

Crowdsourcing real-estate

Open market for real-estate finance

K.C. Asmoredjo
A. Hovanesyan
S.M. To
C. M. Wong Loi Sing

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by

K.C. Asmoredjo
A. Hovanesyan
S.M. To
C. M. Wong Loi Sing

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1

Introduction

The mortgage market is a multibillion market that has seen some serious lows in the last couple of years. The high amount of borrowers defaulting their mortgage played a big role in the 2007-2008 financial crisis [31]. That financial crisis had a big influence on the world economy.

Taking a mortgage from Dutch financial institutions can be done as follows. First, the borrower needs to decide what the possibilities are, e.g. what are the total costs and how big can the loan be? When the financial situation of the borrower has been verified, a house can be chosen that fits the borrower's needs. When an agreement has been met with the seller of the house, a mortgage can be settled with a mortgage lender. Together with the provider it will be possible to choose for a mortgage type that fits the borrower's financial situation.

In the Netherlands, the current maximum mortgage limit is 102%. Each year it is being lowered with 1% till 2018, when the maximum mortgage limit will be 100% [23]. The CEO of the Dutch National Bank [9], Klaas Knot, wishes to see the maximum mortgage limit be reduced to 90% by 2028 [30]. While the maximum amount of the mortgage is a legal limit, financial institutions will usually only provide a fraction of the property value amount. How much the financial institutions will provide exactly depends on the Loan-to-Value ratio [18], which differs case to case. Instead it is expected that the borrower provides a downpayment of the remaining value. The large downpayment means that people that are looking to buy a house will have to save up before they can buy a house.

To enable buyers to get the capital they need but do not have, crowdfunding is a solution. Such crowdfunding platforms already exist and they are becoming more popular. Some give the opportunity to crowdfund mortgages while others are more general and provide a place for entrepreneurs to find investments for their projects. These projects range from opening a new shop to projects like installation of personal solar panels. What these platforms all have in common is that they are centralized, which means that there is a third party that connects the investors with the investees. The crowdfunding services they provide are not for free, which results in unneeded costs for the users of the platform. A way to eliminate the unneeded costs is to make a decentralized platform, where no middleman is needed.

2

Problem description

In this chapter we define the problem, analyze related initiatives and give a description of the client. Further it contains the project requirements and the description of the first screens.

2.1. Problem definition

It is currently very difficult for an average citizen to get a mortgage. Only borrowers with minimal risk of defaulting are given a mortgage. As the value of houses keep rising, it becomes increasingly difficult for people to receive a mortgage. Additionally, because of the mortgages not covering the total cost of the estate, the only possibility is to make a large down payment. For a lot of people, and especially for young adults that recently joined the working force, down payment is not an option. At the same time, interest on saving accounts is so low that it does not covers inflation. Investing could bring a solution to savings losing value over time.

There is a need for a system that connects these parties together. These consist of the *borrower*, the *investor* and the *financial institution*. These three stakeholders all have their own incentive to work with each other. The borrower needs a bank to settle a mortgage and investors to fund the initial down payment. In return the public investors and the bank can receive interest on their respective investments. To solve the mentioned problems, we focus on creating a platform where mortgages can be partially crowdfunded.

Crowdfunding platforms are getting increasingly popular to create funds for projects in which banks are not investing. Platforms on which it is possible to get your mortgage crowdfunded already exist, yet on all of these platforms there is a central party that connects the investors with the borrowers. The central party is not only unneeded, but also brings unnecessary costs and risks. Bringing down the middleman will also bring down the whole system.

To avoid that the whole system collapses when one of the key parties drops out, the system needs to be decentralized. During the project, we will strive to create a platform where people can find mortgages that are funded by both banks and investors. A person will be able to apply for a mortgage where the bank can fund a fraction of the loan (e.g. 70% of the total loan). When the mortgage has been accepted the loan request will be transferred to an open market place where investors can crowdfund the remaining part of the mortgage. The interest rate on these investments will be negotiated between the borrower and the investor.

The aim of this project is to create a scalable decentralized market, where it is possible to crowdfund a mortgage. The system will not be controlled by a single party, but mostly by supply and demand.

2.2. Client description

The client for this project is ABN AMRO [3]. ABN AMRO is collaborating with the TU Delft Blockchain Lab [5], which is part of the Tribler team [25], on the development of blockchain applications. They aim to create some complex blockchain applications that are suitable

for use in practice, within half a year [27]. With the collaboration, ABN AMRO wants to improve their knowledge on blockchain technology, especially on the practical application of distributed digital ledgers.

TU Delft has been researching blockchain since 2007. The research at TU Delft focuses on developing next-generation blockchain technology that is trustworthy and scalable. Their scalable blockchain is based on tamper-proof secure timelines and graph-based data structure. This project will be built on previous work that has been done at the Blockchain Lab [26]. All of their work is shared with the open source community.

2.3. Project requirements

Our implementation will be built upon the decentral market implemented by the 2016 BEP group [29]. This market will have to be modified for use in the mortgage/real-estate branch. The requirements are subject to change during the development phase.

2.3.1. Functional requirements

- Borrower can place loan requests.
- Borrower can upload documents needed to apply for a mortgage.
- Borrower can see offers they get from investors and financial institutions.
- Borrower can accept offers they get from investors and financial institutions.
- Borrower can reject offers they get from investors and financial institutions.
- Borrower can see how much has already been paid off.
- Investor can see which campaigns are available.
- Investor can place an offer on a campaign.
- Investor can see which campaign they have currently invested in.
- Investor can resell their investments.
- Investor can invest passively.
- Investor can see how much has already been paid off.
- Financial institution can create a quote for a mortgage.
- Financial institution can see which mortgages they currently have provided.
- Financial institution can see their pending loan requests.
- Financial institution can review pending loan requests.
- Financial institution can accept pending loan requests.
- Financial institution can reject pending loan requests.
- Financial institution can determine the maximum interest rate that a borrower is allowed to pay an investor for the loan.
- Financial institution can recommend an interest rate that the borrower can pay to an investor for the loan.
- Financial institution can see how much has already been paid off.
- Regulator can see the total financial health of all the active loans.
- Transactions can be done through the system.
- Smart contracts to ensure binding agreements between stakeholders.
- The system can do a risk assessment.

2.3.2. Non-functional requirements

- Python 2 to be able to interface with Tribler and Dispersy.
- PyQt for the GUI.
- Tests and coverage.
- Scalable.
- Full transparency. Everything open-source.
- Secure storage and transfer of information.

2.3.3. Screens & Workflow

Based on the functional requirements, a list of pages the program should have to achieve these goals has been compiled. The screen can be either for borrowers [**B**], investors [**I**] or financial institutions [**F**].

1. **Log In [BIF]**

The log in screen allows a person to identify themselves using their private key. They can choose the location of the key, and also select if they want the location to be remembered for future use. If they (only borrowers and investors) do not yet possess a private key, one can be generated and saved to the location of their choosing.

2. **Profile [BIF]**

The profile screen differs depending on the role of the person that is logged in. It is used to save and update personal information. Investors only need to enter their name, email address and IBAN. Borrowers need to enter more personal information and they can upload personal documents such as payslips and proof of identity.

3. **Portfolio [BIF]**

The portfolio screen differs depending on the role of the person that is logged in. Borrowers can see, accept and reject the offers they got from banks and investors. Investors can see the loans they invested in, their pending investments, and they are able to resell their loans to other investors. When they are reselling a loan, they can accept or reject the offers for that loan. Financial institutions can see which mortgages they currently have.

4. **Place Loan Request [B]**

Borrowers can place a loan request, which will then be sent to all financial institutions of their choice. This will include information on the house, its price, and how much money they want to borrow. There will also be a box to write a small description, so an investor can learn more about who they are investing in.

5. **Pending Loan Request [F]**

Financial institutions can see all pending loan requests. They can review each of the requests and accept or reject them. When they accept a loan request, they have to enter the details about the mortgage, such as interest and duration.

6. **Place Loan Offer [I]**

This screen allows investors to invest passively. They can enter the amount they want to invest, the interest they want, and the duration of the loan.

7. **Open Market [BIF]**

On the open market all investing opportunities are presented to all roles, but investment can only be made by investors. Key things to show are the rating of the mortgage, the duration of the loan, risk and type (new or aftermarket). Search and filter functions will be included as well.

8. **View Loan Bids[BIF]**

The View Loan Bids screen can be reached from the open market and shows the current bids that investors have made in the campaign. Additionally, from here it is possible for investors to place a bid of their own by filling out the amount they want to invest, the duration of the loan and desired interest rate.

9. **Resell Investment [I]**

When an investor has invested in a campaign that is currently running, they can resell their investment to other investors on the open market. This screen shows information about the campaign and has a form where the investor can fill in the remaining duration of the loan, the interest rate and the loan amount.

2.4. Related initiatives

To get some more insight into the current crowdfunding market it is necessary to analyze initiatives related to crowdfunding, crowdfunded mortgages and crowdfunded loans. A quick Google search has returned numerous examples, of which 13 will be analyzed in this section.

2.4.1. Jungo

Jungo [15] is a mortgage bank, with the ability to crowdfund your mortgage. All clients whom are accepted by the bank will guaranteed get a mortgage. But Jungo differs from normal mortgage banks by making it possible for 3rd parties and institutional investors to provide a part of the mortgage in return for an attractive interest.

At the moment of this writing it is not yet clear what the application process is for a mortgage via Jungo as they have not yet launched their service. All borrowers will undergo a risk assessment based on the 'Code of Conduct for Mortgage Loans' [1].

Investors can choose which project they want to finance, for an amount between €250 and €80.000. The provisional interest is between 3% and 3.5%. They pay the money via an iDEAL transfer to the person requesting funding, and will be paid back monthly for up to 8 years. The length of the investment varies per Jungo campaign.

Investors are protected from borrowers who are not able to live up to their obligation by a fund controlled by Jungo to continue paying investors when a borrower misses a payment. This fund is limited however.

Thus Jungo can be seen as a mortgage bank that also functions as intermediary for individuals and institutional investors who wish to invest in a mortgage. Finally they also provide a guarantee (up to a certain point) that your investment will be returned.

2.4.2. Blandlord

Blandlord [4] is a platform for crowd ownership of homes. The idea behind the platform is that home owners can put their house for sale via Blandlord, even if the home is inhabited (the new landlord of the renters will become Blandlord). These houses can then be bought by a number of investors who can buy a percentage of the house. The rent income is then shared among investors depending on the percentage that they own. Thus Blandlord is not only a platform for selling the houses, it also functions as a letting agent.

All homes must be 100% owned by the owner before being placed on Blandlord. To minimize the risk that the homes stay empty due to lack of renters, only houses in areas with a healthy house market are accepted, as judged by Blandlord. Furthermore, an extensive audit of the condition of the house is required as a prerequisite of being able to list the house on Blandlord, to prevent the investors being faced by unforeseen costs.

Investors can buy shares in a house, with the minimum investment amount being €100. The value of the shares are directly correlated to the value of the house. They are paid their

share of the rent on a monthly basis, based on the expected rental income. The costs of using the service is a 1% transaction fee on all transactions (buying/selling shares).

2.4.3. Greencrowd

The focus of Greencrowd [14] is to provide a crowdfunding platform for sustainable energy projects such as installation of solar panels, wind power, et cetera. These projects will in turn provide income by selling the power or service, or for instance lower the energy costs of a building that has installed solar panels.

Organisations can present a plan for a sustainable energy project, which will then be analyzed by Greencrowd to make sure the plan is realistic. They will also analyze the financial risks and assign a grade to each project, ranging from A to G. The interest an investor can expect is tied to the grade. The riskier the project, the higher the return. A project has a certain amount of time to get financed, if the finance goal is not reached before the deadline, all investors will be returned their money.

Investors can invest in all running projects, with the amount varying per project. The running time of the loan also varies per project. The only constant is that the interest is always tied to the grade the project received. Payments also vary per project, which can be monthly or quarterly, and they can include special provisions for paying off a loan earlier (the investor then receives a bonus from the investee).

2.4.4. Fundrise

Fundrise [10] is an online platform where individuals, accredited or non-accredited, are able to directly invest in commercial real estate projects from real estate companies, without the middleman. The main difference between the Fundrise eREITs (electronic Real Estate Investment Trust) and other REITs, is that Fundrise is more transparent and has roughly 90% lower fees. Fundrise enables investors to choose in which eREIT they want to put capital in. Ye

To submit a project for a loan, the companies need to indicate the amount to raise and the project type, and they have to upload relevant documents needed for the application. First the information will be screened to ensure investment is consistent with Fundrise standards. Then follows the in-depth analysis, which includes an on-site visit by a member of the Fundrise team. When the project is accepted, it will receive a Fundrise rating, a letter rating ranging from A to E so that investors can easily compare different investments.

The minimum investment is \$1.000 and the maximum may not exceed 10% of the investor's gross annual income or net worth. The fund transfer is done via bank account. When investors get their return is specific to each listing. When available, a distribution schedule can be found in the offering documents for that investment. Generally investors can expect to receive distributions quarterly. Asset management fees are between 1% and 1.5%.

In the event that a company is not able to pay back the loan, the eREIT will bear the risk. The eREIT will pay the investors to the extent of any deficiency between the value of the collateral and the amount of the loan.

2.4.5. RealtyShares

RealtyShares [22] is a real estate crowdfunding platform that lets accredited investors choose what they invest in. Investors have the choice to invest in one specific property or in a group of properties. RealtyShares offers commercial and residential real estate projects.

To apply for financing, relevant information and documents should be provided by the borrower. RealtyShares then reviews whether the borrower prequalify based on their track record, financial strength and expertise. After the pre qualification, borrowers will be thoroughly reviewed based on their investment strategy, financials, legal standing, and property condition/location.

Investors can start investing from \$5,000. The funds transfer is via bank account. Depending on the type of investment, investors get their return either quarterly or monthly. Investor fees have a maximum of 2% of the invested amount. RealtyShares offers investors to loan their money supported by a collateral, a specific real estate property or pool of properties.

2.4.6. Collin Crowdfund

Collin Crowdfund [7] offers linear loans through crowdfunding to established businesses and startups. Innovatively Collin returns to the basics of banking, where the investor decides what they invest in. Collin also cooperates with banks to demonstrate what is realistic and to give the business the opportunity they deserve. That combination ensures that the investor makes a good return at a reasonable risk and that the business can realize their ambitions.

To apply for a loan the business has to indicate the desired loan amount and the purpose for the loan, and they have to upload relevant attachments for their loan application. Collin then provides the business with a Crowdfund Coach to assist with filling out the Collin Credit Score model, which is a risk assessment that tests the company in terms of solvency, profitability and liquidity. The Collin Credit Score produces a D&B rating [2] and the boundaries of the interest rate the business is allowed to set. Collin either approves or rejects the loan application using all of that information.

Investors can choose which projects they want to finance. Private investors can invest for an amount between €500 and €80,000 and corporate investors can invest from €500 with no upper bound. They pay the investment via an iDEAL transfer to the business requesting funding and will be paid back monthly for the duration of the project, which can be anywhere between 6 months and 10 years.

To protect investors from businesses that are not able to live up to their obligation, Collin continues paying investors for one month. When the business is not able to pay the investors back after that month, there will be no payment of interest to investors.

Collin asks for a small fee from both the business and the investors, which makes it possible for Collin to take care of the payments for both sides. For every investment a management fee is calculated annually at a rate of 0.85%. The business is asked for a one-time fee of 1.9% for a successful loan and a monthly fee of 0.05%.

2.4.7. Upstart

Upstart [28] is a platform that allows people to obtain loans with a fixed rate. Upstart does not only look at credit scores, because they believe people are more than just credit scores. They use a model that considers the school the borrower has attended, their field of study, their academic performance, and employment history in addition to their credit history. That allows Upstart to offer people the loans they have earned.

To apply for a loan at Upstart, borrowers have to fill in an online application which will include information about their academic credentials, work experience and what they plan on doing with the loan proceeds. Upstart also verifies the borrower's personal and credit information as part of the application process.

Investors cannot choose in which project they invest, because loans are not visible publicly on Upstart. Investors can invest for a minimum investment amount of \$100. All loans are fixed-rate loans with a 36 or 60-month repayment period. Investors will get an investor account on Upstart, to which they can transfer money to invest or to transfer their returns to their own bank account.

Upstart determines the interest rate using the borrower's education, credentials, work ex-

perience, and credit history. This means that the interest rates are different for each loan. Once the interest is determined, all loans have a fixed-rate interest. The loans are unsecured obligations of the borrower and are not supported by any collateral.

As compensation for the marketing and ongoing servicing of loans, Upstart receives servicing fees that are paid from the origination fees that are collected from borrowers. Borrowers pay a one time origination fee that is between 1% and 6% of the target loan amount. Investors pay an annual servicing fee of 0.5%.

2.4.8. CrowdAboutNow

CrowdAboutNow [8] is a crowdfunding platform that makes it possible for entrepreneurs to start a crowdfunding campaign. They will support the entrepreneurs whenever they need it. CrowdAboutNow makes it possible to invest safely, both legally and technically.

To apply for a loan, entrepreneurs have to take a test to determine if their plans are suitable for crowdfunding. If their plan is suitable, an account manager will get in touch with the entrepreneur to discuss their plans.

Investors can choose the projects they want to invest in themselves. Investors can invest for an amount up to €80.000. They pay the investment via an iDEAL transfer, for which a fee between €0.70 and €0.80 is asked. It is not clear in what period of time and at what interest rate the investors will get their investments back.

To minimize the risk for investors CrowdAboutNow verifies if the entrepreneur is willing to use its own network to invest its venture capital. CrowdAboutNow verifies the identity of the entrepreneur, the registration of the company, and its bank account. They also meet with the entrepreneur in person. If the entrepreneur has been registered for less than 3 years at the Chamber of Commerce [17], a partner that understands the industry will act as the nominating party. Should there not be enough investors to reach the loan target, all investors will get their money back.

CrowdAboutNow advertise entrepreneurs' crowdfunding campaigns, they give legal advice, and take care of the financial transactions. They do this for a one-time entry fee of 1% of the loan target and a 2% annual fee when the campaign is successfully funded.

2.4.9. Kapitaal op Maat

Kapitaal op Maat (KoM) [16] is a platform that makes it possible for different projects to get crowdfunded. Possible project funding sum can range from €25.000 to €500.000. Individual users can invest any amount between €100 and €50.000. Corporate investors do not have a hard ceiling, but both types of investors cannot invest beyond the amount that is needed to get the project fully funded.

To apply for a loan the company or entrepreneur needs to present the website with a business plan of the venture. After that a fee of €395 is paid to KoM to examine the presented offer and determine the risk of the venture. Additionally, if the venture is accepted, another fee of €350 must be paid to publish the venture on the website. The borrower will receive guidance with the right presentation of the offer. The calculated risk of the venture, which consists of a grade from A+ to C-, determines the interest. This will range from 5.5% for the lowest risk ventures (A+) and 9.5% for the highest risk ventures (C-).

When an investment is made, an initial fee of 0.9% of the investment is paid. All the investments are sent to the escrow account of KoM and stored until the the funding goal is reached. If this goal is reached, a fee of 4% must be paid by the borrower to receive the funding. When the fees are paid and the transactions are made, the borrower will continue to pay the escrow a fixed rate every month until the investment and interest are completely paid off. After that, the escrow distributes the amount accordingly among the investors.

2.4.10. Geldvoorelkaar

Geldvoorelkaar [11] is a crowdfunding platform where Dutch corporations and individuals can invest in national, small to middle sized ventures.

The platform provides different types of loans which consist of: Fixed-rate, Interest-only and Convertible debt loans. The duration of the loan can range from 6 to 120 months. This can be as little as €1.000. There is no limit to how much an entrepreneur can ask, but no funding will be received until the loan goal is reached.

The fees for a funding request are €125 for private investors and between €350 and €500 for corporate investors. Additionally, when the loan goal is reached, the borrower pays a small fraction of the loan goal as success fee each year for the duration of the loan. This fee can range from 0.5% to 7.9% of the loan goal.

Geldvoorelkaar does background checks on everyone asking for a loan. Before a request can be made, the borrower has to present a business plan and a financial report. This is used to determine risk of the venture, which in turn will be used to determine interest of the loan. The higher the risk, the higher the interest. This is usually somewhere between 4% and 10% interest. After the transactions are made, the investors receive monthly payments by the borrower until the loan and interest are completely paid off.

2.4.11. Bouwsteen

Bouwsteen [6] is a new initiative that is going to be available in Q1 of 2017. They want to provide a solution targeted at groups that are not served adequately in the market yet, namely starters (employees and self-employed) and seniors. Their goal is to create a financing product for the private housing market that allows for a reduction in the monthly payments, providing flexibility to the homeowner. Since Bouwsteen have not launched their service yet, it is not clear in what way the mortgages they will offer will work and how they are planning on reducing the monthly payments.

2.4.12. Gradefix

Gradefix [13] is a new initiative by ABN AMRO to automate credit checks. It is completely different than the previous initiatives described in this section as it has nothing to do with crowdfunding, but credit checks are an integral part of any mortgage application. Gradefix calculates this score on the basis of the requester's bank transactions. By calculating the incoming and outgoing sums, and how much money is left at the end of each month, a credit rating is generated.

2.4.13. MoneYou

MoneYou [19] is a bank that gives borrowers a lot of freedom with their mortgage. Unlike other banks, MoneYou does not give any advice in any form. It is up to the applier to decide what is best for them and their situation. The applier decides the specifics of the mortgages such as mortgage type, loan duration and loan amount.

What makes MoneYou special compared to other banks is that they facilitate the mortgage and all of the steps to get a mortgage online. In other words, it is possible for people to apply for a mortgage and go through most of the steps online. Before an application can be made the applier needs to do a quiz on the MoneYou website. The quiz consists of multiple choice questions that should show that the applier knows what they are doing and has the financial knowledge and assets to take out the mortgage. The quiz and other submitted documents such as payslips and other financial documents are used by MoneYou to make a final verdict on giving out the mortgage or not. After the mortgage has been set, the definitive purchasing of the real-estate can be made with the help of a notary.

2.5. Development process

During the project we used the Scrum framework [24]. We worked in sprints of 2 weeks, and we focused on one specific thing every sprint. We held daily meetings within our group, we held meetings with our coach every week to discuss our process and progress, and we held meetings with our client every few weeks to discuss our progress. The meetings made sure that we were able to stick to the goals of the client and to incorporate feedback that they provided.

3

Defining the customer journey

After centering our first two-week sprint around the orientation of the problem, we started working towards a demo for our client.

The problem has three equally important stakeholders, as the system can not be functional with any of these stakeholders not present. These stakeholders are the borrowers, investors and financial institutions. In the following sections, the journey of each of the stakeholders will be discussed.

3.1. Research customer journey

Throughout the first sprint of the project, we concentrated on understanding the problem and related initiatives. Through analyzing the different initiatives, we came to understand more about crowdfunding real-estate.

Because our problem concerns people who need a mortgage, we had to understand how mortgages work too. The two most common mortgages are Linear and Fixed-Rate [21], which are available for starters. Bart Gout, our real-estate/mortgage expert, provided us a document that listed the required documents needed for applying a mortgage and a scheme showing the process of getting a mortgage. These documents can be found in appendix B.

From the related initiatives, which were described in section 2.4, we found out that there are existing crowdfunding platforms for real-estate. There is even a bank that facilitates the mortgage and regulates all the steps to get a mortgage entirely online [19]. A MoneYou representative explained that the required identity check can be delayed until the end when the borrower meets with the notary. Only the definitive purchase will have to be made with a notary. Thus the marketplace does not need to supply a way to verify the identity of a borrower.

With the required information for the application process of a mortgage in mind, and thinking about what the banks need in order to offer a mortgage, and considering what the possible options are for potential investors, we started defining the customer journey.

3.2. The borrower's journey

The borrower's journey can be seen in figure 3.1 and starts when the person opens the market software. At this stage are two cases, either the person has used the software before or they have not. When they have used the software before, they can supply their private key to identify themselves. When they have not used the software before, a key pair has to be generated for the user. After receiving their key, this person is not yet a borrower, as this is a general step for both borrowers and investors.

After logging in they will be forwarded to their profile. On this profile page they can add or append all required personal information. The first time they fill in the profile they choose their role, which can be either borrower or investor. In this section the chosen role will be 'borrower'. Once the required fields are filled in and all the needed documents are uploaded,

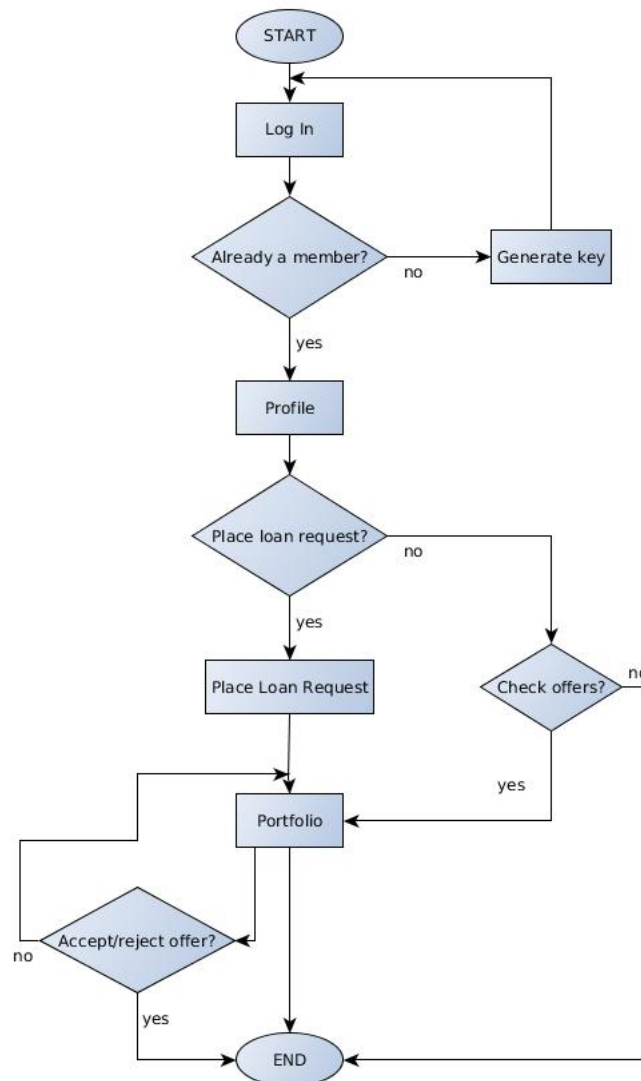


Figure 3.1: Borrower's flowchart

a prospective borrower can go on to apply for a mortgage. If they have already applied for a mortgage, they can check to see if any offers have been received from banks or investors in their portfolio.

Applying for a mortgage is a fairly straightforward process as all required documents will have been uploaded to the profile. The user will have to supply mortgage-specific information, such as house information, the real estate broker, et cetera. They can also choose which banks to send the request to. Once sent, the only course of action is to wait for offers from the banks.

Once a mortgage offer is received, it will be shown to the borrower in their portfolio. The borrower can then elect to accept the offer, or reject the offer. Once a mortgage offer is accepted the crowd funding campaign will start. At this point the mortgage offer is placed on the open market where investors can submit investment bids. As with the mortgage offer from banks, offers from investors will be shown in the portfolio.

From now on the market software will take care of all the work until the campaign is either funded, or the time limit has passed.

3.3. The investor's journey

The investor's journey can be seen in figure 3.2 and starts, like the borrower's journey, when the person opens the market software. They too, have to identify themselves using their private key if they have used the software before, or generate a new key pair if they are new users.

Once they have identified themselves, they are forwarded to their profile. There they can edit their personal information, such as contact information and IBAN. If it is their first time filling in the profile, they have to choose their role, which is either borrower or investor. In this section the chosen role will be 'investor'. After the required information is filled in, they are able to see their portfolio, search for investment opportunities, or choose to invest passively.

The portfolio page lists all of the investor's current investments, pending loan offers, and bids on their investment that they want to resell. They can monitor their investments, accept or reject investment opportunities and bids, and choose to resell investments.

If the investor chooses to actively search for investment opportunities, they can do so at the open market. When an investment opportunity has been selected, they can see the current investment bids on that particular opportunity and place a bid of their own. Their investment bids and the status of the bids will be shown in their portfolio.

The investor can also choose to invest passively. All they have to do is fill in the amount they want to invest, the approximate interest rate they want to receive for it, and the duration of the investment. When the loan offer is placed, the market software will automatically search for investment opportunities that matches the loan offer. The moment an investment opportunity has been found and is accepted by the borrower, it will be shown in their portfolio.

Ongoing investment opportunities can be placed on the open market, if the investor wants to resell their investment. They have to fill in the amount and the interest rate they want for it. Once other investors have placed their bids, the bids will be shown in the investor's portfolio for them to accept or reject.

3.4. The financial institution's journey

The financial institution's journey can be seen in figure 3.3 and starts, like the borrower's and the investor's journey, when they open the market software. The financial institution has to identify themselves by supplying their private key. Unlike the borrowers' and investors' keys, their public key is already saved in the software to ensure that people can not pretend that they are a financial institution.

Once the financial institution has identified themselves, they will be able to see their portfolio. In their portfolio they can see the information on all of the mortgages that they currently have running.

From their portfolio they will be able to go to another page, on which their pending loan requests are displayed. On this page there is a list of all the loan requests from people who want to take a mortgage have submitted.

The financial institution is also able to view every one of those loan requests individually. On the individual loan requests page they will be able to view personal information about the borrower, including the documents that are needed to apply for a mortgage, and mortgage specific information, such as the house the borrower wants to buy and the amount of money they want to borrow. On this page they have the option to accept or reject the application. When they want to accept an application, they will have to fill in some details on the mortgage they want to give out. Once the application has been accepted, it will be sent to the borrower who can then decide if they want to accept or reject their offer.

Financial institutions also have the option to explore the open market. They will be able to see all current running campaigns and the bids that investors have placed on them, but they will not be able to place bids themselves.

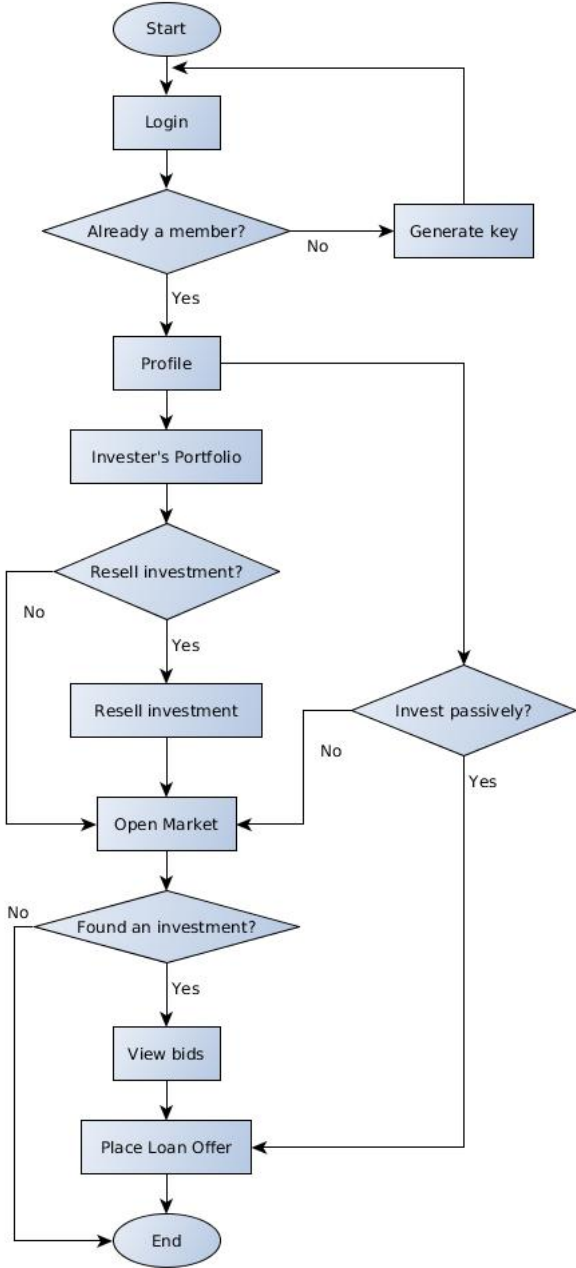


Figure 3.2: Investor's flowchart

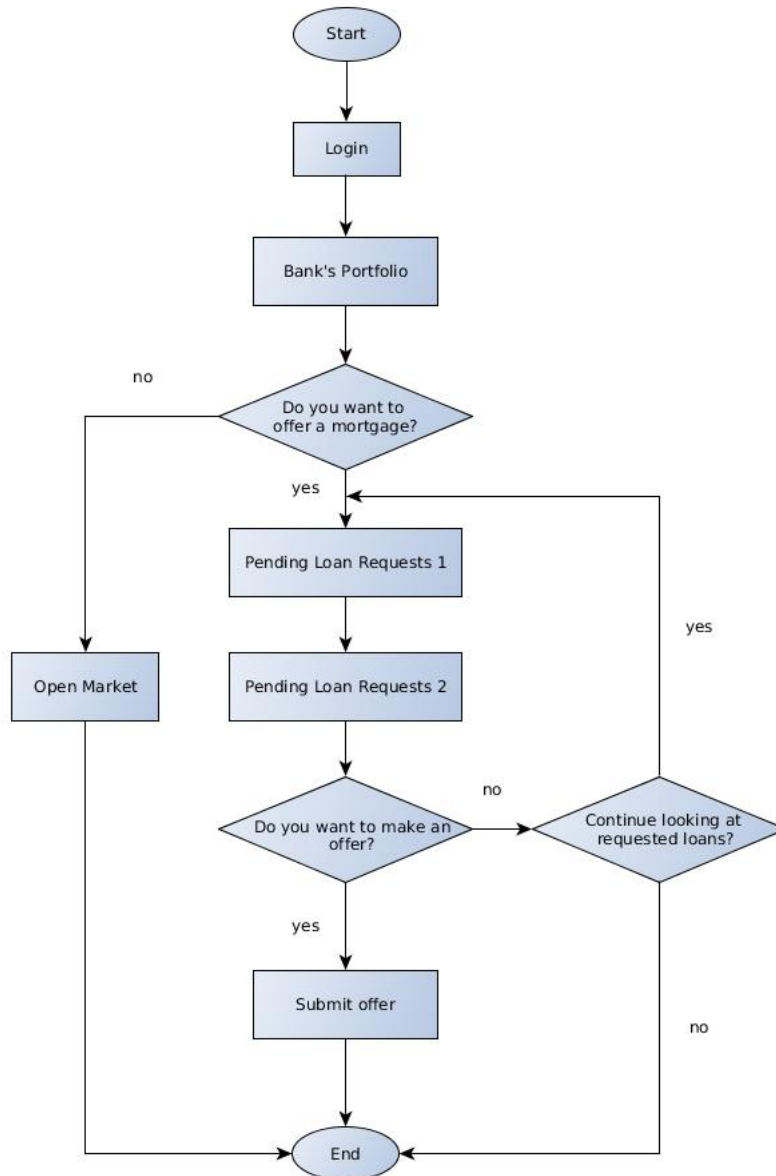


Figure 3.3: Financial institution's flowchart

3.5. MoSCoW requirements

To prioritize the requirements we described in section 2.3, we used the MoSCoW method [20].

3.5.1. Must Have

- Borrower can place loan requests.
- Borrower can upload documents needed to apply for a mortgage.
- Borrower can see offers they get from investors and financial institutions.
- Borrower can accept offers they get from investors and financial institutions.
- Investor can see which campaigns are available.
- Investor can place an offer on a campaign.
- Financial institution can create a quote for a mortgage.

- Financial institution can see their pending loan requests.
- Financial institution can review pending loan requests.
- Financial institution can accept pending loan requests.
- Python 2 to be able to interface with Tribler and Dispersy.
- PyQt for the GUI.
- Tests and coverage.
- Full transparency. Everything open-source.

3.5.2. Should Have

- Borrower can reject offers they get from investors and financial institutions.
- Investor can see which campaign they have currently invested in.
- Financial institution can see which mortgages they currently have provided.
- Financial institution can reject pending loan requests.
- Scalable.

3.5.3. Could Have

- Investor can resell their investment.
- Investor can invest passively.
- Financial institution can determine the maximum interest rate that a borrower is allowed to pay an investor for the loan.
- Financial institution can recommend an interest rate that the borrower can pay to an investor for the loan.
- Secure storage and transfer of information.

3.5.4. Won't Have

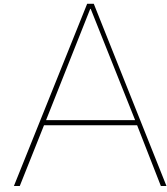
- Borrower can see how much has already been paid off.
- Investor can see how much has already been paid off.
- Financial institution can see how much has already been paid off.
- Regulator can see the total financial health of all the active loans.
- Transactions can be done through the system.
- Smart contracts to ensure binding agreements between stakeholders.
- The system can do a risk assessment.

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Appendices



Project description: Open market for real-estate crowdsourcing

Market platforms such as AirBnB, eBay, Uber, and Blandlord.com bring supply and demand together. Based on our ongoing "blockchain-regulated markets" we now explore usage in various domains. This issue addresses an open market for crowdsourcing in real-estate.[12]

Outcome of initial brainstorm sketches:



Figure A.1: Brainstorm sketches

Sprints:

- Week 1-2: Write-up of context and understanding of problem, understand related initiatives. Describe at least 10 initiatives. Learn Python.
- Week 3-4: Apply Python. Visualize the concept using PyQt designer with 4 operational screens. Feedback round from bank.
- Week 5-6:
- Week 7-8:

Roadmap:

- Feb/Jan: we have 3 components ready in draft: operational market + GUI implemented in QT + business case
- till April: define API between market and business logic, create business logic core, integrate the market, business logic, and GUI.
- April: present MvP results

Various markets for real-estate already exist, such as:

Blandlord is gestart in Rotterdam.

Rotterdam is een ideale stad om huizen te verhuren. De universiteit en vele internationale bedrijven maken dat er grote vraag is naar woonruimte in het middensegment. Het eerste huis is nu beschikbaar in de verkoop. Het appartement ligt in Noord nabij het centrum en is per 1 oktober verhuurd.

Schieweg, Rotterdam

€ 119,000 Koopsom 4.01% Rental income

[View details](#)

already sold 52%

Op de eerste verdieping gelegen ruim opgezet 2-...
Rotterdam, Noord

VHPN

Heb je een vraag? Stel hem hier

Hoe werkt het?

Figure A.2: Blandlord is gestart in Rotterdam


Plus an operational crowdsourcing market, running locally which TUDelft indirectly has access to:

Crowdfunding project Wilsta Prefableidingen - Kapitaal Op Maat - Chromium

Crowdfunding project x

https://www.kapitaalopmaat.nl/Wilsta-Prefab-Leidingen

Investeren Lenen Hoe werkt het? Projecten Inloggen Registreren



Deel dit project [f Share](#) [Tweet](#) [Delen](#) [G+ plus 1](#)

Het project [Investeringen \(119\)](#) [Financieel](#) [Zekerheden](#) [Reacties \(0\)](#) [Updates \(0\)](#)

Wilsta Prefab-leidingen en handelsonderneming is een jong, flexibel en snelgroeiend bedrijf. Wij zijn gespecialiseerd in het vervaardigen en leveren van prefab-leidingen in kunststof (PVC, PE, PP, en PPC), koper, RVS en staal. Wilsta levert maatwerk voor de installateur op het gebied van riolering, mechanische ventilatie en leidingenwerk. Ook voor medische gassen leveren wij de benodigde leidingdelen.

Het ontstaan van Wilsta
 Wilsta prefab-leidingen BV is opgericht in 2008 door Wilma Kollenburg met steun en advies van haar man Stan Witlox. Samen runnen zij het familiebedrijf. Stan Witlox is de derde generatie in het installatie vak. Vanaf het begin van de relatie hielp Wilma al mee (veelal in de avonduren) om in de werkplaats de leidingdelen voor te bewerken. In 1992 zijn Stan en Wilma in het huwelijk getreden en hebben zij het installatiebedrijf in 1994 van de ouders van Stan overgenomen. Met het installatiebedrijf werden voornamelijk werkzaamheden uitgevoerd die geschikt waren om innovatief en creatief te werk te gaan. Het installatiebedrijf is mede doordat Stan door de zware werkzaamheden rugproblemen kreeg gestopt. Wilma is hierdoor gestart met Wilsta. Stan functioneert nu als opzichter.

Wat levert Wilsta?
 Wilsta levert maatwerk voor de installateur op het gebied van riolering, mechanische ventilatie en leidingenwerk. Ook voor medische gassen levert Wilsta de benodigde leidingdelen. Alle prefab leidingen worden vanuit de eigen werkplaats vervaardigd en door eigen personeel geleverd en desgewenst gemonteerd. Wilsta is gespecialiseerd in fusiotherm/aquatherm leidingsystemen, PE leidingen en HDPE leidingen. Wij monteren tevens leidingsystemen volgens het perssysteem. Wij werken met de nieuwste machines en werken nauw samen met fabrikanten en engineers om leidingsystemen te verbeteren. Wilsta is ook actief voor bedrijven in de weg- en waterbouw. Voor deze bedrijven maken wij leidingsystemen uitgevoerd in Pe en Hdpe. Speciaal voor deze branche heeft Wilsta prefableidingen graafmachines, elektrolas en spiegellasmachines.

Specifiek werk en ervaring
 Door de speciale manier van werken hebben importeurs van leidingen de weg naar Wilsta gevonden om deze te gaan prefabriceren. Deze leidingen worden in de eigen werkplaats gemaakt. Wilsta monteert deze leidingen "op het werk" en is een veel gevraagde partner geworden voor grote installatiebedrijven. Hierdoor is Wilsta hard gegroeid en heeft tot op heden een indrukwekkende referentie lijst opgebouwd. Wij werken uitsluitend met de beste materialen.

100% Gefinancierd!
 Met dank aan 111 investeerders!

Investeringsrisico
 A- B+ B B- C+ C C-
 laag hoog


Financieringsduur
 60 Maanden

Rente
 8%

Reeds geïnvesteerd
 € 150.000
 van de € 150.000
 100%

Doel van investering
 Financiering werkkapitaal

Maak kennis met...
 W.M.M Witlox-Kollenburg



Wilsta prefableidingen is opgericht in 2008 door Wilma Kollenburg met steun en advies van haar man Stan Witlox. Samen runnen zij het familiebedrijf.

Geen project van uw keuze?
 Mail mij bij nieuwe projecten.

E-mailadres [Mail mij](#)

Figure A.3: Kapitaal op Maat

B

Mortgage

Welke documenten heb je nodig voor een hypotheek?

Als je een hypotheek afsluit, heb je nogal wat documenten nodig. Welke documenten je nodig hebt voor een hypotheek, ligt aan de fase van het hypotheekadviestraject. En aan jouw situatie. Sommige documenten heb je al nodig bij het oriëntatiegesprek. Andere documenten heb je pas nodig bij het afsluiten van je hypotheek.

Documenten voor hypotheek per fase

In onderstaande tabel zie je welke documenten je voor je hypotheek nodig hebt in welke fase. Dit zijn de 4 fasen van het hypotheekadviestraject waarin verschillende documenten nodig zijn:

1. Oriëntatie: berekening maximale hypotheek en voorbeeld maandlasten.
2. Hypotheekadvies: hypotheek samenstellen en producten vergelijken.
3. Hypotheekofferte aanvragen.
4. Hypotheek afsluiten: getekende hypotheekofferte naar de geldverstrekker.

Documenten voor hypotheek per situatie

In onderstaande tabel zie je welke documenten je voor je hypotheek nodig hebt in welke situatie. De algemene documenten heb je altijd nodig. De overige documenten alleen als die situatie voor jou geldt. Alle documenten mogen een scan of kopie zijn, tenzij er "(origineel)" achter staat.

Identificatie	1	2	3	4
Paspoort of ID-kaart	x	x	x	x
Paspoort of ID-kaart (origineel)*	x	-	-	-

* Origineel moet gecontroleerd worden.

Werk	1	2	3	4
Loonstrook	x	x	x	x
Werkgeversverklaring	x	x	x	-
Jaaropgaven afgelopen 3 jaar *	x	x	x	x
Arbeidsovereenkomst **	-	-	-	x
Rekeningafschrift met bijschrijving netto salaris	-	-	-	x
Arbeidsverleden via Mijn UWV	x	x	x	-

* Als je geen vast contract én geen intentieverklaring hebt.

** Als ingangsdatum minder dan 6 maanden geleden is.

Uitgaven	1	2	3	4
Budgetoverzicht *	-	x	-	-

* Bijvoorbeeld via [Nibud Persoonlijk Budgetadvies](#).

Vermogen	1	2	3	4
Afschrift spaarrekening(en)	-	x	x	x
Opgave beleggingen	-	x	x	x

Vorzieningen werkgever	1	2	3	4
Uniform Pensioen Overzicht (UPO)	-	x	x	x
Opgave MijnPensioenOverzicht.nl	-	x	x	x
Verzekering arbeidsongeschiktheid	-	x	x	x

Woning	1	2	3	4
Getekende koopovereenkomst	-	-	x	x
Taxatierapport *	-	x	x	-

* PDF van een gevalideerd taxatierapport.

Verbouwing	1	2	3	4
Specificatie verbouwingskosten	-	x	x	-

Schenking ouders	1	2	3	4
Getekende overeenkomst	-	-	-	x
Paspoort of id-kaart ouders	-	-	-	x

Lening ouders	1	2	3	4
Getekende overeenkomst	-	-	-	x
Paspoort of id-kaart ouders	-	-	-	x

Lening	1	2	3	4
Overeenkomst	-	x	x	x
Bankafschrift met maandbedrag	-	x	x	x
Bewijs aflossing *	-	-	-	x
Bewijs afmelding BKR *	-	-	-	x
Bewijs eigen geld *	-	-	-	x

* Als je jouw lening of krediet moet opzeggen voor je hypotheek.

Studielening	1	2	3	4
Opgave DUO begin schuld	-	x	x	x
Opgave DUO huidige schuld	-	x	x	x

Gescheiden	1	2	3	4
Convenant	-	x	x	x
Inschrijving gemeente	-	x	x	x
Akte van verdeling *	-	x	x	x

Vonnis rechtbank **	-	x	x	x
---------------------	---	---	---	---

Inschrijving vonnis **	-	x	x	x
------------------------	---	---	---	---

* Als je partner de woning overneemt.

** Als jouw scheiding via de rechtbank gaat.

Flexwerker	1	2	3	4
-------------------	----------	----------	----------	----------

Jaaropgaven afgelopen 3 jaar	-	x	x	x
------------------------------	---	---	---	---

Arbeidsovereenkomst	-	x	x	x
---------------------	---	---	---	---

Zelfstandig ondernemer	1	2	3	4
-------------------------------	----------	----------	----------	----------

Uittreksel KvK	-	-	x	x
----------------	---	---	---	---

Jaarcijfers 3 jaar	x	x	x	x
--------------------	---	---	---	---

Aangiftes IB 3 jaar	x	x	x	x
---------------------	---	---	---	---

Aanslagen IB 3 jaar	x	x	x	x
---------------------	---	---	---	---

Voorlopige cijfers	x	x	x	x
--------------------	---	---	---	---

Uitkering	1	2	3	4
------------------	----------	----------	----------	----------

Specificatie uitkering	x	x	x	x
------------------------	---	---	---	---

Jaaropgaaf	x	x	x	x
------------	---	---	---	---

Buyer

