A Technology-Driven Solution to Disrupt the Residential Real Estate Industry of Existing Homes

By

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B.S. Geomatics Engineering (2006), University of Calgary
M.S. Geomatics Engineering (2009), University of Calgary

SUBMITTED TO THE SYSTEM DESIGN AND MANAGEMENT PROGRAM IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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Abstract

In the past, home buyers and sellers of existing residential homes relied on real estate agents to buy and sell a home. Real estate agents are experts at fulfilling consumers’ needs and often gatekeepers of vital information required to buy or sell a home. However, with more information publically available online, consumers are increasingly turning to the internet as their first and primary source of information in their real estate searches. Given that the majority of real estate interests begin online and consumers are continually turning to a more self-service and self-reliant method of home buying and selling, the value proposition between a real estate agent and their client has diminished. Onlookers have been surprised by the seemingly resilient business model that is still in place within the real estate industry. Is it still justified for real estate agents to charge substantial commissions as the value they provide to their clients is arguably reduced by changing consumer behaviors? Several companies have tried to disrupt the industry with limited success.

The thesis investigates why current companies have failed by first studying the underlying stakeholder needs and their top priorities under numerous macroeconomic conditions. Then, exogenous factors on the system boundary are researched to provide context and a holistic view of the industry in which a proposed system would exist. Following this, concepts are generated using an intra-industry morphological matrix approach. However, in the concept selection phase, the previous approach reveals significant gaps in unmet primary stakeholder needs using technology. As such, inter-industry morphological matrix techniques are used to refine and improve the solution. Finally, various pricing strategies are studied and an appropriate pricing architecture for the propose system is hypothesized.

This thesis proposes a disruptive solution to empower consumers to move the residential real estate industry forward and redistribute value within the real estate ecosystem. The proposed system allows consumers to buy and sell their own homes using a pure technology-based solution developed using a systems approach. Overall, by utilizing a systems approach, all
insights discovered would have otherwise been unknown. It is because of the use of relevant frameworks, that strong underlying system architecture could be designed into a solution that fulfills all the needs of the primary beneficial stakeholder using technology.
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1. Introduction

1.1 Motivation

Real estate agents typically charge up to 6% commission on the resale of a home in the United States. This archaic business model is decades old and the industry is ripe for disruption as the value drivers and needs of the stakeholders have changed.

With the advent of the internet, there is a diminishing value proposition between the consumer and the real estate agent. The consumer can be broken down into the buyer and seller of the resale residential property. In pre-internet times, buyers heavily relied on real estate agents to search for homes and areas of interests, especially with the use of a membership-restricted Multiple Listing Service (MLS) [1]. Home sellers depended on realtors to use the MLS to price and list their property into the database. In return, real estate agents received a substantial commission for their services.

Nowadays, buyers do much of the legwork on their own by going online to search for a resale home and areas of interest. Virtual tours are also becoming increasingly popular. While MLS is still membership-restricted to realtors, almost all of the information about resale residential properties can be found online through MLS’ own website or other websites like Trulia, Zillow or Redfin. Resale home sellers can also utilize the internet and numerous online tools to attain a good price estimate of their property. As such, is it fair for the consumer that real estate agents still receive the same substantial commission, yet are arguably doing less work as the trend for consumers is gradually becoming more self-service?

1.2 Thesis Objective

The goal of this thesis is to use systems thinking to find a technology-driven solution to modernize the current business model for the resale of residential homes. By doing so, this would address the aforementioned diminishing value proposition problem between the consumer and realtor.

The primary objectives of this thesis are listed below.
1. To use systems thinking to understand stakeholder needs and pain points. It is important to understand why the current business model still exists and what pain points are preventing a new business model from being adopted.

2. To investigate the system architecture of a new technology-driven solution. Some examples of the issues considered would be the system’s most desired ‘ilities’ and flexibility to accommodate different nuances in different regions (ie. consumer preferences, macroeconomic conditions, etc.).

3. To use a holistic approach to understand the conditions in which the system could potentially operate outside of its system boundaries.

4. To hypothesize a new innovative technology-based solution that could address consumer needs and pain points.

5. To determine a feasible pricing architecture for a proposed technology-based solution.

1.3 Thesis Approach and Structure

The main research methods and approaches are given below.

1. Literature review.

2. Stakeholder needs analysis. This will help uncover the issues that consumer’s face in adopting a completely self-service business model and facilitate a technology-driven concept.

3. Stakeholder value network (SVN).

4. Kano Analysis to determine each stakeholders top needs.

5. Porter’s Five Forces analysis to gauge industry competition and attractiveness.

6. Concept generation and selection using a morphological matrix.

7. Solution validation and feedback through the use of stakeholder interviews.

8. Pricing architecture framework to determine who to charge, what to charge for and how often to charge.

The thesis research begins in the following chapter, where a literature review will investigate the origins of the real estate industry in the United States and then discuss various current trends impacting the industry.
2. Literature Review

2.1 History of Industry

2.1.1 Homestead Act

On May 20, 1862, President Abraham Lincoln signed into law the Homestead Acts, which opened up millions of acres of land across the country. This law allowed for private ownership of land, also known as a homestead, to any adult that had not previously opposed the United States government. The typical cost to own land was low because land owners were required to improve, develop and reside on the land for at least 5 years. In the end, the government gave away over 300 million acres of land or nearly 10% of the total area in the country. Consequently, this was the beginning of the real estate industry in the United States [2] [3].

2.1.2 The Industrial Revolution

During the Industrial Revolution in the late 18th and early 19th century in Europe, the United States was still an economy based on agriculture and natural resources. Eventually, the Industrial Revolution spread to New England but it was not until the second half of the 19th century, where it spread across the rest of the nation [3]. At this time, the rural population began to move to cities to work in the growing number of factories. Consequently, cities grew dramatically and new urban dwellers needed a place to live.

Conventionally, banks had only lent money to the wealthy. With greater income, the middle class’ wealth increased and banks opened up lending to them. This enabled the blue collar and middle class population to secure mortgages. And as the economy grew, so did home ownership in the country. With more home owners, all other industries related to home ownership grew with it. The large real estate ecosystem that is seen today was created.

2.1.3 Real Estate Today

On average, the period of a real estate cycle in the United States is roughly 18 years. A real estate cycle is defined as a period of housing recovery, expansion, hyper supply and recession. It is the classic “boom” and “bust” pattern that has been cyclical in the country since the 1800s [4]. The most recent cycle began in the late 1990s, where home prices began to rise. Following the dot com bust in early 2000s, the US Federal Reserve dropped interest rates to 1% to fuel the
economy. Banks and Wall Street firms inexpensively and aggressively borrowed money [5]. During the next several years, lending was easy and home buyers flocked to banks and other financial institutions to secure mortgages. Home price valuations increased rapidly, outpacing the growth of income, price-to-rent ratio and affordability. By 2006, the housing bubble reached its peak and numerous economists, including former U.S. Federal Reserve Board Chairman, Alan Greenspan, foresaw the troubling signs of unsustainable price growth in real estate [6]. Greenspan predicted “double digit declines”, while famous Yale economist, Robert Shiller warned of trillions of dollars of home values will be lost in the upcoming housing bust. Finally, home prices began to fall and home owners had negative equity in their homes. In August 2007, Shiller also predicted that many metropolitan areas would see home values drop by more than 50% and he was correct [7]. Foreclosures skyrocketed across the country, especially in the states of California, Arizona, Florida, Nevada, Ohio and Michigan. From January 2007 to December 2011 alone, there were over four million homes completing the foreclosure process and more than eight million foreclosure starts [8]. The housing collapse had a large impact on the entire United States economy. This included a dramatic stop in new home construction, subprime mortgage industry collapsing, rising unemployment and an implosion of the economy greater than in The Great Depression.

In the past several years following the housing collapse, the economy has been steadily improving and recovery has begun. Foreclosures are much less common nowadays, unemployment rate as of December 2015 is back down to 5.0% [9] and home prices have risen back up to pre-recession levels [10].

2.1.4 Role of the Real Estate Agent Prior to the Internet

Historically, real estate agents were consumers’ first point of contact whenever they were interested in buying or selling their home. Home buyers would be interested in knowing the price, features and other relevant statistics of a home. Home sellers would want a fair price estimate of their home as compared to similar homes in their neighborhood and ultimately, be able to list their home on MLS. Real estate agents were best equipped to assist consumers in their needs. At a deeper level, real estate agents provided additional services, such as representing their clients in negotiations, navigation through a complex transaction and moral
support for their clients. By a code of ethics, real estate agents must have their clients best interest in mind [11]. On top of this, real estate agents must be aware of the many laws and regulations surrounding a real estate transaction. Some consumers may not know or even care about these details, so long as they are able to buy or sell a home. Consumers, prior to the internet age, primarily relied on real estate agents for almost all their real estate needs.

2.2 Recent trends

2.2.1 The Internet

The advent of the internet has been responsible for creating new industries but at the same time, also caused disruption in others. It has changed consumer behaviors in numerous industries and the real estate industry is no exception. According to the National Association of Realtors (NAR), approximately 90% of home buyers use the internet as their primary information source. Additionally, 20% of real estate related searches are on mobile devices [12]. The NAR also found that savvy consumers use different online tools to facilitate their research during different phases of the home buying or selling process. The NAR and Google jointly found that first-time home buyers are increasingly using Google.com to research potential homes:

- 47% searched for a home on the internet [12]
- 52% began their home search on the internet [12]
- 77% drove by a home they had viewed on the internet [12]

Interestingly though, despite that the fact the internet has decimated professions like travel agents, stock brokers and car dealers, real estate brokers seem to have resisted major changes so far. In fact, according to Real Trends, a real estate research firm, average commission in the United States increased from 5% in 2008 to 5.4% in 2011 [13]. Onlookers have been surprised by the seemingly resilient real estate broker business model and in the past few years, several startups have grown to try to tackle this business model with limited success.

2.2.2 Incremental Innovation

Trulia, Redfin and Zillow, amongst others, have recognized the role and potential that technology has in disrupting real estate. They have already used technology to shift user
behavior from one that is reliant on real estate agents to one where consumers are reliant on the internet. However, none of these companies have truly radically innovated on the industry’s business model, but have only incrementally innovated it using online real estate technology.

Redfin, for example, uses a hybrid model of using a lot of technology to assist both consumers and its brokers but does not go far enough to radically innovate and disrupt the industry. The website and service has a lot of great technical features and they have even tried to innovate on the business model, where their real estate agents are salary-based, as opposed to commission-based.

Zillow, on the other hand, makes the majority of its revenue by advertising. It does not actually employ any real estate agents, but charges agents to advertise on its website. Similar to Redfin, Zillow has incrementally innovated on many useful technical features to assist consumers in their home search.

Recently, there are also several startups trying to disrupt the industry by breaking up the agents’ commission, but none have succeeded thus far.

2.2.3 For Sale By Owner

Home sellers have been trying to sell their own homes to circumvent a real estate agent’s 6% commission for many decades. For Sale By Owner is a company trying to assist these home sellers. They have their own website, process and business model, that is different than real estate agents’ model and the MLS. Despite For Sale By Owner’s attempt to capitalize on the real estate agent’s commission model, they have had very limited success.

Hendel, Nevo and Francois [14] studied the performance of the For Sale By Owner platform compared to the MLS platform in 2004. The research had several interesting findings:

- Neither platforms carried a price premium. Despite For Sale By Owner sellers saving 6% commission, home prices were not cheaper [14].
- MLS transactions completed in less time [14].
- 22% of For Sale By Owner listings fail and eventually, move to the MLS platform [14].
The For Sale By Owner service will be further analyzed in Chapter 6 and highlight some of its possible weaknesses, which may explain why it did not perform better against the MLS platform.
3. System Problem Statement and Key Questions

From the literature review, it becomes even clearer that current companies in the industry have not been able to disrupt the current commission-based business model used by real estate agents. Incremental technical and business model innovation is insufficient in tackling the status quo of the industry nor consumers’ behavior in home buying and selling. Therefore, the system problem statement of this thesis using the To-By-Using framework [15] is:

**To** safely exchange possession of existing residential property

**By** allowing people to efficiently buy and sell their own homes

**Using** an innovative technology-based solution.

The key questions this thesis answers are:

1. What are the stakeholder needs and which ones are most important? Which stakeholder needs should be targeted by the proposed system?
2. What external factors exist that have prevented current companies from disrupting the industry? And what external factors should the proposed system be concerned about?
3. How well do current companies in the industry fulfill the needs of the primary stakeholder using technology? Are there any unmet needs, which may represent an opportunity a new system to enter the market?
4. What system can be created to address existing customer pain points, while using an innovative technology-based solution?
5. What is the appropriate pricing strategy and architecture to optimize revenue and user adoption of a proposed system?

The following chapter explores stakeholder needs and answers the first key question.
4. Stakeholder Analysis

This chapter will mainly focus on identifying the stakeholders for the proposed system. Once the stakeholders have been identified, the next step would be to investigate each of their needs. In order to deliver the greatest value to each stakeholder, it is necessary to determine which of each stakeholders’ multiple needs are paramount. Using Kano Analysis [15], each stakeholders’ needs are prioritized. And because the primary beneficiary is so vital to the success of the system, their secondary needs are also prioritized for use later on in the thesis’ analysis. Finally, because macro conditions change every few years, the system would have to be flexible enough to accommodate stakeholders’ changing needs over the lifetime of the system. Hence, this has also been examined and the results are used for further analysis.

4.1 Stakeholder Identification

One of the first steps in creating a system is to figure out who your system will benefit. In the proposed system, the stakeholders will be the same players found in the current, traditional process of buying and selling a home.

Consumers: This group consists of the buyers and sellers of homes and are the primary beneficiary of the system. They are beneficiary stakeholders because they both give resources and provide benefit to the system. Consumers have value flows between many different parties in the system, as will be shown in Section 4.3.

Real Estate Agents & Brokerages: In the current system, this stakeholder mainly provides a plethora of services for the consumer in exchange for revenue. Because they give resources and provide benefits to the system, they are considered a beneficiary stakeholder in the current system. Aside from the primary beneficiary, this stakeholder also has value flows between the realtor association and complementary industries.

Realtor Association: These professional trade associations exist at a local, state and national level. They provide guidance and membership to real estate agents, while also ensuring its members to follow a strict code of ethic or laws issued by municipal, state and federal governing bodies.
Regulators: This stakeholder provides regulations specific for the real estate industry. This could be a subset of the government that focuses on real estate industry and can exist at the local, state and national level.

Governments: The government interacts with many other stakeholders but the general role of this stakeholder, as defined by the system, is to protect its citizens in exchange for tax revenue.

Local Community: This stakeholder is the pool of people that serve as the customer base for the buyers and sellers of homes. Additionally, they provide revenue in exchange for services for this system’s complementary industries, which is described next.

Complementary Industries: This stakeholder includes a large group of supporting services that assist the consumer and realtor in the home buying or seller process. Typically, the value flow for this stakeholder includes receiving revenue in exchange for services. Members of this stakeholder group include, but is not limited to, mortgage lenders, banks, lawyers, home inspectors, contractors, appraisers, lenders and more.

For a list of stakeholders, please refer Table 1, below.

*Table 1: Stakeholder identification*

<table>
<thead>
<tr>
<th>BENEFICIARY</th>
<th>STAKEHOLDERS</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>Consumers (buyers/sellers)</td>
<td>Beneficiary</td>
</tr>
<tr>
<td>Indirect</td>
<td>Real Estate Agents &amp; Brokerages</td>
<td>Beneficiary</td>
</tr>
<tr>
<td></td>
<td>Realtor Associations</td>
<td>Beneficiary</td>
</tr>
<tr>
<td></td>
<td>Regulators</td>
<td>Problematic</td>
</tr>
<tr>
<td></td>
<td>Government</td>
<td>Beneficiary</td>
</tr>
<tr>
<td></td>
<td>Local Community</td>
<td>Charitable</td>
</tr>
<tr>
<td></td>
<td>Complementary Industries</td>
<td>Beneficiary</td>
</tr>
</tbody>
</table>

4.2 Stakeholder Needs

Once the stakeholders have been identified, the next step is to determine their needs. Furthermore, the needs have been categorized as their primary need versus other secondary needs. Please refer to Table 2, below, for a summary of each stakeholders’ needs.
### Table 2: Stakeholder needs

<table>
<thead>
<tr>
<th>STAKEHOLDERS</th>
<th>PRIMARY NEEDS</th>
<th>OTHER NEEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumers (buyers/sellers)</td>
<td>Buying/selling a property</td>
<td>Refer to Table 7 for a complete list</td>
</tr>
<tr>
<td>Real Estate Agents &amp; Brokerages</td>
<td>Profit</td>
<td>Support from realtor association, Reputation, Referrals, Network of contacts, Code of ethics</td>
</tr>
<tr>
<td>Realtor Associations</td>
<td>Realtor membership</td>
<td>Government support</td>
</tr>
<tr>
<td>Regulators</td>
<td>Maintain standards and safety</td>
<td>Ethical realtors</td>
</tr>
<tr>
<td>Government</td>
<td>Protect citizens</td>
<td>Economic growth, Taxes, Political support</td>
</tr>
<tr>
<td>Local Community</td>
<td>Economic growth</td>
<td>High property values, Safe neighborhood</td>
</tr>
<tr>
<td>Complementary Industries</td>
<td>Profit</td>
<td>Referrals, Network of contacts</td>
</tr>
</tbody>
</table>

**4.3 Stakeholder Value Network**

A powerful visualization tool to illustrate the stakeholders and their value flows is the stakeholder value network [15]. In Figure 1, below, stakeholders are shown in the boxes, while their directional value flows are shown by the arrows. The value flow is two-ways between most stakeholders. However, the regulator stakeholder has one-way value flows, which indicate that they are charitable beneficiaries.
4.4 Identifying Top Needs using Kano Analysis

4.4.1 Intensity of Benefit

Stakeholder needs can be binned into three categories according to Kano analysis:

1) "Must have" – this need is absolutely essential.
2) "Should have" – this need would be satisfying to have and regretted if it is missing.
3) "Might have" – this need would be satisfying to have but not regretted if it is missing.

Colors have been added to enhance the visualization of the stakeholder value network, show below in Figure 2.
As an example of how the needs were color coded, let's focus on the primary stakeholder, consumers.

Consumers <-> Realtors

The value exchange between consumers and realtors is that consumers offer revenue to the realtors in exchange for services provided from the realtor to the consumer. Revenue for realtors is an absolute essential, as that is what they need to live on. This is the reason why the "revenue" arrow is colored red. On the other hand, the "services" arrow from realtors to consumers is colored green because while the services that are provided by realtors is great to have and would make the current process easier, it is not absolutely essential. Home buyers and sellers have other means to attain the same benefits from realtor's services, such as doing it by themselves or getting services from other contractors.

Consumers <-> Regulators

The value flow from regulators to consumers is the need for protection in regards to real estate dealings. Regulators create laws that protect consumers and that is an absolutely essential; hence, it is colored red.
Consumers <-> Government

Between this pair of stakeholders, the government offers additional protection (on top of the regulators’ specific real estate focused laws) to the consumer. These could be more generic protection policies, which are less essential than regulators’ laws in regards to real estate dealings and hence, this value flow is marked as “should have”. The need for taxes from consumers to the government is absolutely essential, as taxes act as a major revenue generator for the government. The government needs money to operate and provide services.

Consumers <-> Local Community

The value exchange between consumers and the local community are both “must haves” because consumers, in the context of this system, absolutely need to buy/sell a home from/to a fellow citizen.

Consumers <-> Complementary Industry

For this pair of stakeholders, consumers provide revenue to players in the complementary industry and this is absolutely essential in order for the complementary industry players to survive. However, the services that the complementary industry players provide to consumers would be nice to have but not absolutely essential. The consumers can choose to forego some of these services or perhaps, do it themselves.

4.4.2 Importance in Supply

Another important aspect of Kano analysis is the investigation on the importance of supply of the needs. The importance in supply metric measures the bargaining power of suppliers for that specific need. Similar to the intensity of benefit, the importance in supply also bins the needs into three categories, represented by the colored bubbles:

1) Hi – bargaining power of supplier of the need is very high. This could be caused by a monopoly, unique supplier of the need or some sort of lock-in.

2) – bargaining power of supplier of the need is medium.
3) **Low** – the bargaining power of the supplier of the need is low. This could be caused by an open market, open architecture or many suppliers which causes a low importance on the supplier of the need.

Figure 3, below, shows the importance of supply bubbles overlaid on the stakeholder value network diagram.

![Stakeholder Value Network Diagram](image)

*Figure 3: Importance of supply bubbles have been added to the stakeholder value network. Red, orange and green bubbles indicate a high, medium and low, respectively, supplier for that particular need.*

Continuing with Kano analysis, the next step would be the quantification of each need based on the benefit and supply rankings according to the matrix shown in Figure 4.

![Scoring Matrix](image)

*Figure 4: Scoring matrix for supply vs benefit*

Using the matrix in Figure 4, all the needs in the stakeholder value network have been scored. The maximum score is 1.0 and it signifies that the need is very important, whereas the minimum score is 0.1, indicating a need is insignificant. Please refer to Table 3, below.
Table 3: Quantification of needs in the stakeholder value network

<table>
<thead>
<tr>
<th>To</th>
<th>Needs</th>
<th>From</th>
<th>Benefit</th>
<th>Supply</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer</td>
<td>Services</td>
<td>Realtors</td>
<td>Should</td>
<td>Medium</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Protection</td>
<td>Regulators</td>
<td>Must</td>
<td>Low</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Protection</td>
<td>Gov’t</td>
<td>Should</td>
<td>Low</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Revenue</td>
<td>Local Community</td>
<td>Must</td>
<td>Medium</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Services</td>
<td>Complementary Industry</td>
<td>Should</td>
<td>Low</td>
<td>0.2</td>
</tr>
<tr>
<td>Realtor</td>
<td>Professional Support</td>
<td>Realtor Association</td>
<td>Should</td>
<td>Medium</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Revenue</td>
<td>Consumers</td>
<td>Must</td>
<td>High</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Referrals</td>
<td>Complementary Industry</td>
<td>Might</td>
<td>Low</td>
<td>0.1</td>
</tr>
<tr>
<td>Realtor Association</td>
<td>Regulations</td>
<td>Realtors</td>
<td>Must</td>
<td>High</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Membership</td>
<td>Realtors</td>
<td>Must</td>
<td>High</td>
<td>1.0</td>
</tr>
<tr>
<td>Regulators</td>
<td>Funding</td>
<td>Gov’t</td>
<td>Must</td>
<td>High</td>
<td>1.0</td>
</tr>
<tr>
<td>Gov’t</td>
<td>Public Safety</td>
<td>Regulators</td>
<td>Might</td>
<td>Medium</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Taxes</td>
<td>Consumers</td>
<td>Must</td>
<td>Low</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Taxes</td>
<td>Local Community</td>
<td>Must</td>
<td>Low</td>
<td>0.4</td>
</tr>
<tr>
<td>Local Community</td>
<td>Shelter</td>
<td>Consumers</td>
<td>Must</td>
<td>Low</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Services</td>
<td>Complementary Industry</td>
<td>Should</td>
<td>Low</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Protection</td>
<td>Gov’t</td>
<td>Should</td>
<td>Low</td>
<td>0.2</td>
</tr>
<tr>
<td>Complementary Industry</td>
<td>Referrals</td>
<td>Realtors</td>
<td>Might</td>
<td>Medium</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Revenue</td>
<td>Consumers</td>
<td>Must</td>
<td>Medium</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Revenue</td>
<td>Local Community</td>
<td>Must</td>
<td>Medium</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Once each of the links are quantified, it is possible to calculate the importance of loops based on network utility theory. The returned value back to the reference stakeholder is determined by multiplying the scores of the segments of needs within a loop. To focus on the segment of need that is important to the reference stakeholder in the loop, the final segment of need back to the reference stakeholder is double-counted [15]. As an example, let’s look at the loop between consumers to realtors then realtors back to consumers, shown in Figure 5. The need between consumers to realtors is revenue and has a scoring of 1.0. This is depicted as link A. Then, then need between realtors back to consumers is guidance and has a score of 0.4. This need is depicted as link F. Using the formula, $A \times F^2$, where F is squared because we want to double-count that need as it is important to the reference stakeholder, then the final score for this entire loop is $A \times F^2 = 1.0 \times 0.4^2 = 0.16$. 
The remaining loops in the stakeholder value network have been scored and are shown in Table 4.

Table 4: Scoring of the important loops in the stakeholder value network

<table>
<thead>
<tr>
<th>From</th>
<th>Need</th>
<th>To</th>
<th>Need</th>
<th>To</th>
<th>Link A</th>
<th>Final Link</th>
<th>$A^*F^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer</td>
<td>Revenue</td>
<td>Realtors</td>
<td>Services</td>
<td>Consumer</td>
<td>1.0</td>
<td>0.4</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>Revenue</td>
<td>Complementary</td>
<td>Industry</td>
<td>Services</td>
<td>0.8</td>
<td>0.2</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Shelter</td>
<td>Local Community</td>
<td>Revenue</td>
<td></td>
<td>0.4</td>
<td>0.8</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Taxes</td>
<td>Gov't</td>
<td>Protection</td>
<td></td>
<td>0.4</td>
<td>0.2</td>
<td>0.02</td>
</tr>
<tr>
<td>Realtors</td>
<td>Membership</td>
<td>Realtor Association</td>
<td>Professional</td>
<td>Realtors</td>
<td>1.0</td>
<td>0.4</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>Services</td>
<td>Consumers</td>
<td>Revenue</td>
<td></td>
<td>0.4</td>
<td>1.0</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Referrals</td>
<td>Complementary</td>
<td>Industry</td>
<td>Referrals</td>
<td>0.2</td>
<td>0.1</td>
<td>0.00</td>
</tr>
<tr>
<td>Complementary</td>
<td>Referrals</td>
<td>Realtors</td>
<td>Referrals</td>
<td>Complementary</td>
<td>0.1</td>
<td>0.2</td>
<td>0.00</td>
</tr>
<tr>
<td>Industry</td>
<td>Services</td>
<td>Consumers</td>
<td>Revenue</td>
<td></td>
<td>0.2</td>
<td>0.8</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Services</td>
<td>Local Community</td>
<td>Revenue</td>
<td></td>
<td>0.2</td>
<td>0.8</td>
<td>0.13</td>
</tr>
<tr>
<td>Local Community</td>
<td>Revenue</td>
<td>Complementary</td>
<td>Industry</td>
<td>Services</td>
<td>0.8</td>
<td>0.2</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Revenue</td>
<td>Consumers</td>
<td>Shelter</td>
<td></td>
<td>0.8</td>
<td>0.4</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Taxes</td>
<td>Gov't</td>
<td>Protection</td>
<td></td>
<td>0.4</td>
<td>0.2</td>
<td>0.02</td>
</tr>
<tr>
<td>Gov't</td>
<td>Protection</td>
<td>Local Community</td>
<td>Taxes</td>
<td>Gov't</td>
<td>0.2</td>
<td>0.4</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Protection</td>
<td>Consumers</td>
<td>Taxes</td>
<td></td>
<td>0.2</td>
<td>0.4</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Funding</td>
<td>Regulators</td>
<td>Public Safety</td>
<td></td>
<td>1.0</td>
<td>0.2</td>
<td>0.04</td>
</tr>
</tbody>
</table>

For each stakeholder, the highest link score represents the top need for that stakeholder. These top needs are their interpretations have been summarized in Table 5, below.
Not surprisingly, for the primary stakeholder, consumers, their top need is to buy and sell their homes above all other needs. For realtors, their top need is to bring in revenue for the exchange of services provided to consumers. This is also very similar to the needs of the players within the complementary industry, where in order to make a living, they need income to provide for themselves and their families. For citizens in the local community, shelter is their top need. Finally, for the government and regulators, their top need is determined to be providing some sort of protection for the public in terms of real estate, physical, legal, and other general forms of protection.

It is important to note that the analysis, thus far, has focused on typical, normal economic conditions. As the last decade has taught everyone, economic conditions can change drastically in a short matter of time. This affects the real estate industry and as such, the next section looks into how each of the stakeholders' top needs could change as exogenous factors are introduced.

4.4.1 Changes due to Dynamic Market Conditions

As the real estate cycle progresses, some of the things that stakeholders care about or need may change. Therefore, the top needs identified in the previous section is reanalyzed based on varying macroeconomic conditions. If needs change, then flexibility needs to be designed into the system. Flexibility is a vital attribute for a well-designed system. It is much easier to design flexibility into the system prior to implementation.
The conditions that are chosen to be analyzed include varying the regulatory environment, buyers’ vs sellers’ markets, lending willingness of banks and variability of mortgage rates. For each of these scenarios, the extremes are investigated.

Using Kano analysis, the $A^2F^2$ score is calculated for each of the 17 loops for each stakeholders’ needs in the stakeholder value network. Previous discussion on these needs has been labelled as ‘Normal’ in Table 6, whereas new conditions have also been appropriately labeled in the columns to the right of ‘Normal’. Two things can be studied from this investigation.

Firstly, the variation between one single stakeholder’s need can be observed (i.e. the variation within a single row in the table). Large variations in the score mean that the importance of this need changes a lot. For example, looking at the realtor -> realtor association -> realtor loop, the score for a high regulatory environment versus low regulatory environment is 0.64 to 0.16. What this mean is that when regulatory conditions are high, the realtor may rely on the realtor association and fellow members to keep up to date on the latest regulatory developments. The realtor association may enforce its members to enroll in professional development or training courses to stay abreast on new laws. Varying regulatory conditions may not be as important temporally in a region, but where this comes to play is spatially if the proposed system were to be deployed across multiple states with varying regulatory environments.

The second category of insights this section of research brings is the changing of top needs for a stakeholder. The top need for each condition per stakeholder is marked in bold in Table 6, while the score or importance of the need is color-coded from blue to red, indicating little importance to high importance. The top need changes for some stakeholders when the macroeconomic conditions change. For consumers, as an example, under a high regulatory environment or a buyer’s market, it is extra important to have a realtor guide them through the process and use their expertise navigating the market. Without the services that the realtor provides, it may be very difficult for consumers to achieve their goal. As such, under those economic scenarios, a realtor’s services scored high.
Table 6: A*F² scores varying between different economic scenarios, signifying the changing needs of the stakeholders. Bold values indicate the top need per stakeholder for that economic condition. Blue coloring indicates needs that are of little importance, while red coloring shows needs of high importance.

The purpose of such an analysis is to also think about the flexibility that the system needs in fulfilling stakeholders’ needs during the lifetime of the system. Again, there are two parts that flexibility needs to address: 1) variability within a single need and 2) variability of top need per stakeholder. Graphically, the same data is presented in Figure 6, below. The vertical axis is the A*F² score, while the horizontal axis is the Need ID number from the previous table (Table 6). From this visualization, it can clearly be seen which needs have low variability and importance (namely Need IDs 4, 7, 8, 10, 13, 14 and 15) versus all the other needs that have either high variability and/or importance. When designing a new system, it is those needs that have high variability or importance that need special attention.
Figure 6: Graphical representation of the stakeholders' changing needs under different economic scenarios. The vertical axis is the $A^2F^2$ score, while the horizontal axis is Need ID based on Table 6. The minimum score for a need among different scenarios is in blue, while the maximum score is in red.

Under most economic scenarios, the primary stakeholder's need to buy or sell a home is their top need. However, their secondary need is to receive guidance and support by realtors in the process of buying or selling their home, as shown in Figure 7.

![Variability of Needs Diagram](image)

Figure 7: Consumers' secondary need is to receive guidance and services from realtors

Given that the goal of this thesis is to investigate whether it is feasible to use technology to disrupt the current business model, the next step would be to take a deeper dive into what
services realtors provide for consumers. And then ultimately, in Chapter 6, concepts will be generated to use technology to serve these needs and to replace realtors altogether.

4.5 Ranking the Primary Beneficiary’s Secondary Needs

In understanding how the consumers’ secondary needs are fulfilled by the realtor, the needs will be identified and ranked (in terms of importance) in this section.

In Table 7, below, the services that a realtor provides to a consumer have been identified and then scored using the Kano analysis approach described in the previous section.

*Table 7: Identifying the services provided by the realtor to the consumer and subsequent $A^*F^2$ scoring*

<table>
<thead>
<tr>
<th>Need ID</th>
<th>Customer-Realtor Needs</th>
<th>Benefit</th>
<th>Supply</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understanding the process</td>
<td>Must</td>
<td>Medium</td>
<td>0.8</td>
</tr>
<tr>
<td>2</td>
<td>Understanding the types of loans/programs</td>
<td>Should</td>
<td>Low</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>Ways to reduce mortgage payments</td>
<td>Might</td>
<td>Low</td>
<td>0.1</td>
</tr>
<tr>
<td>4</td>
<td>Home and feature searching</td>
<td>Must</td>
<td>Medium</td>
<td>0.8</td>
</tr>
<tr>
<td>5</td>
<td>Ensure paperwork is complete</td>
<td>Must</td>
<td>Low</td>
<td>0.4</td>
</tr>
<tr>
<td>6</td>
<td>Neighborhood selection</td>
<td>Must</td>
<td>Low</td>
<td>0.4</td>
</tr>
<tr>
<td>7</td>
<td>Exposure for sellers (MLS)</td>
<td>Should</td>
<td>High</td>
<td>0.5</td>
</tr>
<tr>
<td>8</td>
<td>Coordination with lenders, attorneys, title company, buyer/seller</td>
<td>Should</td>
<td>Medium</td>
<td>0.4</td>
</tr>
<tr>
<td>9</td>
<td>Home pricing</td>
<td>Must</td>
<td>Medium</td>
<td>0.8</td>
</tr>
<tr>
<td>10</td>
<td>Education about the market</td>
<td>Should</td>
<td>Medium</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Using a combination of benefit and supply ranking, the top needs have been identified as

- Understanding the buying or selling process
- Home and feature searching, primarily for home buyers
- Pricing of a home, primarily for home sellers

In designing a system where it is hypothesized that technology can be utilized to address these needs, it would also be useful to understand the level of variation of these needs under different economic environments.

4.5.1 Changes due to Dynamic Market Conditions

In Table 8, below, the $A^*F^2$ scores are calculated for each of these services that realtors provide to consumers under varying macro conditions.
Table 8: A*F² scores for consumers’ secondary needs under varying macro conditions. Blue coloring indicates needs that are of little importance, while red coloring shows needs of high importance.

<table>
<thead>
<tr>
<th>#</th>
<th>Customer–Realtor Needs</th>
<th>Normal</th>
<th>High Regulations</th>
<th>Low Regulations</th>
<th>Buyers’ Market</th>
<th>Sellers’ Market</th>
<th>Strict Lending</th>
<th>Easy Lending</th>
<th>High Mortgage Rates</th>
<th>Low Mortgage Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understanding Process</td>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.4</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>2</td>
<td>Understand types of loans/programs</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
<td>0.1</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>Ways to reduce mortgage payment</td>
<td>0.1</td>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>4</td>
<td>Home and feature searching</td>
<td>0.8</td>
<td>0.6</td>
<td>0.8</td>
<td>0.6</td>
<td>0.4</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>5</td>
<td>Ensure paperwork is complete</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>6</td>
<td>Neighborhood selection</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>7</td>
<td>Exposure for sellers (MLS)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>1.0</td>
<td>0.3</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>8</td>
<td>Coordination with lender, attorney, title company, buyer/seller</td>
<td>0.4</td>
<td>0.8</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>9</td>
<td>Pricing</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>10</td>
<td>Education about market (comparable homes that have sold, how long a home has been on market, what homes haven’t sold, activity in local market)</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.8</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

The scores highlighted in red are the top scoring needs within each scenario. It can be seen that the previously identified top three needs are still very relevant despite different conditions, but interestingly, needs such as ‘Exposure for sellers on MLS’ becomes the top need in conditions such as buyer’s market. On the contrary, there are some needs which consistently rank of low importance, such as ways to reduce mortgage payments or understanding the types of loans and programs available. These valuable insights will be considered during the concept generation and selection phase of the system design in Chapter 6.

Now that some of the endogenous factors that could affect system architecture and design have been investigated, the next chapter will focus on the exogenous influences to the system.
5. Influences

This chapter begins with a look at Michael Porter’s Five Forces [16] framework to understand some of the external influences that could affect system design. Following that, a deeper look at some of the current companies trying to disrupt this industry is analyzed.

5.1 Porter’s Five Forces

To better understand the industry context in which the proposed system would operate, industry strengths and weaknesses will be identified using five competitive forces, as depicted in Figure 8: Porter’s Five Forces framework, below.

![Porter's Five Forces Framework](Figure 8: Porter's Five Forces framework)

5.1.1 Threat of New Entry

Because the total addressable market for the real estate industry is so large, it is expected that competition would increase once the concept has been proven and adoption increases. Currently, competition is low, resulting in an expected high profit margin.

**Barriers to Entry**

Since the advent of the internet, the barriers to entry for online software companies have steadily decreased. Without the need for complex IT infrastructure and costs, cloud computing has allowed for small online businesses to compete against larger industry behemoths, such as
the traditional real estate industry with realtors. Another barrier to entry for newcomers could be the traditional industry (real estate agents and associations) will defend their market rigorously, potentially through lobbying and marketing.

**Barriers to Exit**

Because there seems to be a low exit cost, barriers to exit cannot be considered as a deterrent to enter. However, the asset specificity, which is the extent of a company’s assets being able to produce other products/services if the proposed products/services fails, is high. This can act as a barrier to entry in two ways:

1. New entrants will be hesitant to invest in highly specialized software, especially since it is not easy for the software to produce other products/services after the initial product/service fails.
2. After existing firms that have created this highly specialized software and technology, it will defend the market against new entrants rigorously.

**Mitigation Plan for a Low Barrier to Entry**

To mitigate the low barrier to entry, the proposed system would have to build some competitive advantages, such as:

1. Design a superior system architecture against its competitors.
2. Design the system to be flexible enough to adapt to new markets – either geographically or through customer price segmentation.
3. Design the system to be able to scale – well defined modules, abstraction and interfaces.
4. IP protection for novel approaches.
5. Leverage MIT’s powerful entrepreneurship network and resources.

5.1.2 Threat of Substitutes

The substitutes to the proposed system include renting, timeshares, hotels, fractional ownerships and the traditional real estate industry, in which the proposed system is trying to disrupt. There is also a low threat of substitutes from outside industries. If the proposed
system could target a niche market within the industry, the threat of substitutes and
competition will be even lower. The reason for this is because if the proposed system were to
capture a lot of the total addressable market share too quickly, this would grab the attention of
the large industry players, as well as signaling out of industry companies that this is a very
attractive market. However, special attention needs to be paid to the fact that the switching
cost between the proposed system and the traditional system seem to be low. This is,
unfortunately, a double-edged sword. On one hand, the low switching cost could mean that it
is easy for consumers to switch from the traditional system to the proposed system. On the
other hand, it could also work in reverse. Hence, the proposed system needs to provide more
value than the traditional system to prevent consumers from switching away from the
proposed system.

5.1.3 Bargaining Power of Suppliers
The bargaining power of suppliers is complex and should be broken down based on specific
suppliers, as follows:

1) Housing inventory database (such as MLS)
   • bargaining power is high
   • access to MLS is restricted to realtors only
   • no other databases exist that are as thorough as the MLS

2) Cloud computing
   • bargaining power is weak
   • several suppliers of cloud technology and data storage available
   • cheaply and readily available
   • switching cost is low

3) Website hosting
   • bargaining power is weak
   • several suppliers of website hosting technology exist
   • cheaply and readily available
   • switching cost is low
4) Complementary industries in the ecosystem (home inspectors, lawyers, title agency, banks, etc.)
   - bargaining power is weak
   - many alternatives available in the market
   - switching cost is low

5) Distribution channel
   - bargaining power is weak
   - distribution of the product/service over the internet is standardized
   - distribution of product/service as a mobile application is standardized with several alternatives available
   - switching cost is low

The only supplier that has been identified with a high bargaining power is the MLS database containing current housing market data. To weaken their bargaining power, the proposed system would need access to the database, possibly through a licensing agreement or negotiation.

5.1.4 Bargaining Power of Buyers

Consumers have few alternatives except for going back to the traditional business model. A lack of alternatives would suggest low bargaining power for the buyers. However, it is easy for consumers to switch back to the traditional business model, which could suggest a higher bargaining power. As such, the bargaining power of buyers is medium.

Initially, as the proposed system targets a niche market, this beachhead customer segment may be less sensitive to price; as new entrants move into this market, this could change though.

A possible strategy to reduce the bargaining the power of buyers could be to increase the switching cost, such as storing all their information, preferences and relationships with other stakeholders into a proprietary database.
5.1.5 Competitive Rivalry

The intensity of competition would initially be low due to the lack of firms directly competing against the proposed system. As adoption increases, new firms are expected to enter the market, thereby increasing competition. Eventually if the market becomes saturated, market growth could peak and competition may become cut-throat.

Possible strategies to combat the intensity of competition include:

- Increase switching costs to the consumers prior to competition enters the market
- Increase process innovation so prices can be lowered
- Increase product differentiation
- Utilize multiple channels of distribution to infiltrate the market at different price points and segments
- When the industry is about to saturate, reconfigure the company assets to ride the next wave of innovative advantage and disengage the company's assets and other capabilities

Aside from direct competition, other forms of competition exist, mainly from those companies using the traditional business model or a hybrid between the traditional and technology-based methods. These competitors are studied in more detail in the next section and also in Chapter 6.

5.2 Competition

The current companies can be categorized into two main buckets: traditional and hybrid.

The companies competing in the traditional business model category are individual or groups of real estate agents that provide services in exchange for a commission from the consumer.

The competitors in the hybrid model tout to use some form of technology to assist in providing services to their consumers. These smart technologies can aid in home and feature searching, ensuring paperwork is complete, home pricing estimates, and market education through the use of content marketing and Web 2.0. These companies are considered hybrid because they
still use real estate agents in some way, albeit some companies have begun innovating on agent's compensation model, such as being salary-based and not commission-based.

In Figure 9, below, is the spectrum of technical innovation that is used to disrupt the industry. On the far left, is the traditional business model, which has existed for decades. The hybrid model is shown in the middle, which has started to emerge with the advent of internet and growing popularity of data mining, machine learning, Web 2.0 and inbound marketing techniques. On the far right is a pure technology-based solution, where real estate agents can be taken out of the picture and their services replaced by technology.

Figure 9: Spectrum of technical innovation in the real estate industry.

It is this thesis' argument that the current "disruptors" are operating in a hybrid model, where they have not gone far enough to truly disrupt the industry. The trend amongst many industries is an increasing reliance on technology and the real estate industry is no different.

In the next chapter, concepts will be generated then selected to explore the possibility of using a pure technology-based solution to fully address the consumers' needs.
6. Concept Generation and Selection

The first part of this chapter investigates how concepts can be generated simply by breaking down existing players in industry into concept fragments. Once this has been done, concept selection deals with selecting the best combinatorial fragments to form a full solution. However, this full solution may still not be ideal and the last section of this chapter explores ideas from other industries on how to improve upon the selected concept.

6.1 Concept Generation

There are many techniques to create concepts. The concept generation technique used for this thesis is to break down how each of the competitors’ serves the needs of the consumers previously listed in Chapter 4. The competitors chosen for this analysis are the ones found to be most innovative and utilized some form of technology to solve their customer’s problems. The chosen companies are Zillow, Trulia, Redfin, Compass, Houwzer, Estately and ForSaleByOwner. Allre, a startup formed in 2014, delivered a promising introduction at the TechCrunch Disrupt SF 2014 conference and had hopes to disrupt the real estate industry using technology. Allre is not included in the analysis because the startup, as of 2015, no longer existed [17].

6.1.1 Integrated Concept Mapping based on Customer Needs

In Table 9, below, the top needs of the primary stakeholder, the consumer, are listed in the first column. The column that is labelled “Weight” is the $A^2F^2$ score, which represents the importance of that need from the Kano analysis performed in Chapter 4. The column labelled “Variability” is the relative change of the $A^2F^2$ score based on varying different macroeconomic conditions, also from previous analysis. The remaining columns are the fragments of how each competitor serves these top needs. When the concept fragments are combined together, the result is an integrated concept.
Table 9: Integrated concepts formed by creating concept fragments of competitors

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleByOwner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Low</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
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<td></td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>Low</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
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<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<td></td>
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<td>No</td>
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<td>No</td>
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<td>Yes</td>
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<td></td>
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</tr>
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<td>No</td>
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<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Sellers Guide</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Understate types of loans/programs</td>
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<td>Medium</td>
<td>Yes</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ways to reduce mortgage payment</td>
<td>0.1</td>
<td>Low</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Home and feature searching</td>
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<td>High</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
</tr>
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<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>If you pay</td>
</tr>
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<td>High</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
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<td>Low</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

6.2 Concept Selection

6.2.1 Quantification of Integrated Concepts

Once the concept fragments and integrated concepts have been formed, the fragments are quantified based on not only how well that specific company served the consumer's need, but also based on how well that specific company uses technology as a basis to serve the need. As an example, from Table 10, below, Zillow scores a 5 out of 5 for how they use technology to address the need of Pricing. According to their website, Zillow uses Zestimate – a proprietary algorithm to guess the value of a home based on millions of public and user-submitted data points. These estimates are automatically recomputed several times a week in case of new data. On the contrary, Zillow scores 0 out of 5 on the need of ensuring that the paperwork is complete. Zillow scores 0 because it does not use technology to address this need but instead, uses real estate agents to accomplish this. The remaining needs for Zillow and all other competitors are scored and are shown in Table 10, below.
Table 10: Quantification of concept fragments

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleByI</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.0</td>
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<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Understand types of loans/programs</td>
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<td>Medium</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>Ways to reduce mortgage payment</td>
<td>0.1</td>
<td>Low</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Home and feature searching</td>
<td>0.8</td>
<td>High</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
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</tr>
<tr>
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<td>Medium</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
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<td>5</td>
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<tr>
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<td>Medium</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
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<td>High</td>
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<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Coordination with lender, attorney, title company, b</td>
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<td>High</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Pricing</td>
<td>0.8</td>
<td>Low</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Education about market</td>
<td>0.4</td>
<td>High</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
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</table>

<table>
<thead>
<tr>
<th>Weighted Score</th>
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<th>10.9</th>
<th>12.5</th>
<th>8.5</th>
<th>4.9</th>
<th>4.9</th>
<th>15.3</th>
<th>21.5</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>60.3%</td>
<td>37.6%</td>
<td>43.1%</td>
<td>29.3%</td>
<td>16.9%</td>
<td>16.9%</td>
<td>52.8%</td>
<td>74.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The weighted score is calculated for each company. It is the sum of the weights multiplied by the scores. The column labelled “Ideal” is the maximum score from all of the competitors, while the column to the very right, labelled “Max”, is the maximum possible score. Finally, the percentages of each company’s weighted score to the maximum score is calculated in the bottom row of the table.

6.2.1.1 Insight 1: Industry-Leading Does Not Mean Technology-Leading

The first insight from the analysis is that despite Zillow touting itself as a technology firm, it only scored 60.3% on its ability to serve the consumers’ needs with technology, as seen in Table 11, below. While this is the top score among the competitors surveyed, it is still far from 100%.

What this means is that even a large technology firm in this industry only reached slightly more than half of the potential in having this industry served completely by technology. There is ample opportunity for a new technology firm to come in and use technology-based solutions to meet consumers’ needs.
Table 11: Zillow scored 60.3% in its ability to use technology to fully serve consumers’ needs.

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying/Selling</td>
<td>1.0 Low</td>
<td>2.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Understanding Process</td>
<td>0.8 High</td>
<td>3.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Understand types of loans/programs</td>
<td>0.2 Medium</td>
<td>3.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Ways to reduce mortgage payment</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>5.0</td>
</tr>
<tr>
<td>Home and feature searching</td>
<td>0.8 High</td>
<td>5.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Ensure paperwork is complete</td>
<td>0.4 Medium</td>
<td>0.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
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</tr>
<tr>
<td>Neighborhood selection</td>
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<tr>
<td>Exposure for sellers (MLS)</td>
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<td>5.0</td>
<td>5.0</td>
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</tr>
<tr>
<td>Coordination with lender, attorney, title company, buyer/seller</td>
<td>0.4 High</td>
<td>0.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
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<td>5.0</td>
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<tr>
<td>Pricing</td>
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<td>5.0</td>
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<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
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<td></td>
<td></td>
<td></td>
<td>60.3%</td>
<td>74.1%</td>
</tr>
</tbody>
</table>

6.2.1.2 Insight 2: A Technology-Based Solution’s Opportunity to Enter the Market

The second insight from this research is that using a morphological matrix approach, where the best concept fragment is taken from each competitor to form an ideal integrated concept, the score of the ideal integrated concept is only 74.1%. Please refer to Table 12. This is interpreted that the best of the best within the industry still reveals a gap of nearly 25.9%, but also keep in mind that this ideal integrated concept is still fictitious as has been created only by piecing elements from different companies together. Similar to the first insight, this shows that there exists an opportunity for a full technology-based solution to enter this market.

Table 12: Using a morphological matrix approach, the best of the best concept fragments resulted in a score of 74.1%.

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying/Selling</td>
<td>1.0 Low</td>
<td>2.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Understanding Process</td>
<td>0.8 High</td>
<td>3.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Understand types of loans/programs</td>
<td>0.2 Medium</td>
<td>3.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Ways to reduce mortgage payment</td>
<td>0.1 Low</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Home and feature searching</td>
<td>0.8 High</td>
<td>5.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Ensure paperwork is complete</td>
<td>0.4 Medium</td>
<td>0.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Neighborhood selection</td>
<td>0.4 Medium</td>
<td>0.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Exposure for sellers (MLS)</td>
<td>0.5 High</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Coordination with lender, attorney, title company, buyer/seller</td>
<td>0.4 High</td>
<td>0.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Pricing</td>
<td>0.8 Low</td>
<td>0.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Education about market</td>
<td>0.4 High</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Weighted Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.5</td>
<td>21.6</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60.3%</td>
<td>74.1%</td>
</tr>
</tbody>
</table>

6.2.1.3 Insight 3: Unmet Consumer Needs using Technology from Current Industry Companies

This analysis reveals two rows with complete zeroes, shown in Table 13, below. Rows with all zeroes indicate that the consumer’s need is not being addressed by technology at all by
anybody in the industry. The first row of all zeroes is the need to find ways to reduce mortgage payments. Looking at the variability column for this need shows that it has low variability during different macroeconomic conditions. Interestingly, the importance weight is 0.1, which is the lowest score possible. Considering that it has low variability coupled with low importance, this consumer need can potentially just be ignored or placed on a very low priority in the design of the proposed system. The second row of zeroes is the consumer need of document coordination and signing between all the relevant parties. Currently, this is being handled by the real estate agent for other companies.

Table 13: Rows of zeroes indicate a need currently not addressed by technology at all in the industry.

These rows of zeroes, or in other words, needs that are not currently met via technology, poses a great opportunity to develop technology to fill this need. There are three major benefits in doing this:

1) Creates a competitive advantage
2) Creates differentiation against current competitors
3) Generates efficiency over current competitors

Settling with the ideal integrated concept created by a best morphological matrix combination in industry yields only 74.1%. The next frontier would be investigation on how to move from the ideal integrated concept score of 74.1% to the maximum score of 100%. The difference between the ideal and max score represents the gap in how technology is used to serve this
need in this industry. The two main approaches in closing this gap is technical innovation or borrowing ideas from other industries. The next section will explore the latter idea.

6.2.2 Getting to Utopia

As seen in the previous section, using the best morphological matrix combination within this industry is not enough in finding a solution that would completely serve consumers’ needs using technology. This section will focus on a similar concept to using a morphological matrix to select the best combination, but it will not use concept fragments within this industry, it will use ideas and concept fragments from other industries in order to attain a technology-based solution scoring of 100%. Previous sections used an intra-industry morphological matrix, while this next section will use an inter-industry morphological matrix methodology. Each of the eleven consumer needs are discussed, as follows.

6.2.2.1 Primary Beneficiary Need 1

Table 14: Consumer Need #1 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleByOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying/Selling</td>
<td>1.0</td>
<td>Low</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: Buying or selling a home is a vital need for the consumer and its importance varies little in different macroeconomic conditions. The vast majority of companies utilize real estate agents to accomplish this. Some companies have departed from the traditional commission-based model to having salary-based model but For Sale By Owner is the only one that uses a process to sell without an agent. Still, the technology For Sale By Owner uses is not enough to make the process efficient. As a result, they got a score of 4 out of 5.

Getting to Max Score: To improve efficiency through the use of technology, an online platform is proposed where stakeholders interact and engage to complete the process of home buying or selling. Examples of an online platform where this is happening is eBay, Amazon and AutoTrader (for cars). In the system, all stakeholders contribute in the exchange of value flow within the ecosystem. Consumers can easily connect with lenders, home inspectors, lawyers, title agencies, escrow companies and mostly importantly, over consumers. Negotiations,
contracts and agreements can be done electronically with the aid of coordination through the platform. The system will provide checks and bounds for the entire process of home buying and selling for consumers.

6.2.2.2 Primary Beneficiary Need 2

Table 15: Consumer Need #2 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleByOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding Process</td>
<td>0.8</td>
<td>High</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis:

The current industry top score of 4 out of 5 is held by For Sale By Owner. Their website has a lot of information and is very detailed. However, the sheer amount of information made available has made the process seem complicated and overwhelming. This is why For Sale By Owner is not given a score of 5.

Getting to Max Score:

The first idea is to use technology to simplify the process. Virtual assistants or brokers, similar to Apple’s Siri or IBM Watson, are examples in other industries of how artificial intelligence and technology is being used to assist humans.

The second idea in helping consumers understand the process of buying or selling a home is to set up a forum for experts and consumers to engage with each other. Another advantage from this would be that this inbound marketing technique would pull your target consumer demographic onto your website (ie. Web 2.0).

6.2.2.3 Primary Beneficiary Need 3

Table 16: Consumer Need #3 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleByOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand types of loans/programs</td>
<td>0.2</td>
<td>Medium</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: The industry leaders for helping consumers understand the types of loans and program available to borrow money are Zillow and For Sale By Owner. The information
provided is textual and requires a lot of reading to understand which alternatives are appropriate for the consumer.

Getting to Max Score:

To achieve the maximum score, the first idea is to create an online platform where different stakeholders can virtually connect and engage with one another. Buyers, sellers, mortgage lenders, lawyers, title agencies, inspectors, and more, can plug into the platform and avoid some of the menial face-to-face meetings. This would also have the side benefit of increasing efficiency. And through the online platform, consumers can be connected to an assigned lender from the network of lenders registered in the system.

The other idea to accomplish this need is to provide only relevant information to the consumer. This could be done by anything from a simple questionnaire to automatically selecting information based off of the information they have entered into the system.

6.2.2.4 Primary Beneficiary Need 4

Table 17: Consumer Need #4 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleB</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ways to reduce mortgage payment</td>
<td>0.1</td>
<td>Low</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: No company in the industry provides very much information or solutions in helping consumers find ways to reduce their mortgage payments. A possible reason for this is that as seen from the table, above, it is very low importance and the importance of this need does not vary under different macroeconomic conditions.

While developing a solution to this need could provide a means of differentiation against competitors, it is low priority and not further considered at this time.

6.2.2.5 Primary Beneficiary Need 5

Table 18: Consumer Need #5 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleB</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home and feature searching</td>
<td>0.8</td>
<td>High</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Ideal Score Analysis: Several companies in the industry do a great job at providing technology to help the home and feature searching process for home buyers. The process is becoming quite standardized across the industry, as there always seems to be an interactive map plus advanced filter for features.

Getting to Max Score: The proposed system can easily follow some of the industry leaders for this need, as many companies are fulfilling this need via technology. However, to differentiate the proposed system from its competitors, machine learning techniques can be used, as follows:

- As consumers look at homes, they can pin or upvote homes they like, similar to how Pinterest [18], Reddit [19] and Quora [20] operate.
- The system will use associative rules and clustering algorithms [21] to show popular pinned and upvoted homes as recommendations based on what other consumers in their exact demographic liked.

The added benefit is that consumers listing their homes will want to have the best looking pictures and marketing to get highly pinned and upvoted. As such, competition between sellers can cause a positive reinforcing loop [22]. Of course, these machine learning algorithms can be combined with conventional filtering techniques to ensure consumers’ “must-haves” are met.

6.2.2.6 Primary Beneficiary Need 6

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleB</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure paperwork is complete</td>
<td>0.4</td>
<td>Medium</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: The only current industry player that uses technology to fill this need is For Sale By Owner. Their use of technology is limited though because it involves displaying a non-interactive checklist on a webpage. For this reason, they have been given a score of 3 out of 5. All other industry players use real estate agents to meet this consumer need.

Getting to Max Score: The use of dashboards is becoming more popular for analytics in other industries. The dashboard idea could be transformed into this context, where it would show
the consumers’ process in getting all the necessary steps complete. Additionally, because the stakeholders are present in the online platform, coordination to get paperwork done can be automated to send reminders to all involved parties.

6.2.2.7 Primary Beneficiary Need 7

Table 20: Consumer Need #7 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass H</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleB</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighborhood selection</td>
<td>0.4</td>
<td>Medium</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: One of the needs of the consumer is to find a neighborhood to live in. This could be a problem for newcomers to a city, where they are not familiar with the different areas nor have friends to solicit advice.

Getting to Max Score: Similar to helping consumers find homes and features for homes, machine learning algorithms can be used to recommend neighborhoods. Amazon currently uses such techniques to recommend other books and items the purchaser may be interested in, based on their search history [21]. Perhaps the proposed system can recommend neighborhoods based on where other consumers within the same demographic spent the most time and interest looking online.

6.2.2.8 Primary Beneficiary Need 8

Table 21: Consumer Need #8 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass H</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleB</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure for sellers (MLS)</td>
<td>0.5</td>
<td>High</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: Many companies are doing a great job using technology to increase exposure of their consumers’ homes for sale. All companies post on MLS, as well as each other’s websites and platforms.

Getting to Max Score: A similar approach can be used for the proposed system, where homes can be listed across multiple databases. In addition, to increase exposure for specific homes, there is an incentive to create a well thought out ad and beautiful pictures, so they can be upvoted in the proposed system.
6.2.2.9 Primary Beneficiary Need 9

Table 22: Consumer Need #9 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleB</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordination with lender, attorney, title company, buyer/seller</td>
<td>0.4</td>
<td>High</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: No industry players use technology to satisfy this consumer need. If it is done, generally it is accomplished by real estate agents.

Getting to Max Score: The solution to this need is to use an online platform where stakeholders connect. Coordination amongst stakeholders is done through the online platform system. Details have been discussed in previous sections and will not be repeated here.

6.2.2.10 Primary Beneficiary Need 10

Table 23: Consumer Need #10 Analysis

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>Variability</th>
<th>Zillow</th>
<th>Trulia</th>
<th>Redfin</th>
<th>Compass</th>
<th>Houwzer</th>
<th>Estately</th>
<th>ForSaleB</th>
<th>yOwner</th>
<th>Ideal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing</td>
<td>0.8</td>
<td>Low</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Ideal Score Analysis: Several companies have price estimates for homes. The most famous one out of the group of competitors is Zillow’s Zestimates. Zestimates has been used as a great PR tool to draw in many new prospective customers. Zillow and Trulia received the maximum score of 5 because of their use of machine learning and data mining techniques to create the estimate.

Getting to Max Score: A good approach for the proposed system is to emulate what Zillow and Trulia have done to create home price estimates, but to use a different algorithm to circumvent IP restrictions.

Another approach to solve this problem is to have home appraisers connected to the system’s online platform, so that they can connect with consumers to calculate an accurate price for their homes.
Ideal Score Analysis: The final consumer need deals with overall education about the market. The amount of information on the internet, fueled with the volatility in the real estate market during the recent recession and recovery, has created an awareness and interest for consumers in economic and real estate conditions. Companies like Zillow, Trulia and Compass seem to use content marketing techniques, like creating blogs, forums and articles to both draw in consumers, but also educate them.

Getting to Max Score: It should be fairly straight forward to emulate the best practices of the industry in this area. Blogs, forums and articles are commonplace in many industries and consumers, in some sense, almost have an expectation that a technology firm would have some form of interactive platform.

6.3 The Aggregated Solution

The combined solution to satisfy all of the consumers’ needs are summarized as follows:

Feature 1: Online platform

Feature 2: Virtual assistant and brokers

Feature 3: Forum, blogs and articles

Feature 4: Welcome questionnaire

Feature 5: Machine learning to aid home and feature searching and to recommend neighborhoods

Feature 6: Dashboard to ensure paperwork is complete

Feature 7: Exposure into MLS and other databases

Feature 8: Big data mining to predict home prices
In reality for developmental work, resources are limited and it is often desired to produce the minimum set of features that can prove an idea as feasible and at the same time, able to deliver value to the consumer. Hence, the next section will provide an analysis on the priority on the development of the aggregated solution.

6.4 Developmental Priorities

To understand the development priority of features, the effort it takes to develop each feature in combination with its satisfaction of consumers’ needs are quantified. Table 25, below, shows the priority score for each feature. Feature development effort is color-coded according to the legend on the right.

Table 25: Quantification of developmental priorities

<table>
<thead>
<tr>
<th>Needs</th>
<th>Weight</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying/Selling</td>
<td>1.0</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding Process</td>
<td>0.8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand types of loans/programs</td>
<td>0.2</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ways to reduce mortgage payment</td>
<td>0.1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home and feature searching</td>
<td>0.8</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure paperwork is complete</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighborhood selection</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure for sellers (MLS)</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordination with complementary players</td>
<td>0.4</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pricing</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Education about market</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>PRIORITY SCORE</td>
<td>3.3</td>
<td>1.9</td>
<td>3.0</td>
<td>0.9</td>
<td>2.4</td>
<td>4.8</td>
<td>1.0</td>
<td>1.6</td>
<td></td>
</tr>
</tbody>
</table>

The priority score is calculated by summing each needs’ weight that each feature satisfies, multiplied by the level of effort. For example, feature 1 has a priority score of 3.3. This is calculated as follows:

\[(\text{Sum of Weights}) \times (\text{Effort}) = (1.0 + 0.8 + 0.2 + 0.1 + 0.4 + 0.8) \times 1.0 = 3.3\]

By investigating the table, “low hanging fruit” can be identified by the priority score since it is a function of high weight, low effort and large quantity of satisfied needs. Feature 6 has the highest priority score at 4.8 because it is low effort and fulfills several high weighted needs.

It is important to realize that several needs (ie. rows) are only satisfied by one feature (ie. column). Hence, these features are vital and must be included in the minimum development set, regardless of their priority score. These include features 1, 3, 5 and 7.
The next step is to determine the lowest number of features to include that would satisfy all needs. According to Table 26, below, features 1, 3, 5 and 7 cover the majority of the consumers’ needs with the exception of ensuring paperwork is complete. To fulfil this need, there is the option of feature 2 or 6. The priority score for feature 6 is 4.8, which is higher than feature 2’s priority score of 1.9. Hence, feature 6 is selected.

Table 26: Determining the minimum number of features to develop

<table>
<thead>
<tr>
<th>Needs</th>
<th>Feature ID 1,3,5 and 7</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying/Selling</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding Process</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand types of loans/programs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ways to reduce mortgage payment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home and feature searching</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure paperwork is complete</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Neighborhood selection</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Exposure for sellers (MLS)</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordination with complementary players</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pricing</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education about market</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRIORITY SCORE</td>
<td>N/A</td>
<td>1.9</td>
<td>0.9</td>
<td>4.8</td>
<td>1.6</td>
</tr>
</tbody>
</table>

The minimum set of features to develop to deliver full value to the consumer and prove this concept is feasible are features 1, 3, 5, 6 and 7. Please refer to Table 27, below.

Table 27: Final developmental priorities for features

<table>
<thead>
<tr>
<th>Feature ID</th>
<th>Feature</th>
<th>Development Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Online Platform</td>
<td>Primary</td>
</tr>
<tr>
<td>2</td>
<td>Virtual assistant and brokers</td>
<td>Secondary</td>
</tr>
<tr>
<td>3</td>
<td>Forum, blogs and articles</td>
<td>Primary</td>
</tr>
<tr>
<td>4</td>
<td>Welcome Questionnaire</td>
<td>Secondary</td>
</tr>
<tr>
<td>5</td>
<td>Machine learning to aid home and feature searching and to recommend neighborhoods</td>
<td>Primary</td>
</tr>
<tr>
<td>6</td>
<td>Dashboard to ensure paperwork is complete</td>
<td>Primary</td>
</tr>
<tr>
<td>7</td>
<td>Exposure into MLS and other databases</td>
<td>Primary</td>
</tr>
<tr>
<td>8</td>
<td>Big data mining to predict home prices</td>
<td>Secondary</td>
</tr>
</tbody>
</table>
7. System Validation and Verification

7.1 Methodology

To validate and verify that the aggregated solution, interviews were conducted with various stakeholders. The interview style of validation and verification was chosen because a prototype of the proposed solution was not created. Three interviewees were chosen:

1. Gerry Moylan
   Gerry has been a licensed realtor in the state of California since 2003. He is a high-performing realtor and also the president of Moylan Realty Group [23], a real estate brokerage firm in California.

2. Mark Gonzales
   Mark first attained his realtor license in 2005. After working for several years as a real estate agent, he joined Redfin. At Redfin, Mark was a real estate agent before transitioning to a recruiter role, where he actively searches for the best real estate talent across the country to join the growing firm.

3. Rene Wolfensberger
   Rene is a potential home buyer that has been searching for a home for nearly two years. He has used the services from Zillow, Redfin and For Sale By Owner.

The interviews were conducted individually. Each of the interviewees were briefed on the purpose of this research and exposed to the concept generation and selection phase of the analysis. Feedback was collected on feasibility of the aggregated solution and will be presented in the section.

7.2 Results

7.2.1 Interview #1: Real-Estate Agent

Gerry Moylan has been in the real estate business for many years. He is extremely familiar with the entire process and consumer sentiment. Through the years, he has observed and understood the reasons behind the successes and failures of various large brokerage firms. Even within these firms, he states that there has been innovation in the business model; albeit
they still use traditional commission-based real estate agents. For example, Keller Williams brokerage firm has been quite successful in their profit sharing business model, where they have implemented a “commission cap”. What this means is that after the brokerage firm’s realtors bring in and share a certain level of commission with the brokerage firm, the realtors keep 100% of the remaining commission for the rest of the year. This has allowed for the brokerage firm to thrive and is largely due to applying a different and innovative business model than older firms like Remax.

Specific feedback for the aggregated solution is summarized in the following table.

Table 28: Interview feedback from Gerry Moylan

<table>
<thead>
<tr>
<th>Need</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Platform</td>
<td>Gerry has several concerns with having an online platform serving as the central connection point for all the stakeholders:</td>
</tr>
<tr>
<td></td>
<td>1. Lack of Personal Interaction</td>
</tr>
<tr>
<td></td>
<td>Home buying and selling is one of the largest financial decisions for the vast majority of people. As a result, people are very emotional and trust is an important factor. Consumers may not trust technology or more frankly, a computer screen, for a transaction of several hundred thousand dollars. He believes that consumers would very much prefer interacting with a live person, such as a licensed real estate agent to complete the deal.</td>
</tr>
<tr>
<td></td>
<td>2. Lack of Consumer Hand-Holding</td>
</tr>
<tr>
<td></td>
<td>Because of the large amount of assets being transacted, if consumers do not feel safe throughout the process, less successful transactions will happen. Even if consumers feel secure, the process is complicated with an abundant number of laws and regulations to follow. Capitalizing on this fact, Gerry has, in the past, approached consumers trying to sell their homes on their own and have successfully converted them to become his own customers. Gerry cites that common reasons consumers are willing to convert include their inexperience, lack of customer networks, marketing inexperience, pricing issues and more.</td>
</tr>
</tbody>
</table>
### 3. Negotiations

Gerry believes that real estate agents are generally better trained to negotiate between home buyers and sellers. Agents can act as a buffer between the two parties, whose judgment can often be clouded due to high tensions and emotions.

### 4. Murphy’s Law

In his experience, something can and often times, will go awry sometime during the home buying or selling process. It is rare for transactions to be perfect. With a more automated, technology-based online platform, if something unplanned happens, it may become difficult for consumers to resolve the issues themselves. Because of this, Gerry believes that real estate agents are needed to handle problems and reassure consumers.

Finally, if the online platform were in place, he mentions that it could work if realtors were still part of the system to provide a-la-carte consulting services for consumers as an added check that everything is complete and provide extra piece of mind.

<p>| Understanding the Process | In helping consumers understand the home buying or selling process, Gerry agrees that some websites and agents overwhelm their customers with too much information, thereby turning them off from the experience. He also agrees in not giving consumers too much information about the process at one time. Technology can be used to simplify the process. In his experience, he found that giving step-by-step instructions to his clients was far more useful. |
| Understanding Types of Loans | Gerry did not seem to be opposed to the idea of using the online platform network to refer consumers to relevant complementary industry partners whom could assist in the process of helping consumers understanding the types of loans available to them. If information is provided on a website, perhaps in a forum as suggested in the proposed aggregated solution, then the information should be portrayed in video and not textual format, according to Gerry. |</p>
<table>
<thead>
<tr>
<th>Home and Feature Searching</th>
<th>Gerry thought the idea of using machine learning algorithms to recommend likely homes that consumers in similar demographics could work, so long as the assumption that similar demographics like the same thing is true.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensuring Paperwork is Complete</td>
<td>Gerry was interested in the idea of using an online platform system or similar technology to ensure that paperwork is complete. He believes that such menial work can be easily automated by technology. Currently, some real estate agents do this by themselves or have a Transaction Coordinator. A Transaction Coordinator may or may not be licensed and is responsible in putting all the forms and paperwork together for a realtor.</td>
</tr>
</tbody>
</table>
| Pricing | For the need of pricing a home, both ideas from the proposed aggregated solution were discussed with Gerry. The first idea where data mining and machine learning techniques would be applied to existing data, in order to predict new home prices, was not positively received. Zillow’s Zestimates uses similar algorithms and Gerry believes that its estimates are inaccurate. There are several reasons for Zestimates’ inaccuracy, including:  
  - House records may be inaccurate because of  
    - illegal additions  
    - old, non-up-to-date records  
  - Price per square foot is wrong because square footage is wrong  
  
  Because of these and other issues, he believes Zillow often times over estimates prices of homes.  

The second idea in providing the pricing of homes is to include home appraisers as part of the system’s network of complementary industry partners. Gerry thinks this would be a reasonable approach because having a person manually appraising a home is much more accurate, in his experience. Appraisers can check the public record, MLS and also inspect the home. His opinion is that the next best approach following using a home appraiser is to use a realtor. |
All in all, the overall impression from Gerry is that there will always be a role for the realtor, even if it is in a more limited role in the future. Technology should assist realtors in becoming more efficient and allow them to complete more transactions with less effort. In adopting a fully technology-based solution, the main hurdles seem to be consumers’ willingness in having technology represent them in one of the largest financial transactions of their life.

7.2.2 Interview #2: Redfin Agent and Recruiter

Redfin is one of the players in the industry that has adopted a hybrid business model. While the company still uses real estate agents, one of their major business model innovations is to pay their agents a salary, instead of a commission.

Mark Gonzales has experienced the industry as a realtor, Redfin real estate agent and Redfin recruiter. His feedback for some of the ideas from the proposed aggregated solution are summarized in the table, below.

*Table 29: Interview feedback from Mark Gonzales*

<table>
<thead>
<tr>
<th>Need</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Platform</td>
<td>After speaking with Mark regarding have an online platform to connect and engage all stakeholders, he brought up three major concerns:</td>
</tr>
<tr>
<td></td>
<td>1. <strong>Negotiation is Tough</strong></td>
</tr>
<tr>
<td></td>
<td>Because the online platform allows home buyers and sellers to directly engage with one another, negotiation is not as simple as one would imagine. Negotiation is not just one price, but on property conditions, timelines, etc. This is compounded by laws and regulations, so just because a buyer and seller has agreed to a deal does not make it legally binding if it is against regulations.</td>
</tr>
<tr>
<td></td>
<td>2. <strong>Intricacies of a Local Market</strong></td>
</tr>
</tbody>
</table>
|                    | Consumers that are not familiar with the market may not be aware of the nuances of a local market. Mark gave the example of where a market could be totally different even if they are just a few blocks apart he believes that this is where the strength of real estate agents comes in. Real estate agents are expected to know whether the next street
Understanding the Process

Mark is doubtful that the proposed aggregated solution can help consumers navigate the complex process. Furthermore, consumers may not trust the technology and he believes that they would still want to work with a real person. It may take a long time before the system can prove that it’s competent enough for mass adoption.

Neighborhood, Home and Feature Searching

In selecting neighborhoods, homes and features, Mark is concerned that technology would not do a good enough job in addressing consumers’ specific needs and requests. He believes technology or any algorithms may not be able to capture small nuances in the market and also would not be up-to-date. If technology advances enough to capture the local dynamics of a market, then he believes a real estate agent would still be needed to double check and verify the work of an automated system.

Ensuring Paperwork is Complete

While it may be possible for an automated technology-based system to check which documents may be missing, Mark believes that it might be difficult for the same system to verify the content within the documents. An actual person, such as a real estate agent, would be needed to go over the paperwork and ensure that the content is fair and reasonable for their client. More importantly, the real estate agent needs to complete their due diligence and ensure that what is written in the documents is legal and binding.

Coordination between Stakeholders

The idea of having a central online platform responsible in coordination between stakeholders may not be enough in Mark’s view. Having a computer or automated system send reminder texts or emails to people to get things done is
Overall, Mark’s impression on a pure technology-based system assisting home buyers and sellers seems pessimistic and with an understandable dose of skepticism. This is very likely the same sentiment that many consumers will have since this system has not been proven out. On top of that, the entire transaction process is complex with a lot of opportunity for things to go wrong.

When asked what he thinks the future would look like for real estate, Mark believes that there will always be a need to have a live person to talk to and work with for one of peoples’ largest and most complex transactions of their lives. However, as Redfin has and continues to prove, technology will also have a place in the process. Technology will assist real estate agents in becoming much more efficient and allow them to complete more transactions. Already, technology has enabled Redfin realtors in closing 25-40 transactions, in the same time it takes traditional brokers to close 6-8 deals.

<table>
<thead>
<tr>
<th>Pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>In presenting the two ideas from the proposed solution to Mark, he believes that a machine learning and data mining algorithm to estimate the price of a home would be inaccurate. He draws on experience from Zillow’s Zestimates, where he claims their estimates can be wildly inaccurate. Given this option and the option of having home appraisers as part of the system’s network of complementary industry partners, Mark definitely prefers using home appraisers to estimate home prices. This is because having someone inspect the records and look at the house would provide a more accurate and precision home price estimate.</td>
</tr>
</tbody>
</table>
7.2.3 Interview #3: Home Buyer

Rene Wolfensberger is a potential home buyer that has on-again, off-again searched for homes using Redfin, Zillow, For Sale By Owner and also attended open houses in the Los Angeles area. He is comfortable with technology and his feedback on the proposed system is summarized in the table, below.

Table 30: Interviewer feedback from Rene Wolfensberger

<table>
<thead>
<tr>
<th>Need</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Platform</td>
<td>In proposing an online platform where all stakeholders could engage and complete the home buying or selling transaction, Rene believes that this idea could work but only if it is very systematic and intuitive. He mentions his experience with AutoTrader, which is an online platform for car sales, was less than ideal. While the concept was great, he did not find the AutoTrader platform very useful because it did not allow him to complete the process without filling in every detail for their complicated questionnaire.</td>
</tr>
<tr>
<td>Understanding the Process</td>
<td>To help consumers understand the process of home buying or selling, Rene thinks it needs to be simple enough, yet sufficient. It should be easy to get started and you don’t need everything to be filled out completely. He is generally onboard with the idea of using technology to direct consumers and only provide relevant information. In discussing the use of a forum to engage industry experts (ie. real estate agents and complementary industry partners) with consumers, Rene is concerned about the incentive for industry experts to participate in a forum. He mentions if the online platform provides referrals between complementary industry partners and consumers, then an aspect of whom to refer could be based on the level of engagement in the forum.</td>
</tr>
<tr>
<td>Understanding the Types of Loans/Programs Available</td>
<td>Rene agrees with the two approaches proposed in the system. He believes that having an “online wizard” to filter out irrelevant information and the use of lenders and bankers as part of the network could work.</td>
</tr>
</tbody>
</table>
Ways to Reduce Mortgage Payments

Previous analysis showed that this was the least important need with low variability amongst various market conditions. Also, none of the competitors tackle this need using technology. Hence, it was proposed to not be included in the solution. Rene believes that this need should be not be ignored and even goes further to question the low importance score. If this need was addressed, it would provide a point of differentiation against competitors and he would be more inclined to use the system.

Neighborhood, Home and Feature Searching

Rene seemed excited about the prospect of using machine learning algorithms to recommend neighborhoods and homes to him, similar to how other companies recommend books he may enjoy reading. However, his only concern is the accuracy of these predictions. Specifically, he is interested in knowing how the algorithms can provide enough customized recommendations to him since there is a chance he may like homes different than what people in his demographic may like.

Ensuring Paperwork is Complete

In response to using a dashboard and online tools to ensuring completion of required paperwork, Rene questions whether all documents can be electronically signed or even submitted electronically? He mentions that, at least in the state of California, there are instances where electronic signatures or electronic submissions of legal documents are not allowed.

Pricing

Rene believes the process of having a home appraiser manually estimate the price of a home would be better than using a data mining technique.

Overall, Rene seems to be open to the idea of having technology play a much bigger role in the home buying or selling process. Key impressions from Rene’s interview are that the technology needs to be user friendly and simple. He also agrees with the other interviewees, in that there will always be a need to real estate agents especially with the affluent demographic, where they can afford and value full service.

7.3 Summary

Three interviewees were selected to provide feedback on the proposed aggregated solution. The interviewees’ opinions ranged from skepticism to excitement. Aside from the useful
specific feedback for individual features, the general take-aways learned from conducting these interviews include:

1. All of them believe that real estate agents will still have some purpose in the future, even if people rely more on technology.
2. Technology will increasing improve efficiency of the overall transaction, with or without a real estate agent.
3. A pure technology-based solution does not seem to be appropriate for everyone. It is, therefore, important to find the beachhead market, as they will likely be less price sensitive, open to technology, identify system weaknesses and may determine whether such a system is able to go mainstream for widespread adoption.
4. Both realtors that were interviewed worry that the online platform approach would lack personal interaction and trust, that consumers have learned to expect and rely on.
5. Both realtors also mention a large number of pitfalls that can happen during the process and that the system needs to be ready to handle.

A pure technology-based solution will have technical, sociopolitical and psychological barriers to overcome before it can prove viability and ensure mass adoption. The proposed aggregated solution needs to be robust, yet flexible enough to meet these challenges and also adapt to changing consumer needs and expectations.
8. Pricing

This chapter investigates a potential pricing architecture of an implementation of the proposed system. Previous studies [24] have shown that small improvements in pricing can result in a significant increase in profit. In [24], a company was able to boost profits by 12.5% by increasing pricing by 1%, whereas a decrease of 1% in fixed costs only yielded a 4% increase in profits.

8.1 Pricing Alternatives

In pricing a product or service, there are several options:

8.1.1 Cost-Based Pricing

This strategy prices a product or service based on the cost to create the product or service. A typical implementation of this method is charging a set markup from the sum of the unit variable cost and average fixed cost, as shown in Equation 1.

\[ \text{Price} = (1 + \% \text{markup})(\text{unit variable cost} + \text{average fixed cost}) \]  

There are several downfalls to this pricing strategy, including the inability to completely estimate every variable cost. Determining average fixed cost is also difficult because they are unstable. Average fixed cost is dependent on the number of sales, which is a function of prices. This results in a circular calculation. Finally, this is not an ideal pricing strategy because it implies that if sales fall, then costs go up and prices should also increase. However, if sales fall, then prices should probably not increase.

8.1.2 Competition-Based Pricing

This pricing strategy describes the scenario where the price is not based on the product or service, but primarily based on competitors’ pricing decisions. The price is typically set to match or discount from a competitor.

Potential issues with this strategy include ignoring the value proposition to the customer, as well as competitors’ likely response to your price matching or discounting. This could result in a disastrous price war. Consequently, in the long run, customers inadvertently expect a discount and teaches them to purchase based on price and not value.
8.1.3 Customer-Based Pricing

Customer-based pricing is where a product or service’s price is dictated by the customer.

The pitfalls of this pricing strategy include customers lying about their ability or willingness to pay for a product, or even customers’ inability to accurately gauge the value of a product. Finally, it could be beneficial to identify and target beachhead customers due to their willingness to pay high prices rather than target all customers.

8.1.4 Value Based Pricing

The aforementioned pricing strategies ignore the value proposition. Value-based pricing both qualitatively and quantitatively analyzes the value created to the customer. As such, value-based pricing should be used.

8.2 Economic Value to the Customer (EVC)

A useful framework to understand the value a product or service creates for a customer is the ‘Economic Value to the Customer’ (EVC). EVC is based on the idea that a customer will buy a product if its utility is greater than the utility of its closest alternative. Here, utility is defined as the value of a product minus the price. In the Equations 2 through 6, below, subscript \( a \) denotes our product, whereas subscript \( b \) represents the closest competitor.

\[
\begin{align*}
\text{Utility}_a &> \text{Utility}_b \\
V_a - P_a &> V_b - P_b \\
P_a &< (V_a - V_b) + P_b \\
P_a &< \text{DifferentiationValue}_{ab} + P_b \\
\text{EVC} &= \text{DifferentiationValue}_{ab} + P_b
\end{align*}
\]  

Hence, in order to sell the product, the price should be lower than the sum of the price of the closest competitor and the amount of differentiation value between the product and the same competitor as shown in Equation 6, above.
Looking at the consumers, the reference product and closest competitor should be For Sale By Owner since their offering is most similar and comparable to the thesis’ proposed solution. There are four points of differentiation that make up the differentiation value:

1. Increased efficiency (ie. time savings)
2. Network efforts
3. Big data generated
4. Higher reliability

After quantification of the points of differentiation, the EVC can be determined. However, the EVC only represents the potential theoretical maximum price that the product can be charged at. Typically, consumers expect a discount from the EVC due to the ‘fairness effect’. The price that can likely be charged is somewhere between the closest competitor’s price to 50% of the differentiation value created [24].

8.3 Pricing Architecture

Central to any successful business model is identifying how a company will receive payment for value created to customers. It is also much easier to set the pricing architecture correctly at the beginning of a business, since any changes later on may become difficult, complicated or even impossible. The pricing architecture analysis is broken into three parts, which will be explored next.

8.3.1 Who to charge

In determining which stakeholders to charge, the obvious group would be the consumer. However, additional revenue could be attained by charging all stakeholders whom can benefit from the points of differentiation created by the system. Home buyers and sellers benefit from the increased efficiency and reliability of the system. Realtors can benefit (and thus be charged) from the big data generated by the system, while complementary industry partners can be charged for both access to the big data and value created from the network effects of the system. Please refer to Table 31, below.
8.3.2 How often to charge

How often to charge benefitting stakeholders should be determined by the time intervals in which they receive value from the system. For consumers, they should be charged once since they only receive value once at the time of a home purchase or sale. The justification for this is that a newly listed home is much more likely to sell than a home that has been listed for a long period of time, like a year. For realtors and complementary industry partners accessing the big data generated by the system, a monthly billing period may work as positive value, namely in a continuous flow of new data being added to the system, is being delivered frequently. For complementary industry partners benefitting from the growing network effects of the system, they can be charged per successful transaction. This will ensure that the amount of revenue extracted from the system correlates with the network effect [24].

8.3.3 What to charge for

Products and services need to match payments to how consumers demarcate the received value. For consumers, they should be charged nominally for a successful transaction of buying or selling a home through the system. By not charging consumers when they sign-up and nominally only when there is a successful transaction, this will also increase user adoption, thereby increasing network effects and big data. For realtors, the value they attain from accessing big data is continuous, so long as there is new data coming into the system. Hence, a licensing fee to access the big data should be charged. Finally, for complementary industry partners, a commission should be charged for successful transaction completed as a result of the network effects of the system.
Please refer to Table 32, below, for a summary of the pricing architecture.

Table 32: Final pricing architecture

<table>
<thead>
<tr>
<th>WHO</th>
<th>WHAT</th>
<th>HOW OFTEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumers</td>
<td>Successful home buying or selling</td>
<td>Once</td>
</tr>
<tr>
<td>Complementary Industry</td>
<td>Commission for successful transaction through network effects Licensing fee to access big data</td>
<td>Per transaction</td>
</tr>
<tr>
<td>Partners</td>
<td></td>
<td>Monthly</td>
</tr>
<tr>
<td>Realtors</td>
<td>Licensing fee to access big data</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
9. Conclusion and Recommendations

The business model for the resale of residential real estate in the United States is decades old. Even to this day, when the majority of consumers use the internet as their primary research tool for real estate, realtors still charge up to 6% commission when a home is sold. This exorbitant fee may have been justified in the past when the agent did all of the work for their clients, but with the abundance of real estate web tools publicly available in an increasingly self-service environment, the value proposition between the real estate agent and consumer is diminishing.

Several players have tried to enter the real estate space in trying to use technology to capture market share and disrupt the traditional real estate industry, but have largely not been successful. These firms use a hybrid model of high technology to assist consumers in real estate research, but still resort to using or referring the consumer to a real estate agent to close the deal.

At a high level, the goal of this research was, therefore, to understand the stakeholders and their needs, then brainstorm a solution to meet their needs. To summarize the research done, it is useful to briefly mention the highlights of each chapter.

In Chapter 2, the literature review was focused on understanding the history of when and how the real estate industry was formed. The recent housing cycle was also analyzed. Next, research looked into recent trends in the industry, including the role that the internet has played in recent years and how that has changed customer behavior. A brief study in how current competitors, including Zillow, Redfin and For Sale By Owner are trying to change to industry, but have so far not been successful. Later chapters will propose ideas on why these companies have failed to disrupt the industry. However, prior to investigating this, it is important to understand who the stakeholders are in this ecosystem and what they need.

Chapter 3 presents a synthesized system problem statement plus key questions the thesis answers, based on the literature review and context discussed in the previous chapter.
Chapter 4 breaks the system down into stakeholders and their needs. The stakeholder value network is formed to visually understand the value flows between various stakeholders in the system. Because stakeholders have multiple needs, Kano analysis is used to quantify and identify each stakeholders’ top need. Since stakeholders’ top needs may change depending on the macroeconomic conditions, Kano analysis is repeated to identify each stakeholders’ top need under

- High and low regulations
- Strict and easy lending conditions
- Buyers’ and sellers’ markets
- High and low mortgage rates

Consumers’ secondary needs are also analyzed, since:

- Consumers are the most vital part of the system
- Consumers secondary needs must be fully understood if a solution is to be designed for them

Studying how consumers’ needs change under various macroeconomic conditions is useful because it helps determine how much flexibility is needed in system design. Often, once a system has been implemented, it may be difficult and expensive to accommodate changes after-the-fact. Hence, the level of solution flexibility should be known prior to concept selection and solution implementation.

Another aspect that is important to analyze prior to concept generation and selection is to know about the exogenous influences that affect the system outside of its boundary, as discussed in Chapter 5. To accomplish this, Porter’s Five Forces framework is used. Any specific weaknesses identified by the framework are also matched up with a mitigation plan. The framework provides a holistic view in which a proposed system would operate and also emphasizes the need to look at the current competition in the industry right now. By using Porter’s Five Forces framework, this research concludes that the majority of the latest
competitors use a hybrid technology-agent model and that no one has created a pure technology-based solution to fully disrupt the industry yet.

Chapter 6 continues to analyze the current competitors. The research from Chapter 4 (ie. consumers’ needs, the needs’ importance and variability) is combined with the competitive analysis in Chapter 5, to quantify how well each firm is fulfilling a consumer’s need using technology. By breaking down consumers’ needs versus how well they are being fulfilled by competitive technology, integrated concepts are formed. Following this, an intra-industry morphological matrix approach is used to generate a range of viable concepts. Three insights arise from this, so far:

- Zillow, although touting themselves as a technology firm, only scored 60.3% in its ability to use technology to serve consumers’ needs
- Using a morphological matrix, piecing together the best of the best from each firm only attained a score of 74.1% in its ability to serve consumer needs using technology. This implies that there is a lot of room in this industry to improve towards a pure technology-based system.
- Several consumer needs scored zero across all competitors, which means that the need is currently not being served using technology. If the proposed system can serve this need using technology, then this could provide a form of competitive advantage, differentiation and increased efficiency against competitors.

The second half of Chapter 6 focuses on bringing the 74.1% score to 100% using an inter-industry morphological matrix approach. In other words, looking at how the best companies in other industries fulfil a similar kind of need for its customers by using technology. Finally, once the final aggregated solution is proposed, the chapter ends with an analysis on which features to develop first and need to be delivered so that the system is proven as viable.

Interviews with various stakeholders were conducted to help validate and verify the selected aggregated solution. Three stakeholders were selected: 1) A licensed real estate agent and president of a brokerage firm; 2) a licensed real estate agent and recruiter working at Redfin;
and 3) potential home buyer that is familiar with several leading real estate firms. Their feedback can be summarized as follows:

1. All of the interviewees believe that real estate agents will still have some purpose in the future, even if people rely more on technology.
2. Technology will increasingly improve efficiency of the overall transaction, with or without a real estate agent.
3. A pure technology-based solution does not seem to be appropriate for everyone. It is, therefore, important to find the beachhead market, as they will likely be less price sensitive, open to technology, identify system weaknesses and issues prior in this niche market and may determine whether such a system is able to go mainstream for widespread adoption.
4. Both realtors that were interviewed worry that the online platform approach would lack personal interaction and trust, that consumers have learned to expect and rely on.
5. Both realtors also mention a large number of pitfalls that can happen during the process and that the system needs to be ready to handle.

The final chapter of the thesis investigates possible pricing schemes and the revenue structure for the proposed aggregated solution. Value-based pricing is used to frame the pricing architecture for the system. The goal of the pricing architecture is to answer who to charge, what to charge for and how often to charge. By investigating the points of differentiation against the closest competitor, it is found that multiple sources of revenue are possible since three stakeholders (ie. consumer, real estate agent and complementary industry partners) can be charged.

A systems approach was applied to the problem of finding a technology-driven solution to disrupt the residential real estate industry of existing homes. Through various frameworks and analysis, many insights were discovered throughout the thesis that would enable a solution to be flexible, yet robust. The proposed aggregated solution pushes the boundary on what is available in the industry towards an efficient, radically innovative pure technology-based system.
The limitations of the systems approach used in this thesis include not being able to anticipate the potential reaction from real estate agents and associations, nor does it address the social effects of the system. Having a new system alter an existing industry displaces jobs and redistributes value across the stakeholder value network. How value could be strategically redistributed to maximize system adoption is of future work.

Other future work may include a mitigation plan against the potentially strong reaction from competitors, real estate agents and real estate associations. The interviewees’ numerous concerns, such as the proposed system not working due to a lack of personal interaction and trust, also needs to be investigated. Identifying who the beachhead market is also a vital step prior to product launch. Finally, any assumptions made in this thesis, like assuming that complementary industry partners would join the network if consumers have joined, need to be verified.
Bibliography


