or distributed among all the members of the group after a given time period, in the case of an ASCA (Bisrat *et al.*, 2012).

ROSCAs were developed in low-income countries in order to help members gain access to credit and help cope with risk, such as the death of a loved one (Kedir, 2005). According to Lukhele (2018), there are close to 80 000 stokvels in South Africa which save about R45 - 49 billion every year, while, in Ethiopia, the savings of ROSCAs are said to make up 8 to 10 percent of the country's GDP (Kedir, 2005). ROSCAs have different names around the world, in Ethiopia, they are known as Ekub (Mulaudzi, 2017), Osusu, Esusu, or Susu in Gambia, Nigeria, and Sierra Leone, Tanda in Mexico, and Paluwagan in the Philippines (ROSCAS, 1995).

ROSCAs combine borrowers and savers. The members receiving the pot near the beginning of the cycle are seen as borrowers who pay off their loan over the life of the ROSCA, in contrast to the members receiving the money near the end of the cycle, who are seen as savers as they only have access to funds near the end of the life of the ROSCA (Kedir, 2005).

1.3.2 The make-up of stokvels and how they operate

Stokvels are usually made up of 3 to 50 (Mulaudzi, 2017) people, Bisrat *et al.* (2012) has cited some groups having up to several hundred members. The stokvel elects a committee that consists of a chairperson, secretary, and treasurer. This committee is usually in charge of running meetings and the day to day admin of the stokvel. In the smaller sized stokvels, the members are usually close associates, friends, neighbours or schoolmates (Bisrat *et al.*, 2012). The larger groups are often made up of people who do not have close ties to each other, meaning that anyone who is known by at least one member of the group and whose character can be vouched for by the members of the community can join the stokvel (Bisrat *et al.*, 2012). This close association means that ROSCAs, even the larger ones, have an advantage over banks in that they can monitor their members and also enforce payment (Kedir, 2005). ROSCAs have been known to enforce social and economic sanctions on members who default without good reason (Besley *et al.*, 1993). The defaulting member will then struggle to join another ROSCA due to a lack of "social collateral" (Besley *et al.*, 1993).

There are primarily three ways in which the group can decide who will be getting the next pot, namely using 1) random allocation 2) bidding or 3) chairperson/leader allocating funds (Kedir, 2005). When using random allocation there is usually a random draw. The name that is picked will receive the next pot, that name is then removed from the names eligible for the next draw. This process is repeated until all the members have received the pot in that cycle. Kedir (2005) explains that the bidding process requires that members put forward a price that they are willing to pay to be the recipient of the next pot. The pot is allocated to the highest bidder, which is the person willing to accept the smallest percentage of the pot. The members also receive the pot only once in the cycle, until all members have received the pot. The chairperson or leader of the ROSCA can also be elected to allocate the next pot (Kedir, 2005). With this method, the chairperson will take into account the financial needs of the members and members ability to pay. This helps minimize the risk of default, because some members will be better credit takers and others better savers (Kedir, 2005)

1.3.3 How stokvels have evolved over the years

The word stokvel is said to originate from the word "stock fair" (Mulaudzi, 2017), which were cattle auctions held in the 19th century. This was a forum for the farmers and labourers to come together and socialize and pool money together to purchase cattle (Response, 2012). The labourers took this concept of pooling money together back to their villages. The first stokvel in South Africa was recorded to have started in 1932, known as the "Bantu burial society" Mulaudzi (2017). This came into existence because the law forced black workers to work in places far away from their families, such as the mines. Mulaudzi (2017) explains how the death of these migrant workers while away at work would be a huge financial burden on their families, as transporting the bodies back to the village would be expensive. The wives of these migrant workers then started to pool money together in the case of a death of one of their husbands. The money would be used to transport the body home and cover funeral costs (Mulaudzi, 2017). Stokvels have since then been stereotyped, in South Africa, as financial associations for the poor, as they have been used by this group as a means to gain access to credit and insurance since they have been historically underserved by formal financial institutions (Response, 2012).

1.3.4 Types of stokvels

Burial societies

Burial Societies are a combination of saving and insurance associations (Irving, 2005). The group's aim is to make contributions to a fund that will cover funeral expenses in the case of a member having a death in their family (Matuku and Kaseke, 2014). The funds can also be used should a member become ill or loses their employment. A burial society does not work exactly like an insurance policy, as the amount a member receives is usually linked to their prior savings (Irving, 2005).

Rotating savings and credit associations

This group requires members to make regular, timely, contributions to a fund. The money collected is then allocated to a member of the group at each meeting, usually monthly meetings, on a rotating basis (Kedir, 2005). These allocations are made using a lottery, bidding, or mutual agreement among group members. This group brings together borrowers and savers while combining saving, insurance, and credit (Kedir, 2005). Those users who take the pot near the end of the cycle are savers and the ones who take it first are borrowers. Members having close ties usually means that the members do not mind swapping turns to receive the pot should a major event occur for a member (*What are Savings Groups*, 2018).

Accumulating savings and credit associations

Accumulating savings associations also require members to make regular contributions to a fund, however, the money is not paid out to members on a rotating basis. The money is saved until an agreed date (*What are Savings Groups*, 2018). This money can be used to provide interest-bearing loans to members or people not in the association. The main advantage of this type of saving group is that people who wish to borrow need not deposit money into the fund in advance and people who have surplus money and wish to save can deposit their money into the fund (Kabuya, 2015). This kind of association requires stricter bookkeeping as the contributions made by members and loans granted over the life of the association needs to be recorded (Kabuya, 2015). Careful consideration needs to be made on what to do with excess funds, coming from the interest from loans, and when to redistribute the money to members (*What are Savings Groups*, 2018).

Entertainment Stokvel

The recipient of the pot in South African ROSCAs is usually responsible for hosting a gathering where the members members pay a set amount to attend the gathering and socialise. This has led to a new type of stokvel, where members pay a fee to attend a gathering where food and drinks are sold at a profit (Irving, 2005). This stokvel is not restricted to only the members of the group as loud music is played to attract passers-by in order to increase the profit made from sales.

Cooperative buying societies

Stokvels might also be formed in order to increase members' buying power and purchase goods in bulk (Irving, 2005), an example given by Response (2012) of such goods is Christmas groceries. The groceries purchased are usually non-perishable goods and are sometimes also distributed to extended family (Response, 2012). These grocery stokvels are usually neglected in literature as they provide no further insights into members economic and social behaviours (Irving, 2005).

1.3.5 Why people join stokvels

Many arguments have been put forward as to why people join ROSCAs but no consensus has been reached (Besley *et al.*, 1993). Kedir (2005) sites increasing individual buying power for buying consumer durable goods, reducing intra-household conflict due to resource allocation, insurance against risks such as the death of a loved one, handling social pressure, helping discipline members to save regularly even if the member's saving preferences change over time as reasons why people join ROSCAs. Gugerty (2007) quotes a ROSCA member saying that they enjoy the inflexible nature of the contributions and they join ROSCAs "to get the strength to save".

When buying consumer durable goods, the members of the stokvel will be more likely to push to get the pot earlier and the person who gets the pot last will not be any better off by joining the stokvel. Their motives for joining might be linked with disciplining themselves to save regularly (Bisrat *et al.*, 2012). Should the stokvel be joined as a means of insurance then the members should be able to readily switch the order in which the pot is allocated. Bisrat *et al.* (2012) critics the insurance motive, because members of a stokvel usually live in the same geographic area, have similar occupations and as a result, have similar salaries and are prone to the same shocks as the other members. However, Bisrat *et al.* (2012) does motivate for the reduction of intra-household conflict theory stating that men care less about durable goods while women prefer to allocate some of the household income to saving towards the purchase of the durable goods. That is why some women are said to join stokvels without their husband's knowledge, but this has not been confirmed because 40% of stokvels require the spouse's approval upon joining (Bisrat *et al.*, 2012).

1.3.6 Existing ROSCA applications

The large amount of money being saved by ROSCAs has resulted in a large number of applications being developed to manage ROSCA activities. A few of these have been reviewed in the section below.

Stokfella

StokFella (2018) is a South African platform that helps stokvels to manage their admin, monthly member contributions and payouts. Stokfella seeks to empower stokvel groups by providing them with financial management and financial decision making tools. This platform allows stokvels to grow their savings by giving them access to investment channels on the application. The platform has a free "Basic Account" which gives users the basic features of managing their stokvel admin and user contributions and allows up to 5 members. The "Advanced Account" allows users to invest in interest-bearing products and allows up to 50 members.

ROSCA Finance

Rosca Finance (2018) is a crowd-savings platform that allows a group of individuals to come together for a set period of time to contribute money to a fund. This fund allows members to save, borrow, and invest money on the same platform. The amount contributed by the members increases on each rotation. Users join the platform and position themselves in the rotation such that the position aligns with their intention to borrow, save, or invest. The borrowers will be near the start of the rotation, they will pay interest, savers near the middle, they will earn a little interest, and the investors near the end of the rotation, they will earn more interest than the savers.

Chamapesa

Chamapesa (2018) is a Kenyan ROSCA platform that uses digitised bookkeeping and Ricardian Litechains to provide users with private and immutable ledgers. These immutable ledgers improve accountability and transparency amongst chamas (the Kenyan term for a ROSCA) in Kenya and reduce theft, fraud and accounting errors. Chamapesa uses an ERC-20 token called Chamacoin. This coin can be used to collect and distribute usage fees, reward users and be used as collateral. A chama has to put up collateral in the form of Chamacoin. This collateral is then held in a Smart Contract. Members are encouraged to recruit new members or chama groups to join the network as this will earn them Chamacoin and increase their group's savings. Chamacoin can also be earned by groups sharing their data with third parties.

Tanda

Tanda is a Yahoo Finance ROSCA application. The application allows groups of 5 or 9 to make fixed monthly contributions to a "money pool" (Perez, 2018). The first two people to receive payouts pay an interest fee, while the last two people to receive payouts earn 2% interest on their contributions. A user's score increases by making contributions to their group. With a higher score, a user gains access to savings groups with higher contributions and options to receive their payouts earlier (Perez, 2018). Should a member drop out of the group the group will need to cover their position. To join the platform users need to submit a valid ID and have a U.S. bank account (Perez, 2018).

Cashare

Cashare (2018) is a platform in Switzerland that facilitates ROSCAs activities by combining peer to peer banking and peer to peer lending. Users invite individuals to join their savings group who will contribute the same amount to the pot.

KyePot

KyePot (2018) is a platform that provides people in India with a means to borrow money at low rates and save money and earn good returns. The platform allows chits (Indian term for ROSCA) to track their savings and set financial goals. The members contribute a set monthly amount. This pot is allocated to a member using a bidding process. The member with the lowest bid (willing to take the smallest percentage of the pot, e.g. 85%) gets the pot for that month. The remaining (e.g. 15%) gets split between the members of the group, including the member that won the bid.

Chapter 2

Design and methodology

This section describes the development approach, methodologies and requirements gathering processes that guided the design and implementation of the stokvel management application, Stokkie.

2.1 Development Approach

An agile and iterative approach was used in the design and implementation of the application. The features were tested with a set experienced software developers. They looked at the design and the flow of the application and gave feedback based on industry standards for developing software. The feedback was recorded and used to improve the design and flow of the pages.

The Kanban development methodology was used in order to track and manage progress. Kanban is based on three principles (1) creating a workflow of what needs to be done, (2) preventing the team from committing to too much by limiting the amount of work in progress, (3) creating a flow of tasks, once a task is done the task with the highest priority on the backlog will be started next (*What Is Kanban?*, 2018). Trello boards were used to track tasks. Tasks were divided in to 'To Do', 'In Progress' and 'Done' lists.

The tasks on the Trello board were made up of user stories. These are used to determine the tasks that the user should be able to perform in order to complete their user story, "As a [type of user] I want [some goal] so that [some reason]".

Personas were also used in order to determine who the application is being designed for (Cohn, 2004). Three personas exist for the Stokkie application. Nomathemba: is a 42-year-old "spaza" shop (informal convenience store located in townships) owner and needs to buy some stock for the Easter holiday. She wishes to borrow money at a low interest rate, but does not have a credit record to borrow from a bank. Sipho: is a 33-year-old artisan and would like to save up some money in order to start his own business in the next 6 months. He would like to put aside some money every month to ensure that he has enough to purchase his own equipment. Zipho: is a 37-year-old domestic worker. She has two children, one of which will be starting high school next year. She would like to save enough money to be able to go see her mother in the Eastern Cape in December and buy her Christmas groceries, and to buy stationery and uniforms for her children when they go back to school in January. She would like to invest her money in order to earn good interest on her savings over the 12 month period.

2.2 Requirements Analysis

The end user was not involved in the requirements analysis process, the requirements were sourced from existing literature, mainly from Mulaudzi (2017), "From consumers to investors: an investigation into the character and nature of stokvels in South Africa's urban and peri-urban and rural centres using a phenomenological approach". In his paper, he discusses the opportunity to use stokvels as a source of financing for small to medium enterprises in communities (Mulaudzi, 2017).

The requirements were also sourced from *Rosca Finance* (2018), which is a crowd-savings platform. ROSCA Finance, however, requires that users have a United States bank account. Stokkie aims to reduce the barriers to joining by not requiring that bank accounts be registered in order to facilitate the stokvel activities.

The requirements analysis focused on structuring stokvel groups in such a way that they can provide credit to those who need it while rewarding the members that are willing to receive money near the end of the stokvel rotation.

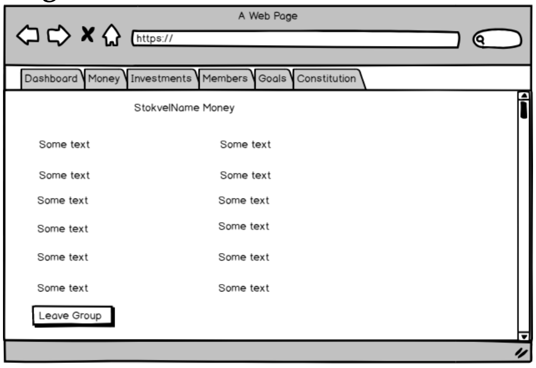
2.3 Wireframes

Wireframe prototypes were used in order to determine the layout of the screens and how the screens should flow in order to complete tasks (Snyder, 2003). Wireframes were used to design the layout and flow of the web application. An example of one of the wireframe screens is below in Figure 2.1.

2.4 Unified Modeling Language (UML) class diagram

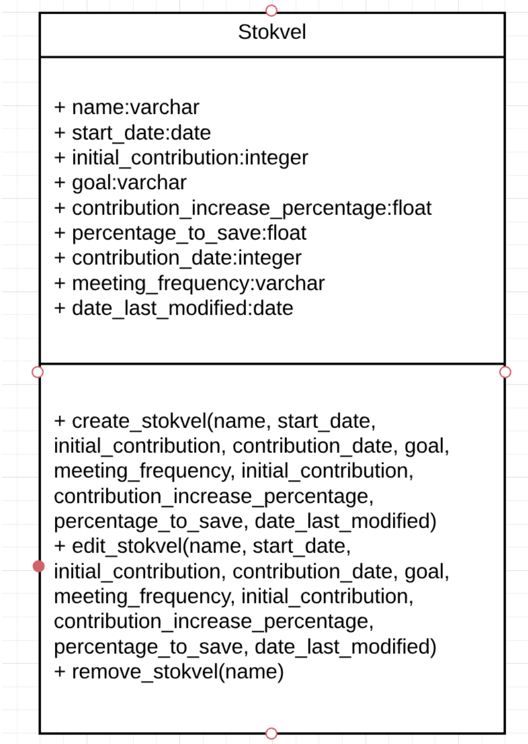
This section outlines the model classes that were used to define the Django models. UML class diagrams were used to define the architecture of the software. UML diagrams aid in the initial development of the system and developing the system as it evolves (Selic, 1998). The model classes included the following classes (1) StokvelUser: stores the individual user information, created when a user signs up

Fig. 2.1: The stokvel information view .



onto the application, (2) Stokvel: stores the information about the stokvel group that will be used to determine the monthly contributions, (3) StokvelMembers: stores the users of the application that are a part of a particular stokvel and what their position is in the rotation, (4) StokvelRotation: records the information about the order in which members will receive the money in the cycle, (5) StokvelPayout: records the amount that will paid out to each member. Figure 2.2 shows an example UML class diagram of the Stokvel class.

Fig. 2.2: An example of the Stokvel class diagram.



Chapter 3

Implementation

This section outlines the features that were implemented and the development tools and frameworks that were used to develop the system.

3.1 Results of Requirements Analysis

From the available literature the requirements list, following in section 3.1.6, was produced. The application can be used as a simple tool to manage stokvel members contributions and payouts, in accordance to how the group usually operates or as a tool for stokvels that want to structure their savings group such that there are borrowers who pay interest, and savers and investors who will receive interest on their savings.

3.1.1 Aim

To allow users to be borrowers, savers or investors in a stokvel. This structure will allow stokvel members to gain access to credit by receiving the money near the beginning of the cycle and to incentivise members who get the positions near the end of the cycle to not opt into saving on their own.

3.1.2 Why

We need to incentivise members of a stokvel to take positions that are closer to the end of the rotation instead of rather saving on their own. The current way of doing things makes it such that the members at the end of the rotation lose out on the interest that they could have gained if they had put their money in a savings account, as they receive the same amount as the person who receives the money first. This first receiver is essentially getting an interest free loan.

We also need to incentivise members that have already received their pot to not drop out of the stokvel due to the member's saving habits or needs changing.

Tab. 3.1: Results of system usability testing

Member number	Member contribution	Member receives
1	R1000	R6000
2	R1010	R6060
3	R1020	R6120
4	R1030	R6180
5	R1040	R6240
6	R1050	R6300

Members dropping out during the rotation causes a major problem because the remaining members have to step in and cover for the member. The members in the group need to be protected from defaulters. Many of these groups do not have a large amount of expendable income after paying their bills, having to pay much more than what they initially planned might lead to even more defaulters.

3.1.3 How it works

Members decide on an initial contribution amount. This will be the first amount contributed by members to the fund. An interest rate should also be decided on. This interest rate will determine by how much the monthly contributions increase. For example, a group of 6 could decide on R1000 as the initial contribution and 1% as the interest rate. Table 3.1 displays how much each member will get when it is their turn to receive the money.

3.1.4 Protecting against defaulters

Members have the option to set aside a portion of the interest on the monthly payments and put it in a savings account. This will be used to cover for defaulters, by decreasing the amount of money that the remaining members have to pay if one drops out during the cycle and also incentivise members to stay until the end of the cycle. If none of the members drop out then the money will be distributed equally to the members at the end of the cycle.

3.1.5 Limitations

The size of the stokvel will be limited to 12 people so that the complete cycle does not take longer than 12 months, as longer cycles might increase the risk of members defaulting. The individual monthly contributions will be limited to R 10 000 per person. The National Credit Act (NCA) (*National Credit Act*, 2006) of South

Africa requires entities that lend money must register as a credit provider with the National Credit Regulator under two circumstances (1) if the lender has at least 100 credit agreements under their name or, (2) the money owed to them in the credit agreements which they are party exceeds R500 000. Therefore the maximum that a member could receive in a stokvel of 12 people each paying R 10 000 would be R 120 000, well under the threshold set by the NCA.

3.1.6 Implemented features

The features implemented in the application are as follows:

- Sign up as a user
- Create a stokvel
- Join a stokvel
- Allow stokvels to calculate member contributions and set who is next in the rotation
- Display the monthly contributions, how much a member at a certain point in the cycle will get based on the monthly contribution increase.
- Allow stokvels, that wish to keep to their normal operation, to manage their stokvel activities without increasing contributions

3.1.7 Development Tools

The application that will allow users to complete all the functionality outlined above is a web-based application. The web application was developed using the Django[1] web framework with a SQLite[2] database as these allow for quick prototyping. HTML and JavaScript were used for the front-end. The Model View Controller[3] (MVC) pattern was used in the development of the web application. Models were outlined and classes defined for them. Wireframes were designed for the create, display, edit and deletes views for the models. This process helped identify the necessary models and views, these were then refined during the implementation phase.

[1] https://www.djangoproject.com/
[2] https://www.sqlite.org/index.html
[3] https://en.wikipedia.org/wiki/Model-view-controller

GIT was used for source control, all of the source code is available on GitHub[4]and the PyCharm Integrated Development Environment (IDE) was used to develop the source code.

[4] https://github.com/thandile/StokvelApp

Chapter 4

Testing and evaluation

The evaluation plan and participants of the testing are discussed in the next section. Four different evaluations were carried out namely: system testing, a heuristic evaluation, system usability, and user acceptance testing. How each test is carried out and the expected outcomes of the test are explained below.

4.1 System Testing

System testing tests the system as a whole. System testing occurs after integration testing to confirm that the system as a whole works as expected (Aparna *et al.*, 2018). This testing method verifies that the system meets its specified requirements and focuses mainly on (1) external interfaces, (2) multi-program and complex functionalities, (3) security, (4) recovery, (5) performance, (6) operator and user's smooth interaction with the system, (7) installability, (8) documentation, (9) usability 10) load/stress (Aparna *et al.*, 2018). System testing focuses on testing the architecture of the application and whether the business requirements have been met, it also helps minimise the post-deployment support calls. White-box testing (Nidhra and Dondeti, 2012) was used as the tester was familiar with the internal structure and workings of the application. The following aspects of the system were tested (1) functionality, (2) recoverability, (3) reliability, (4) documentation and, (5) security (Aparna *et al.*, 2018). The test case outline the objective of the test, the test description and the expected result. A test will be marked at "Passed" or "Failed" based on the outcome of the test.

Test Case ID	Test Case Objective	Test Case Description	Expected Result	Pass/Fail
1	Sign up as a user	Enter user details and click register	Login in screen appears	

4.2 Heuristic evaluation

Nielsen (1995) has 10 general principles for interaction design, these help developers find usability problems with their user interfaces in order to improve the user experience. These principles cover the following areas concerning the interface (1) visibility of system status, (2) Match between the system and the real world, (3) User control and freedom, (4) Consistency and standards, (5) Error prevention, (6) Recognition rather than recall, (7) Flexibility and efficiency of use, (8) Aesthetic and minimalist design, (9) Help users recognize, diagnose and recover from errors, and (10) Help and documentation (Nielsen, 1993).

This evaluation was conducted with an Information Systems Masters student and an industry software developer. These evaluators also completed the usability evaluation, however, the heuristic evaluation was completed first so that the findings from the evaluation could be implemented before the usability evaluation.

The evaluators were asked to carry out common tasks that users would want to complete on the interface. The evaluators were free to ask questions as they completed the tasks in order to clarify their assumptions. These tasks were designed so that the evaluators could determine how easily a novice user would be able to complete tasks on the interface.

4.3 System Usability Testing

Usability testing measures how easy or intuitive it is to use an interface. Three potential users were identified. They are all currently members of one or more stokvel groups and work as unskilled employees in corporate companies. They all have basic knowledge of how to use a computer and know how to use websites available on the Internet. During the usability testing the users carried out specific tasks and they were observed while completing them. Notes were taken about areas where they struggled or hesitated. After the test, the users completed the System Usability Scale questionnaire and gave comments on where they struggled and how they felt the interface could be improved in that area.

The testing was carried out using Brooke *et al.* (1996) System Usability Scale. The scale has been widely used to evaluate various systems. It uses a 5-point Likert scale, which ranges from "This is not a problem" to "This is a catastrophe" (Levi and Conrad, 1997), which includes 10 questions. The users answer the 10 questions by ranking them from 1 to 5, according to how much they agree with the statement.

The 10 questions are as follows (1) I think that I would like to use this system frequently, (2) I found the system unnecessarily complex, (3) I thought the system was easy to use, (4) I think that I would need the support of a technical person to be able to use this system, (5) I found the various functions in this system were well integrated, (6) I thought there was too much inconsistency in this system (7) I would imagine that most people would learn to use this system very quickly, (8) I found the system very cumbersome to use, (9) I felt very confident using the system, (10) I needed to learn a lot of things before I could get going with this system (Brooke *et al.*, 1996).

4.4 User Acceptance Testing

The user acceptance testing was conducted with the same group of users as the System Usability testing and at the same time. This testing requires that the users Accept or Reject the features that they are testing (Davis, 1993). The test was modified slightly by using a 5 point scale, a score of 1 meant that the user thought the feature was badly designed or implemented and would need further work and a score of 5 meant that the user accepted the feature as is (Leung and Wong, 1997). They were also encouraged to give comments as to why they gave the feature that score.

Chapter 5

Final Application Design

The principles used to design the interfaces were taken from Porter (2018) Principles of User Interface Design (1) Clarity is job number 1, (2) Conserve attention at all costs, (3) Keep users in control, (4) One primary action per screen, (5) Consistency matters, (6) Progressive disclosure.

Porter (2018) advocates for simple screens that can inspire confidence within the user and that will lead to further use. They also believe that users should be kept in control by having a visible system status and describing to the user what will happen should they continue with an action. In order to not confuse users Porter (2018) advises that interface elements should not be similar if they do not behave similarly, and this should be consistent throughout the interface. Users should also not be overwhelmed with too much information on one screen. They should be given enough information in order to make a choice and subsequent decisions should be delayed until necessary. To implement these principles simple screens were used. Screens only contained form fields which allowed them to complete the task at hand, to make it clear to the user what was expected of them and not get distracted by other actions they can complete on the page. An example of such a form is the create stokvel form in Figure 5.6. Interface elements that had different functions were designed or colour coded differently, for example, the edit and the exit buttons on the stokvel pages, in Figure 5.7. Drop down menus and tabs, as seen in Figures 5.6, 5.9 and 5.10, where used in order to minimise the information a user was given and the choices that they had to make at a time.

The images below(Figure 5.1 to 5.15) outline the flow of the screens in the Stokkie application. The source code for the project can be found in the Stokkie Github repository.

The images show the screens for signing up as a user, editing and viewing user details, creating a stokvel and and viewing the stokvel information, adding and viewing the members in a stokvel (Either the create or edit forms were shown in each case as they reuse the same template). The screen for adding details about the stokvel rotations are also included, the screen that shows the amounts that will be contributed by the members in the stokvel. Figure 5.10 shows the screen with the table that outlines the monthly contributions that will be made by members and what the members will be receiving. The members can use the ”Assign Members” to assign members to a position in the stokvel rotation.

Fig. 5.1: The user sign up view.

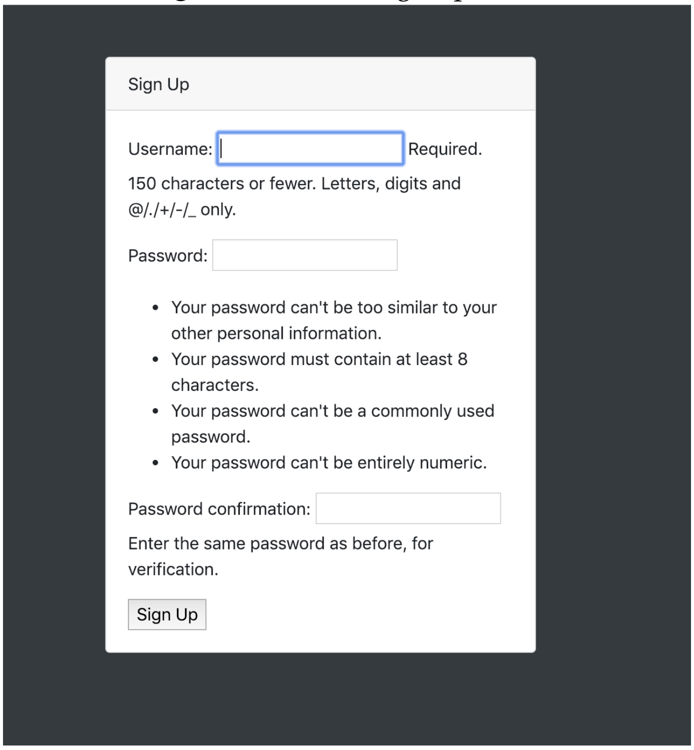


Fig. 5.2: The login page view.

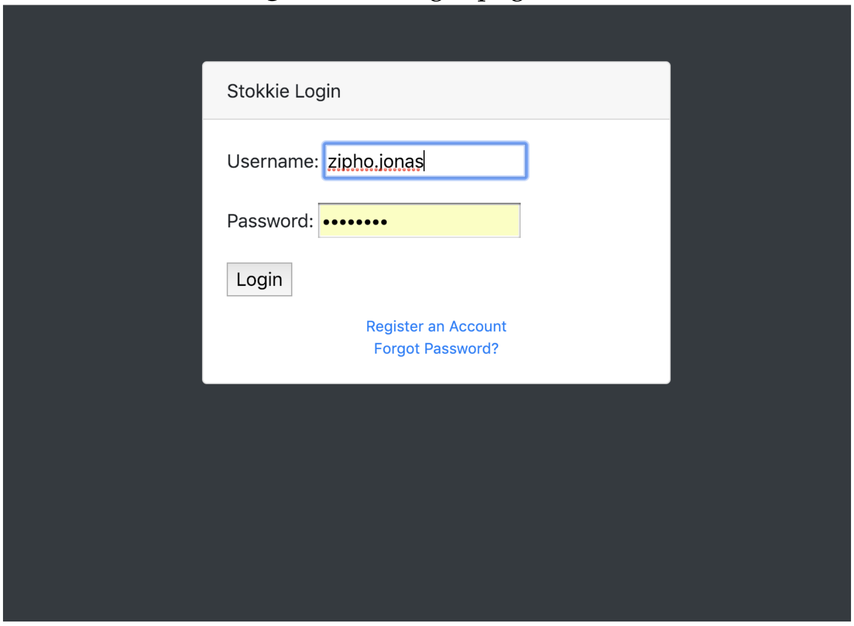


Fig. 5.3: The view that allows users to enter their user details and create their user account.

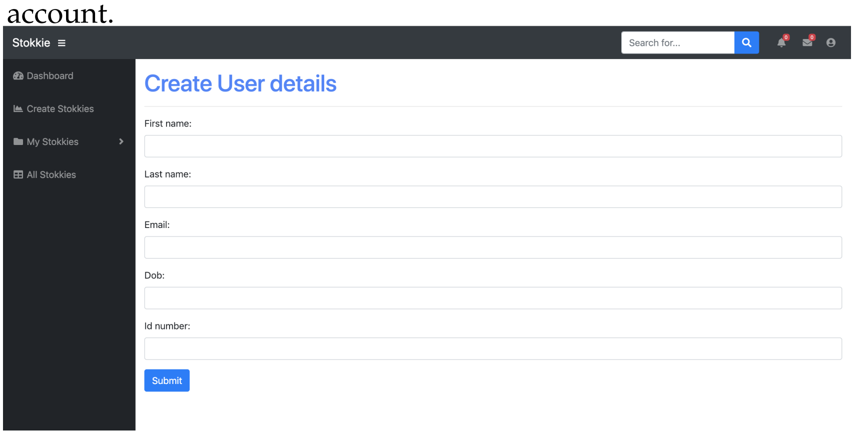


Fig. 5.4: The view that shows the user's information and allows them to edit their details.

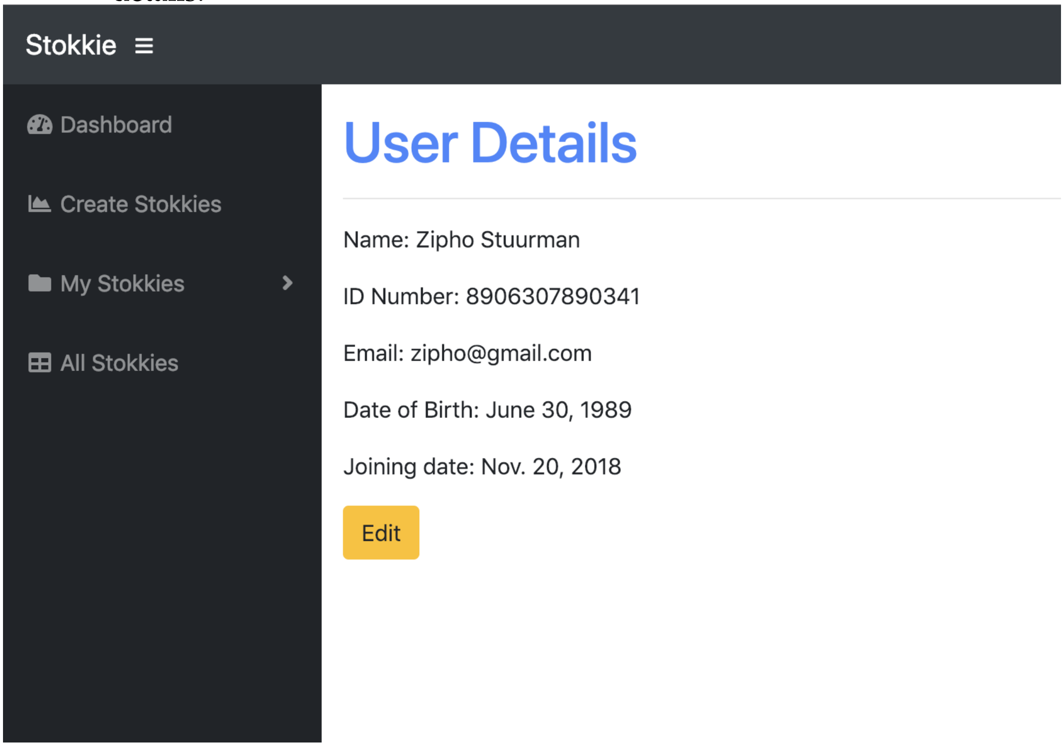


Fig. 5.5: The view that allows the user to edit their details

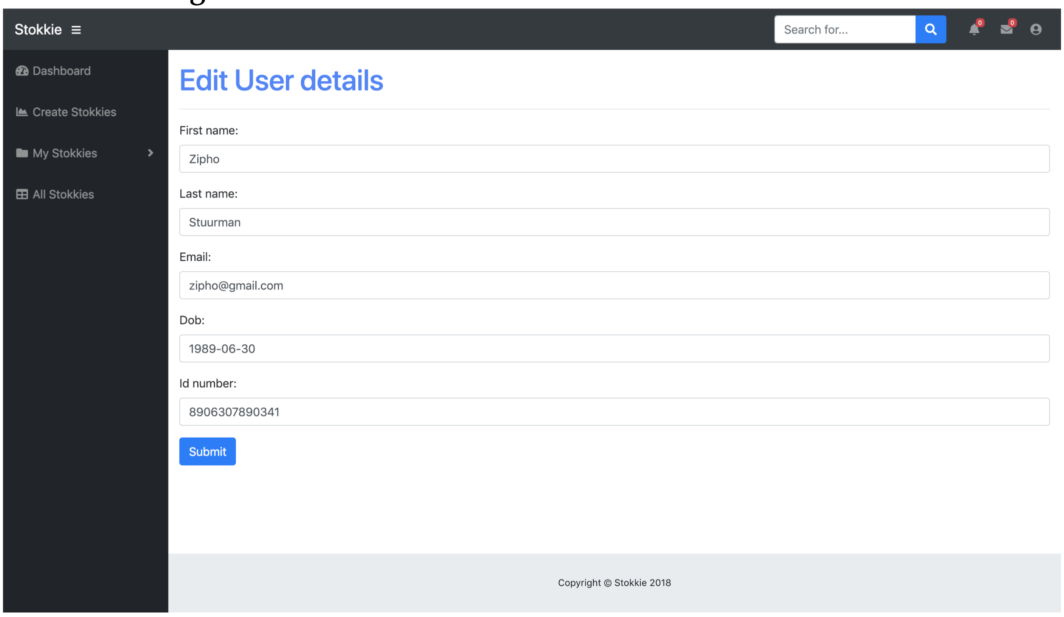


Fig. 5.6: The view to enter the relevant stokvel information

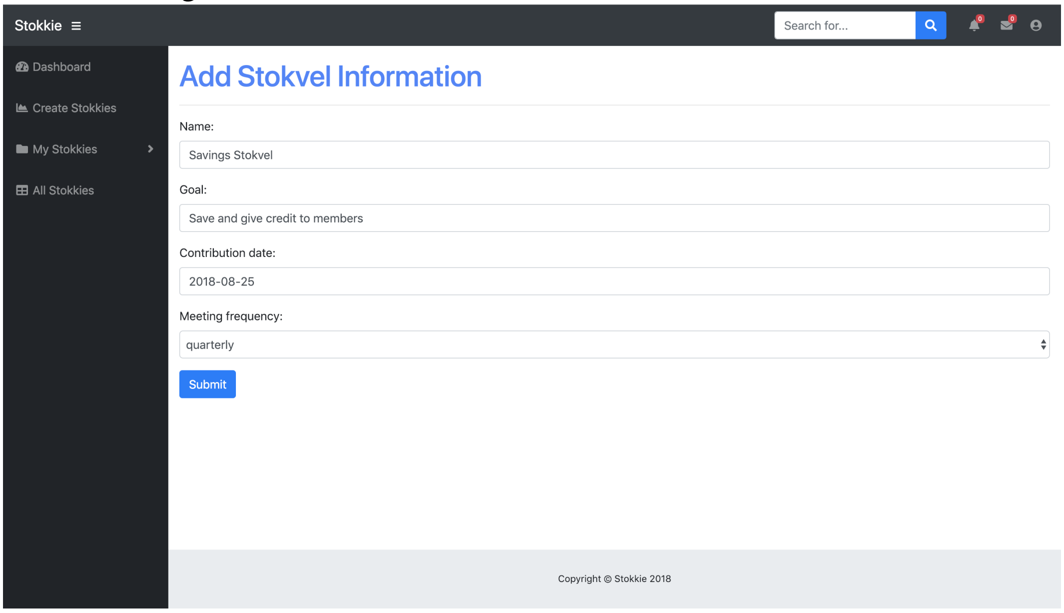


Fig. 5.7: The view that shows the entered stokvel information

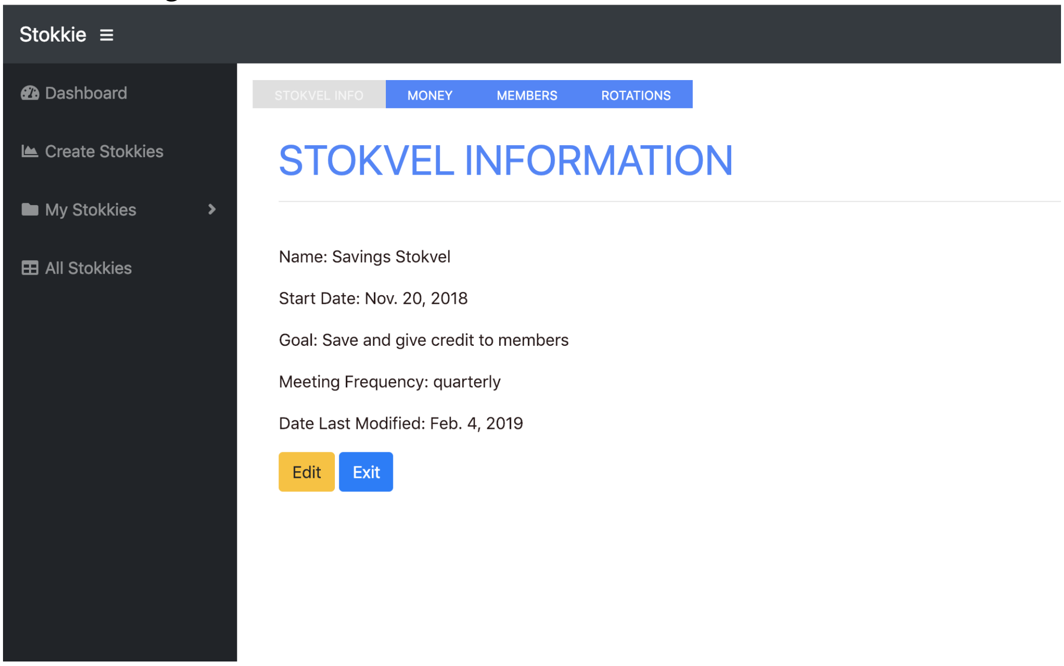


Fig. 5.8: The view that shows the members that are in a particular stokvel and the positions that they hold in the stokvel.

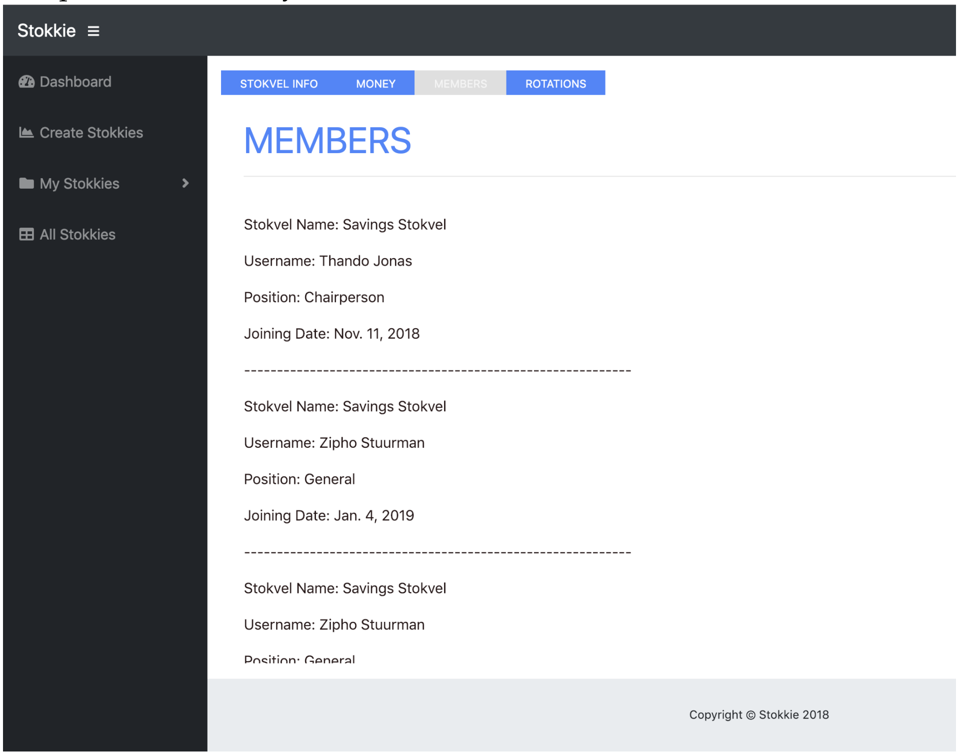


Fig. 5.9: The view to add users to the stokvel.

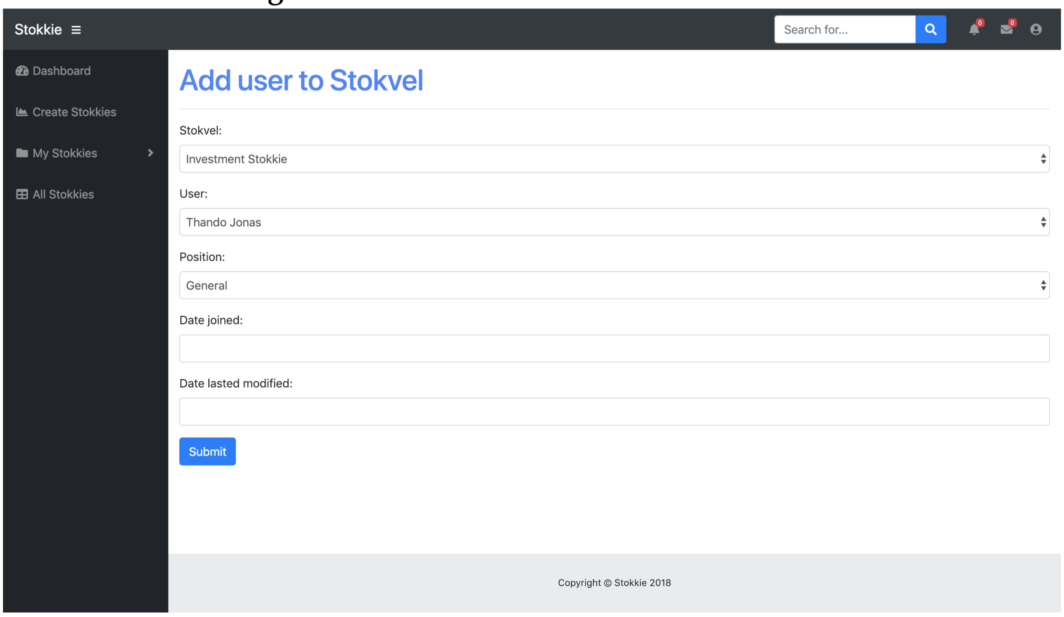


Fig. 5.10: The view that allows a user to enter the money details for the stokvel.

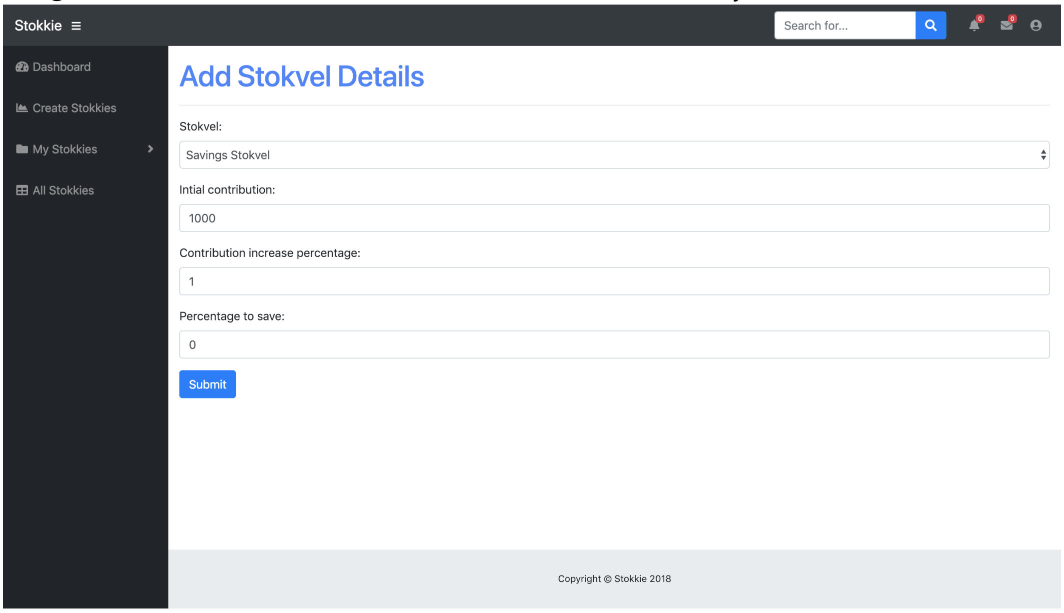


Fig. 5.11: A view showing the monthly payments to be made by each of the members and the total amount that the member will be receiving

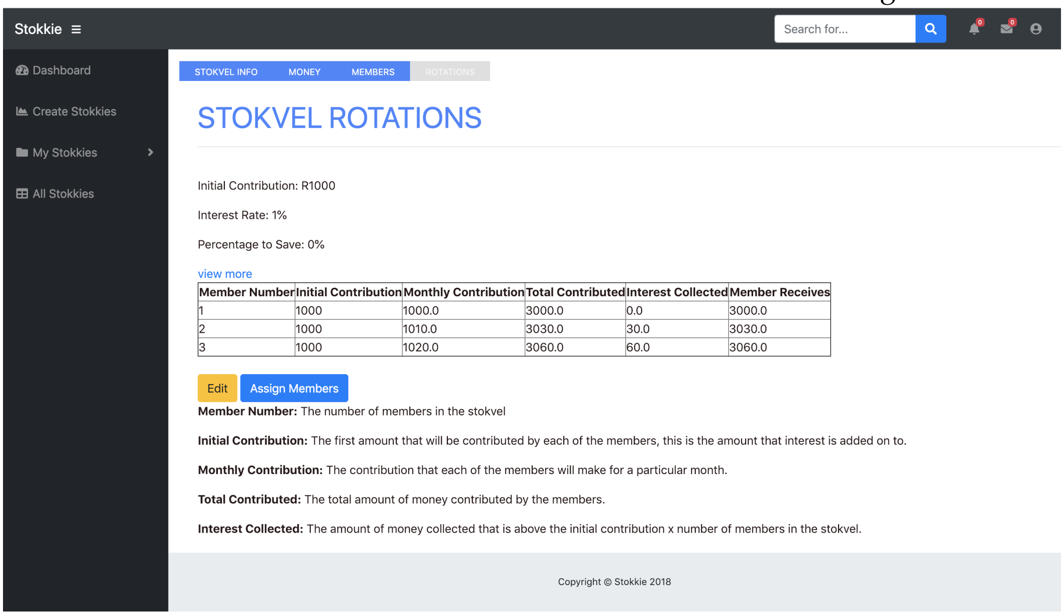


Fig. 5.12: A view that allows the user to assign members of the stokvel to a position in the rotation according to whether the user wants to be a borrower, saver, or investor

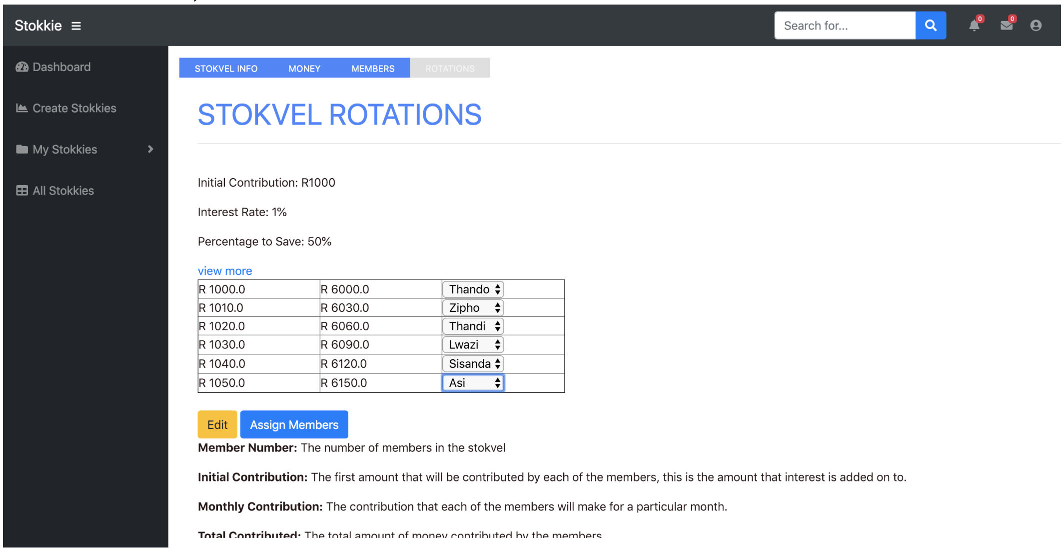


Fig. 5.13: The view that shows all the stokvels available to join

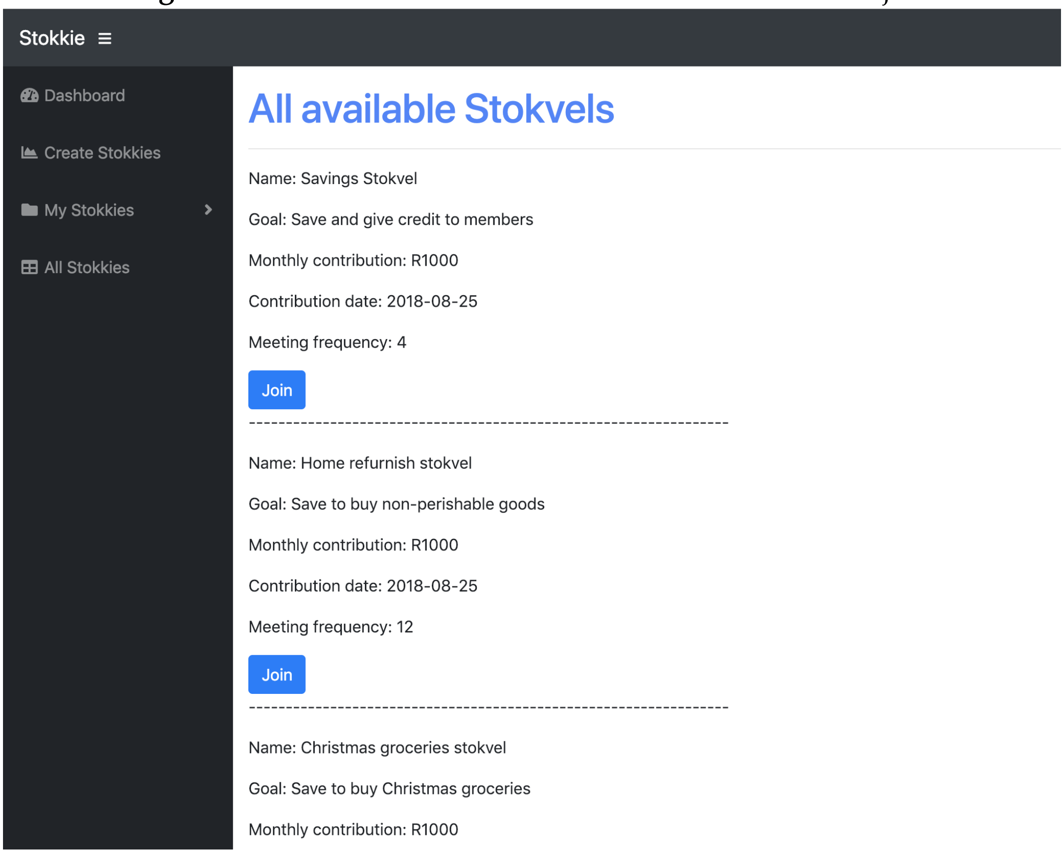


Fig. 5.14: clicking on the "My Stokkies" menu item allows the user to see which stokvels they are members of. Clicking on one of them will take them to that stokvel's page

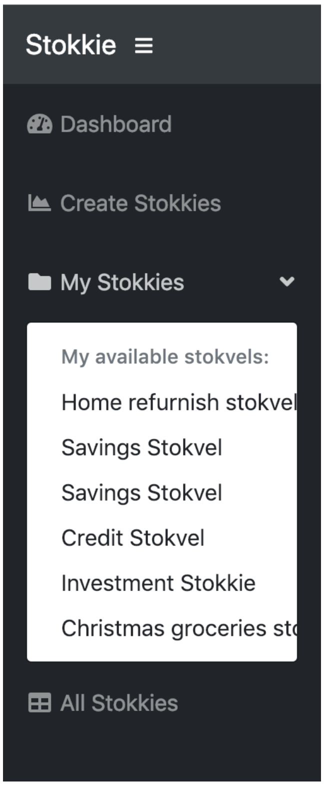
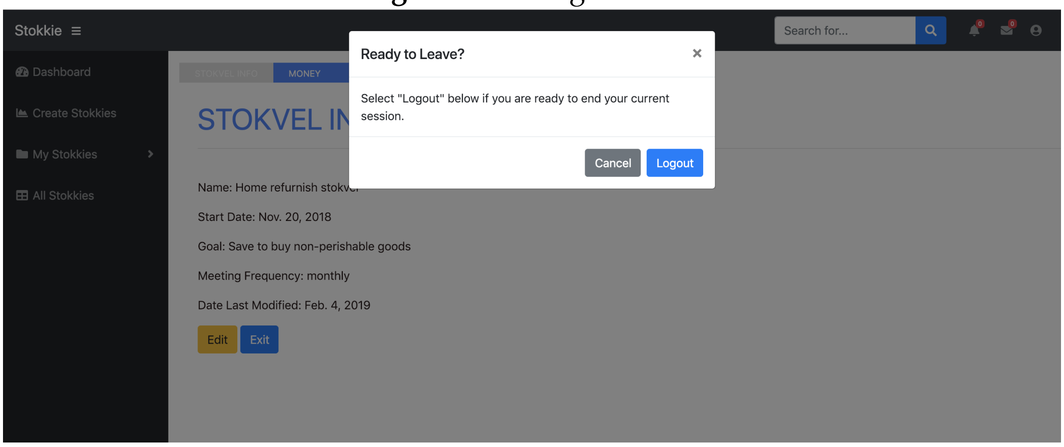


Fig. 5.15: The logout view



Chapter 6

Results

The objective of this project was to build a web-based application that stokvel groups can use to record their member's information and the money that will be contributed and paid out to members. Testing of the web application was conducted to determine if this objective was met.

6.1 System testing

System testing was done to make sure that all the features listed in the requirements list were implemented correctly. The test plan outlined the test case objective, test case description, the expected result, and whether the test passed or failed. Below are the results of the testing. All the system test cases passed after the final iteration.

Test Case ID	Test Case Objective	Test Case Description	Expected Result	Pass/Fail	Comment
1	Sign up as a user	Enter user details and click register	Login in screen appears	Pass	
2	Login in as existing user	Enter the user credentials and click login button	User is taken to the landing page, welcoming them to Stokkie	Pass	
3	Create Stokvel	Click create Stokkie, enter the Stokvel information and click on the submit	The Stokvel information is saved and appears on the next page shown	Pass	

4	Join Stokvel	Click on the All Stokkies and click on the Join button	The newly joined Stokvel appears on the users My Stokkies list	Pass	
5	Join a Stokvel where the user is already a member	Click on the All Stokkies and click on the Join button	The user should not be able to join the Stokvel, the name should not appear twice in the My Stokkies list	Pass	There should be an alert that notifies the user that they are already a member of the stokvel
6	Edit Stokvel information	Select a Stokvel and click on the edit button. Update the information and click submit	The Stokvel information should appear with the changes made	Pass	There should be an alert that notifies the user that the change has been successfully saved
7	Delete Stokvel	Select a Stokvel under My Stokkies, if you are the creator of the Stokvel click delete	The Stokvel should no longer be available on the All Stokvels list and the users My Stokkies list	Pass	

8	Add Stokvel money details	Under My Stokkies select the Stokvel you wish to add details for. Click on the Money tab for the stokvel, click the add button, enter the Stokvel details click submit	The Stokvel money page should now appear with the entered data and the Stokvel money calculations should appear with the corresponding calculations	Pass	There should be examples of how the stokvel money details can be entered so that the user has an idea of the data required
9	Edit Stokvel money details	Select a Stokvel and under the money tab click on the edit button. Update the information and click submit	The Stokvel money page should now appear with the changes, and the money contributions should also have changed	Pass	
10	Leave Stokvel	Select a Stokvel, on any tab click the exit button	The Stokvel money page should now appear with the changes, and the money contributions should also have changed The Stokvel should no longer appear on the users My Stokkies list	Pass	
11	Logout	Click on the logout link	The user should no longer be able to access the data	Pass	

6.2 Heuristic evaluation

A heuristic evaluation was conducted in order to evaluate the system against Nielsen (1995) 10 usability heuristic principles. Expert evaluators were used to conduct this evaluation and they provided feedback on areas of the system that required improvement in terms of usability. The evaluators completed tasks on the application and were encouraged to explore the application as they provided their feedback. Feedback was given as the tasks were being carried out and was categorised according to Nielson's 10 usability heuristic principles.

6.2.1 Visibility of system status

The evaluators commented on the visibility of the system status stating that it was not clearly visible. An example was when data was edited, there was no message indicating that the data had been updated, the user had to manually check that the data they entered was now visible on the page. They thought that the input forms needed to be labelled to give the user an idea of the type of data that they needed to enter.

6.2.2 Match between system and the real world

The evaluators expressed that the use of icons could have made aspects of the system easier to recognise and understand for users. They felt that examples of a possible set up for a stokvel would have been very helpful for the users because many of the terms used in the forms were not part of the vocabulary the users used in their stokvel activities, e.g. "Contribution increase percentage".

6.2.3 User control and freedom

As they were using the application the evaluators felt that as users they did not have enough control over the system. They commented that a user should be asked to confirm before completing an action that will modify the database and that there should be a way for a user to undo an action, but the edit and delete actions were enough to address this undo issue.

6.2.4 Consistency and standards

The evaluators thought that the data appeared consistently throughout the system. The buttons and menu items were shown in the same way across different pages to aid recognition and to prevent the user from getting confused.

6.2.5 Error prevention

The use of drop-down lists was appreciated by the evaluators as these would minimise possible data entry errors, but they felt that date pickers should have also been used to ensure that dates were entered in the correct format.

6.2.6 Recognition rather than recall

The system suggests a set of options for the user to pick from in order to minimise user recall. An example of this is adding members to a stokvel, the user can pick from the set of available users to add to the group, the positions that the members can occupy in the group are also picked from a set of options.

6.2.7 Flexibility and efficiency of use

The system can be used differently by both novice and advanced users. The evaluators approved of the ability to set up a stokvel with increasing individual contributions (for advanced users) or with equal individual contributions (for novice users) depending on the complexity the stokvel group desired.

6.2.8 Aesthetic and minimalist design

The evaluators appreciated the minimalist design as the screens were simple and did not contain too much information. When designing a system that has a set of novice users it is important not to overwhelm them with a busy interface as this can potentially confuse them. The screens were designed to only contain information that would allow the user to complete the task they were busy with.

6.2.9 Help users recognise, diagnose, and recover from errors

The system did not have pop up or error messages that informed the user that they had made an error. The evaluators thought that the errors could have been handled more gracefully in such a way that the user knows how to recover from it.

Tab. 6.2: Results of system usability testing

Tester	Score	Tester	Score
User 1	72.5	Expert 1	82
User 2	77.5	Expert 2	85.5
User 3	60		
Average	70	Average	83.75

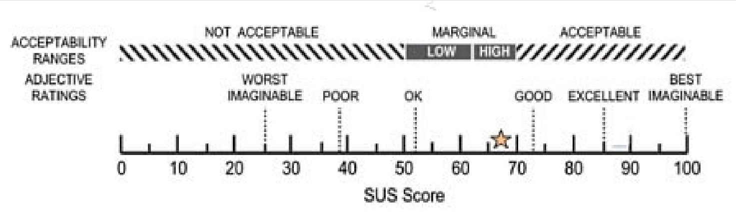
6.2.10 Help and documentation

The evaluators did not have access to any documentation for the testing. They were, however, able to explore the system's features without any documentation and training and they managed to complete the tasks.

6.3 System usability testing

The System Usability Scale (SUS) is a fast and trusted questionnaire to assess perceived system usability (Affairs, 2013). The application was tested by both the evaluators and the users. The system scored between 60 and 85.5, the average score being 76.875. Table 6.2 below displays the scores given by each of the testers. This score is not a percentage, but is a percentile ranking. The SUS score can be interpreted on the Adjective Rating Scale Bangor *et al.* (2009). This scale allows the user to rate their user experience using a five-point scale that rates the system from "Awful" to "Excellent", see Figure 6.1. The SUS score of 76.875 translates to "Good", which covers the 68 to 80.3 percentile range.

Fig. 6.1: System Usability Scale



The observations from the tests with the users and the evaluators varied largely. The testers had to complete 9 tasks. The times to complete the tasks also varied, the expert evaluators completed the tests within 10 minutes, while one of the users took up to 30 minutes to complete the tasks.

The users hesitated during the testing, afraid of making mistakes, they thought it was their ability to use the system that was being tested. It was explained to them that they were not being tested and that they should not worry about how they used the system or taking too long, but rather it was the system that was being tested, them struggling to use the system meant that the system was not built well. Due to time constraints during the first testing session it was decided that should the user take longer than five minutes to complete a task then the observer would be allowed to steer them towards the action they wanted to perform.

The task that the users struggled the most with was adding stokvel money details, which is the initial contribution and the percentage that contributions increase by. They required explanations of all of the terms used in the form. They were also confused by the table produced by the numbers they entered. Once these numbers were explained to them the users felt that the calculations were ”too complicated” for their stokvel group. One user added that they did not think that the members of their stokvel were in the group to make a profit, they were in it to get into the habit of saving.

6.4 User acceptance testing

All the implemented features were accepted by the users. The stokvel calculations feature was marked as needing more work in terms of making things easier to understand for the user as it was the most important task that users had to complete. The users were mostly happy with how the system had been implemented, however, they did feel that they would need additional assistance to be able to use the application with confidence.

Chapter 7

Discussion

The expert evaluators commented often that things should be made visible and if a screen has some potentially confusing forms then help texts need to be provided for the users. Testing with the users proved that the comments made by the evaluators were correct. The users were more reserved than the evaluators when it came to exploring the system and needed direct instructions, proving that things would need to be made more visible for them in order to have a better experience using the system.

7.1 Future work

Features could be better implemented in order to give the user more control over the system and provide them with a seamless user experience. Emails should be sent out to the users when then they sign up on the web application and when changes are made to the stokvel groups that they are members of. The security measures of the application also need to be improved as any user can join a stokvel, users should request to join the stokvel group and be approved by the chairperson or secretary of the group and these members should not be able to make changes to the stokvel details or delete the stokvel group.

The manner in which the calculations work in the application is not easy to figure out and documentation should be included on the web application to help the user effectively use the application.

An improved way of helping users understand the impact of the monthly payments that they make would be through a dashboard that visualizes how much will be received by each member in comparison to everyone else. This might influence the position in the rotation users want to be placed in.

Logging should also be introduced in order to capture the users' actions on the application in order to gain insights into the actions that the users complete on the application most frequently and also where users struggle with completing actions and leave these uncompleted. These frequent actions should be made more accessible to users, for example, having a shortcut for viewing who is next in the rotation. The actions that users struggle with should be simplified and more support (e.g. help texts and FAQs) should be made available for them.

Participatory design methods should be used in the requirements gathering process. The user should be involved in both the design and evaluation of the process (Steen *et al.*, 2007). Multiple iterations of development and usability testing should be carried out with potential users of the application and expert evaluators in order to avoid project failure (Larman, 2004). This should be done in order to refine the interface and the features to produce a product that the users can use comfortably.

Chapter 8

Conclusions

In this paper, we presented the design and implementation of a stokvel management application. Existing literature and applications were used to create a requirements list, these requirements resulted in a web-based application being developed. The final application was tested using system testing, to evaluate the implemented features and their correctness, a heuristic evaluation with a set of expert evaluators, lastly, the users did usability testing and user acceptance testing. The evaluators and users gave the application a combined score of 76.875, which translates to a good interface on the System Usability Scale.

The users accepted the application, however, the system usability testing did show that the interface needed improvement. The system was developed using multiple iterations but time constraints did not allow for multiple iterations of user testing. It is best to have multiple iterations of user testing so that the user experience feedback can be incorporated into the following iterations.

Bibliography

Affairs, A. S. f. P. (2013). System usability scale (sus).
URL: *https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html*

Aparna, Kammar, R., Supriya, Rupali, Shah, B., Mehta, B., Hekim, L., Uva, S., Matt, Abhishek and et al. (2018). What is system testing - a ultimate beginner's guide.
URL: *https://www.softwaretestinghelp.com/system-testing/*

Bangor, A., Kortum, P. and Miller, J. (2009). Determining what individual sus scores mean: Adding an adjective rating scale, *Journal of usability studies* **4**(3): 114–123.

Besley, T., Coate, S. and Loury, G. (1993). The economics of rotating savings and credit associations, *The American Economic Review* pp. 792–810.

Bisrat, A., Kostas, K. and Feng, L. (2012). Are there financial benefits to join roscas? empirical evidence from equb in ethiopia, *Procedia Economics and Finance* **1**: 229–238.

Brooke, J. *et al. (1996). Sus-a quick and dirty usability scale,* Usability evaluation in industry **189***(194): 4–7.*

Cashare *(2018).*
URL: *https://play.google.com/store/apps/details?id=com.cashareinc.casharehl=en https://www.cashare.ch/en/*

Chamapesa *(2018).*
URL: *https://chamapesa.com/faq.html*

Cohn, M. (2004). User stories applied: For agile software development, *Addison-Wesley Professional.*

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts, International journal of man-machine studies **38***(3): 475–487.*

Gugerty, M. K. (2007). You cant save alone: Commitment in rotating savings and credit associations in kenya, Economic Development and cultural change **55***(2): 251–282.*

Irving, M. (2005). Informal savings groups in South Africa: investing in social capital, *University of Cape Town.*

Kabuya, F. I. (2015). The rotating savings and credit associations (roscas): Unregistered sources 0f credit in local communities, IOSR Journal of Humanities and Social Science. 20 (8) *pp. 95–98.*

Kedir, A. M. (2005). The economics of rotating savings and credit association: Evidence from ethiopia.

KyePot (2018). Bringing the power of group savings into your hands.
***URL:** https://www.kyepot.com/how-it-works*

Larman, C. (2004). Agile and iterative development: a manager's guide, *Addison-Wesley Professional.*

Leung, H. K. and Wong, P. W. (1997). A study of user acceptance tests, Software Quality Journal **6***(2): 137–149.*

Levi, M. D. and Conrad, F. G. (1997). Usability testing of world wide web sites, Conference on Human Factors in Computing Systems: CHI'97 extended abstracts on Human factors in computing systems: looking to the future, *Vol. 22, pp. 227–227.*

Lukhele, A. (2018). Three decades of stokvel banking - nasasa.co.za.
***URL:** http://nasasa.co.za/site/wp-content/uploads/2018/05/Three-Decades-of-Stokvel-Banking-Andrew-Lukhele-NASASA-2018.pdf*

Matuku, S. and Kaseke, E. (2014). The role of stokvels in improving people's lives: The case in orange farm, johannesburg, south africa, Social work **50***(4): 504–515.*

Mulaudzi, R. (2017). From consumers to investors: an investigation into the character and nature of stokvels in South Africa's urban, peri-urban and rural centres using a phenomenological approach, *PhD thesis, University of Cape Town.*

National Credit Act *(2006).*
***URL:** https://www.gov.za/documents/national-credit-act*

Nidhra, S. and Dondeti, J. (2012). Black box and white box testing techniques-a literature review, International Journal of Embedded Systems and Applications (IJESA) **2***(2): 29–50.*

Nielsen, J. (1993). Iterative user-interface design, Computer **26***(11): 32–41.*

Nielsen, J. (1995). 10 usability heuristics for user interface design, Nielsen Norman Group **1***(1).*

Perez, S. (2018). Yahoo finance launches social savings app tanda, an alternative to credit cards.
***URL:** https://techcrunch.com/2018/01/19/yahoo-finance-launches-social-savings-app-tanda-an-alternative-to-credit-cards/*

Porter, J. (2018).
***URL:** http://bokardo.com/principles-of-user-interface-design/*

Response, A. (2012). Stokvels - a hidden economy unpacking the potential of south african traditional saving schemes.

Rosca Finance *(2018).*
***URL:** https://app.rosca.io/faq/*

ROSCAS (1995). Roscas: Whats in a name?
***URL:** http://www.gdrc.org/icm/rosca/rosca-names.html*

Selic, B. (1998). Using uml for modeling complex real-time systems, Languages, compilers, and tools for embedded systems*, Springer, pp. 250–260.*

Snyder, C. (2003). Paper prototyping: The fast and easy way to design and refine user interfaces*, Morgan Kaufmann.*

Steen, M., Kuijt-Evers, L. and Klok, J. (2007). Early user involvement in research and design projects–a review of methods and practices, 23rd EGOS Colloquium*, number 7, pp. 1–21.*

StokFella *(2018).*
***URL:** http://stokfella.com/screen/*

Trust, F. (2018). Impact evaluation of savings groups and stokvels in south ...
***URL:** http://finmark.org.za/wp-content/uploads/2018/11/FMT-Impact-Evaluation-of-Savings-Groups-and-Stokvels-in-South-Africa-24-October-2018.pdf*

What are Savings Groups *(2018).*
***URL:** http://www.mangotree.org/Resource/What-are-savings-groups-The-evolution-of-group-mechanisms-for-savings-and-credit*

What Is Kanban? *(2018).*
***URL:** https://resources.collab.net/agile-101/what-is-kanban*