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Building a sustainable mobility solution review information aggregation system

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Abstract

This research will provide the idea of a mobility information aggregation system. The system will aggregate reviews of cars and combine them to a final car rating. This research is mainly focused on the business side of this system. The mobility platform should contain other features as good design and search function compared to the competition. Firstly, information aggregation will be described and explained and applied to the mobility system. Information aggregation is collecting, analyzing and performing analysis to information that will add value for users. Thereafter, a brief view will be provided about business models, which business model the system will use and much revenue can be generated. Advertisements and affiliate programs are the best fit as business models. In the last section potential sources for the data are discussed.

Keywords: Information aggregation, review aggregation, mobility system, business models, 3rd-party automotive system

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1 Introduction

1.1 Overview of the American car industry

In 2016 the sales of new vehicles were 17.55 million [1] in the United States. In figure 1 the total vehicle sales are visible for the last 17 years. There is a significant drop in 2008 when the economic crisis began but since the car sales are increasing. Manheim and Edmunds conducted a large research of the car market in the US. 38.5 Million used cars were sold in 2016 [2]. So approximately in 2016, 56.06 million cars were traded. The average price of the used cars was $19,189. 1.82 Million of those 17.55 million cars were bought by rental companies [3], 9.6% of the new cars.

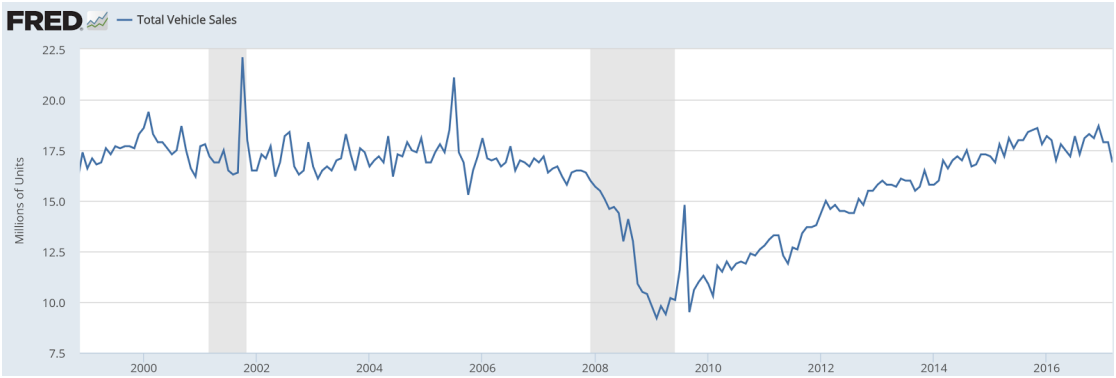


Figure 1: Total vehicle sales in America [4]

According to the Bureau of Transportation Statistics, in 2014 (the latest data available) the total number of registered vehicles is 260.351 million. These numbers implies that the car industry is large and that cars are traded actively.

Customers face many choices for buying a car. What type, model or make should they buy? The most important question is what is the best car for each

[1] https://www.nytimes.com/2017/01/04/business/2016-record-united-states-auto-sales.html?_r=0 (accessed 10/5/2017)

[2] https://static.ed.edmunds-media.com/unversioned/img/car-news/data-center/2017/feb/used-car-report/used-car-report-q4.pdf (accessed 10/5/2017)

[3] https://publish.manheim.com/content/dam/consulting/2017-Manheim-Used-Car-Market-Report.pdf (accessed 10/5/2017)

customer? To support the people in the car buying process, aggregated car reviews can help people choosing the right car.

1.2 Research questions

The goal of this research project is to have a foundation for a review information mobility solution for the American market. To achieve this objective, it is necessary to have a set of research questions. The main research question is:

How can a sustainable review information aggregation based system be created for mobility solutions?

To find the answer to this this main question there are three sub-questions to be posed:

1. What is the function of an information aggregation website?
2. What business model is a good fit for a car information aggregation system?
3. What are the data sources for the system?

1.3 Research scope

To start with this project it is important to first determine the scope. In total six people are conducting research about the mobility solution review information aggregation system, see figure 2 for all the projects. This document is mainly focused on the business aspects of the mobility system. 'How can revenue be generated' and 'in what kind of environment is the system operating' are important questions. The other research projects are more focusing on design, analyzing reviews

and calculating depreciation of cars. When those six projects are completed and combined, a good framework of the mobility solution platform is outlined.

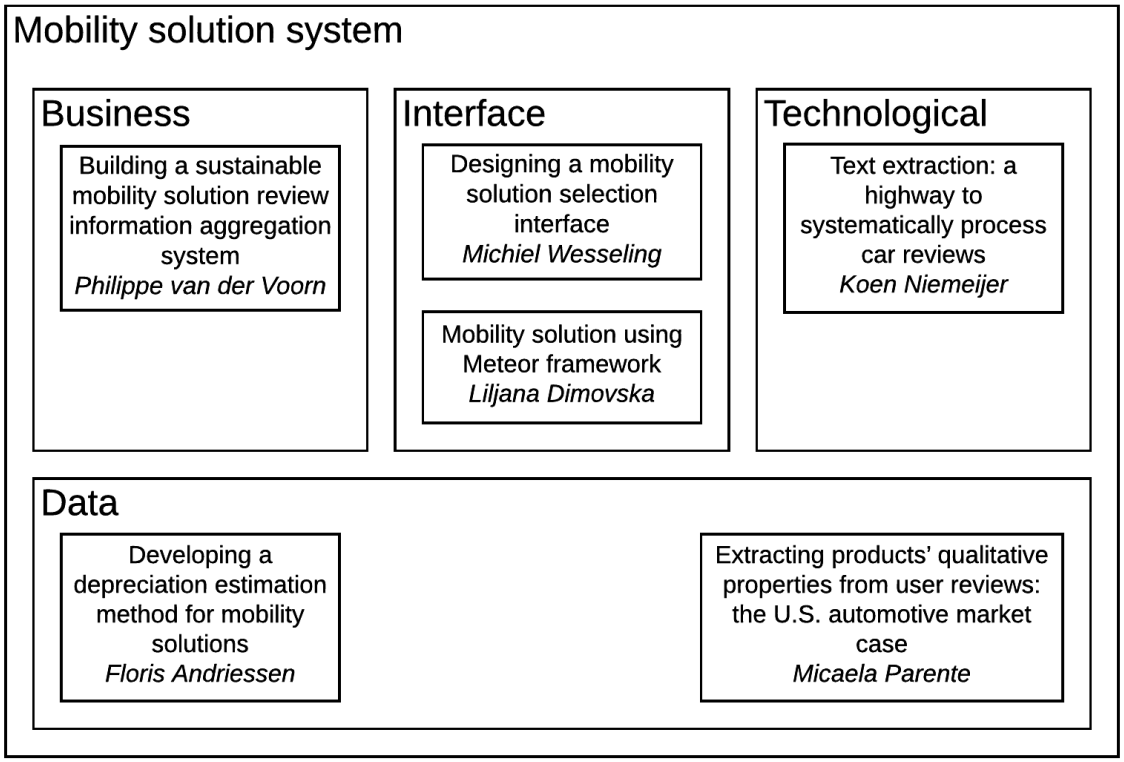


Figure 2: Overview of the mobility solution project

1.4 Research approach

The approach for this research will be a structured literature study about the exact meaning of information aggregation, how information aggregation works and what the building blocks are for information aggregation. Next, an extensive literature study will be conducted to find the different business models for information aggregation websites.

After the business models are well defined, two case studies will be executed. One case study observes which business models information aggregation websites

are using. The goal of this case study is to see what business models of other aggregation websites are using to generate revenue. This case study includes the industry were the business is operating, the business model, the data extraction method, online visitors performance, financial performance (if it is publicly available) of the following websites: Tweakers, Metacritic, Trivago, Tripadvisor and Skyscanner. Once the case study is completed, the right business model needs to be attached to the mobility system.

For the second case study the competitors of the mobility solution system are reviewed. By conducting this case study statistics of visitors and car listings on the websites are compared. This information can be used to predict revenue of the mobility system in the future.

Yin [1] created a design for case studies. In both case studies that will be performed it consists of a multiple-case design with a holistic design. The holistic design includes a single unit of analysis to observe the global nature of the phenomenon, when no sub-units can be pointed. As different businesses are compared in the case studies, the multiple-case design is applied. In figure 3 the designs of case studies are visible, created by Yin. For this project the design in the upper right corner is used.

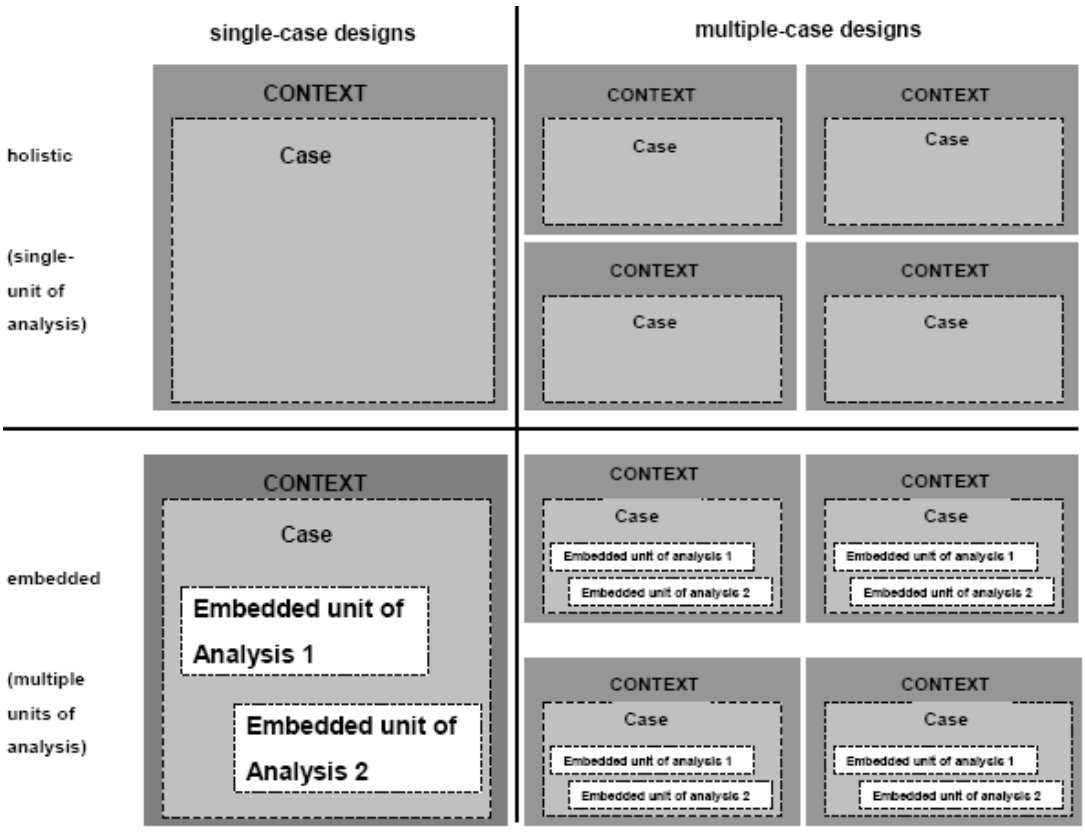


Figure 3: Basic designs of case studies by Yin

1.5 Research feasibility

In the short time given for this project it is not possible to deliver a fully functional system. To make the mobility system, a full database with the reviews is needed. As there are more than hundreds of cars and many more reviews about the cars, there is no time to complete this task. It is not possible to create a website scraper that can browse through all the car review websites, give a rating per review and adds automatically the rating to our mobility system. This is something looking for in the future but not feasible in the short time period given for this project. Therefore, the reviews needs to be found and inserted manually. The goal is to have a large database with every car that has been made, but only the reviews

of the newest cars are relevant. There are many car manufacturers and that is too much to add manually for the database. It is more important to look at the functionalities of the system. How to act and in what way? It does not go deep into technological knowledge but stays more focused on the business side.

This paper is structured as follows: information aggregation will be explained and the solution for the mobility platform will presented based on the holistic framework for aggregators and a SWOT analysis is performed. Thereafter, business models will be applied to the mobility solution and how money can be made. The system needs data resources and that will be discussed in the data resources section. Finally, the conclusion summarizes the selected proposals and ideas and will give direction for the next steps to develop the sustainable review aggregation mobility solution.

2 Information aggregation

2.1 What is Metacritic

To begin with information aggregation, the best website for reviews of movies according to data-scientist Alexandru Olteanu [5] is Metacritic. Metacritic will be used as an example in the following section.

What is Metacritic exactly and how does it use information aggregation? According to the Metacritic website, *Metacritic aggregates music, game, tv, and movie reviews from the leading critics.* [6] Figure 4 shows a Metacritic page of the TV show Sherlock. Circle 1 shows the Metascore rating of 85. The Metascore is the combined score of all the leading critics reviews across the internet and the trademark of Metacritic. To obtain the final Metascore of Sherlock, Metacritic used 17 reviews and combined them, see circle 2. Those reviews are from renowned websites, magazines and newspapers. For Sherlock they used sources like The New York Times, The Huffington Post, USA Today and Entertainment Weekly [7].

[5] https://medium.freecodecamp.com/whose-reviews-should-you-trust-imdb-rotten-tomatoes-metacritic-or-fandango-7d1010c6cf19 (accessed 15/6/2017

[6] http://www.metacritic.com/ (accessed 15/4/2017)

[7] http://www.metacritic.com/tv/sherlock/critic-reviews (accessed 15/4/2017)

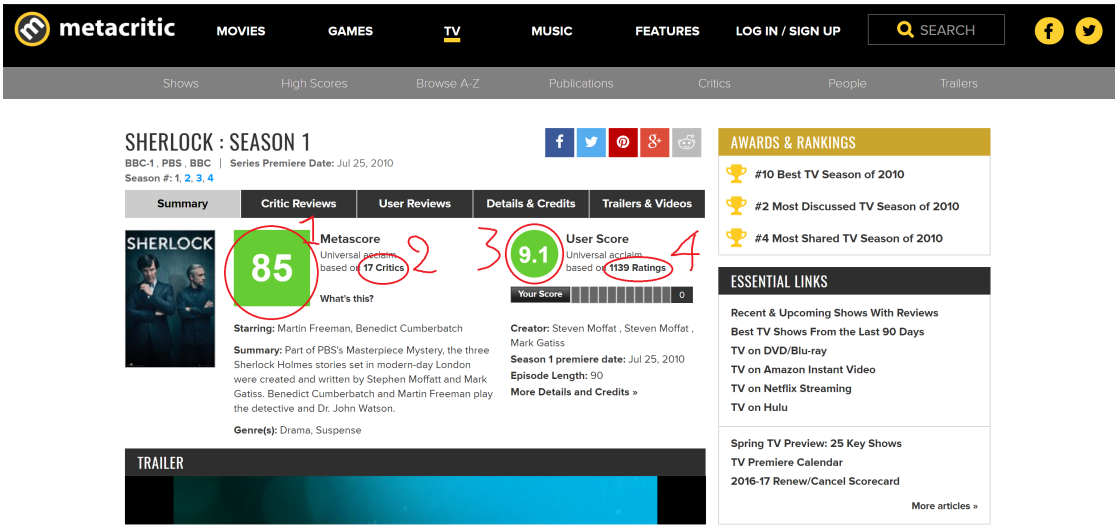


Figure 4: Page of the tv show Sherlock on www.metacritic.com

Metacritic gives the users the possibility to give a rating to a movie, game or music, see circle 3. This rating is based on the user ratings, see circle 4. Metacritic does not use this rating for their Metascore, but it is important for Metacritic that users can speak out and give their opinion. *"Metacritic's mission is to help consumers make an informed decision about how to spend their time and money on entertainment. We believe that multiple opinions are better than one, user voices can be as important as critics, and opinions must be scored to be easy to use."* [8]

2.2 What is an aggregator and aggregatee?

Metacritic is called an information *aggregator* website. The definition given by Madnick [2] of an aggregator is *"A web aggregator is an entity that can transparently collect and analyze information from a wide range of web sources, with or without prior arrangements. In the process, the aggregator resolves the semantic or contextual differences in the information, such as differences in prices extracted from sites that use different currencies or include or exclude shipping charges. The*

[8] http://www.metacritic.com/about-metacritic (accessed 20/4/2017)

aggregator adds value by providing post-aggregation services."

This definition has three characteristics:

- *Access Transparency:* An aggregator appears to be a normal user to a data source by simply accessing the information. Every other internet user online can do this.
- *Contextual Transparency:* An aggregator resolves contextual differences so it can make effective comparisons.
- *Analysis:* Instead of simply presenting data as is, an aggregator uses post-aggregation analysis to provide value-added information to their users. [2].

An *aggregatee* is an organization whose information could be collected by an aggregator. It is possible that aggregators become aggregatees, because once they provide their services over the web, another aggregator can aggregate their information. Such an aggregator is called a *mega-aggregator* [2].

2.3 Linking the definitions to the Metacritic example

For a better understanding of the definitions they will be applied to Metacritic. Metacritic meets the three requirements for an aggregation website.

Access Transparency: Metacritic uses the reviews of movies, music, games, etc. For the Sherlock example mentioned in section 2.1, Metacritic uses the New York Times as a source, the aggregatee. This newspaper is available to anyone and everyone has admittance to the review on the website of the New York Times.

Contextual Transparency: In the entertainment industry, critics are using 4-star ratings and letter ratings. Metacritic uses a conversion table to convert contextual differences from different sources to a uniform rating, see figure 5 [9].

[9]http://www.metacritic.com/about-metascores (accessed 28/4/2017)

Analysis: The value-added information from Metacritic is the Metascore. The Metascore is the combined score of the leading critics reviews across the internet and the trademark of Metacritic. Based on this number, people can decide whether to buy something or not.

4-Star Scale	
Their Grade	Converts to
4	100
3.5	88
3	75
2.5	63
2	50
1.5	38
1	25
0.5	12
0	0

Letter Grades	
Their Grade	Converts to
A or A+	100
A-	91
B+	83
B	75
B-	67
C+	58
C	50
C-	42
D+	33
D	25
D-	16
F+	8
F or F-	0

Figure 5: Metacritic conversion table

2.4 Holistic framework for aggregators

Crawley [3] developed a holistic framework to gain a systematic view of a web aggregator. The holistic framework addresses questions of why, what, how, who, where, when, and how much. Putting a web aggregator under the lens of the holistic framework (see figure 6 [10]), various aspects of the aggregator will become

[10] Adapted from Professor Ed. Crawleys lecture notes (accessed 21/5/2017)

better understandable.

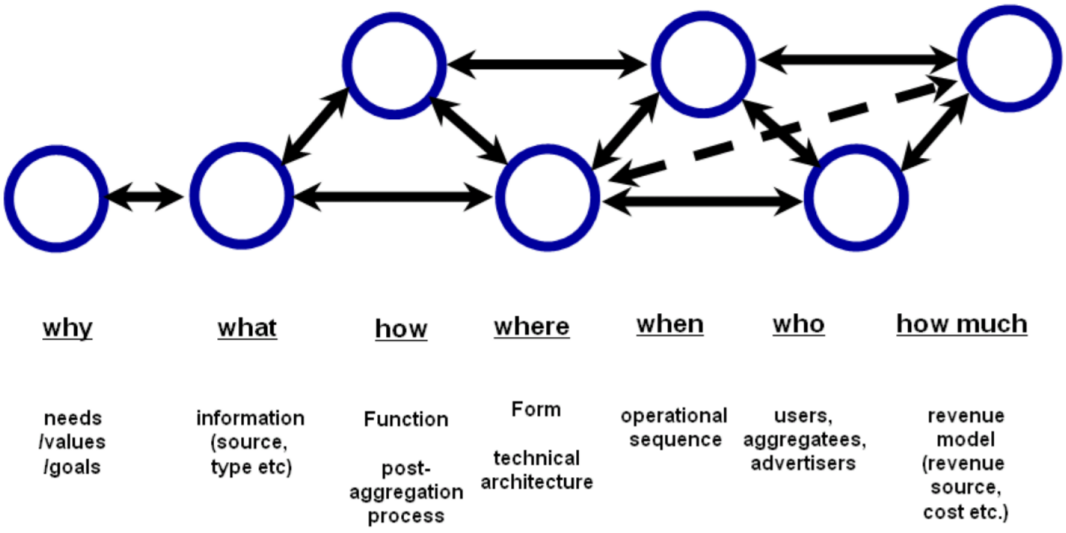


Figure 6: Holistic framework for analyzing aggregators

- *Why:* the "Why" question asks about what needs an aggregator satisfies and what values or benefits the aggregator provides to its users. An aggregator should be unambiguous about who are the beneficiaries of its service, this is addressed in the "Who" item and what are the needs of their beneficiaries [4].

- *What:* the "What" question is about the information that aggregators gather and analyze. Further questions include: - What are potential sources of the information? What types of content do aggregators gather? - Which industry do aggregators focus on? - What is the structure of the content? Aggregators need to understand the information well enough to collect and process them effectively [4].

- *Where:* the "Where" question mainly addresses the structure or the form of an aggregation system. It specifically refers to the place in which the

aggregation service is offered and the technical architecture of an aggregation system. What is the structure of an aggregation system? What are the key components of the system? [4].

- *When:* the "When" question asks about the operational sequence of an aggregation system. It refers to how users use the review aggregation services such as searching and viewing the information [4].

- *How:* the "How" refers to how information is collected and processed. Aggregators do not just collect information and re-present them to users. They conduct certain analysis and processing in the information gathered and present results to the user in an easy way [4].

- *Who:* aggregators need to define which parties are interested in their services and therefore benefit from those services and who will pay for their services. There are parties such as users and advertisers who can directly benefit from aggregators services. There are also in-direct beneficiaries. Aggregatees, for example, can indirectly benefit from aggregators services because aggregators can guide customers back to aggregatees [4].

- *How much:* this question targets an aggregators business model. What are the sources of revenue? What is the cost structure? Is the business profitable? Some aggregators rely on the advertising model to sustain their businesses. Other aggregators follow the revenue sharing business model, in which they build formal relationships with aggregatees so that aggregators can share revenues generated by re-directed sales traffic to aggregatees [4].

2.5 Information aggregation and the mobility solution

2.5.1 The idea

Aggregation websites can arise from frustration [11] or because there is an opening in the market. At present there is not a website that combines professional car reviews and combines them like Metacritic does for the entertainment industry. There are websites that only contains reviews like Autoreview.nl or topgear.com/car-reviews and there are websites that only show occasions like gaspedaal.nl and car-gurus.com. Some websites do combine reviews and occasions like Autoweek.com.

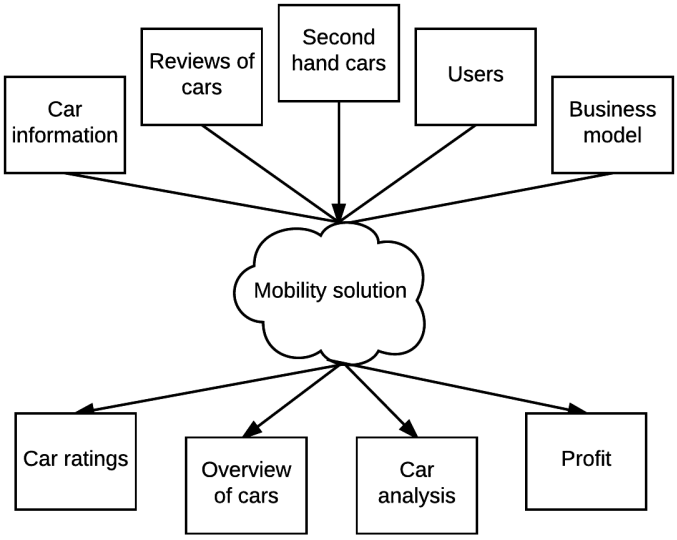


Figure 7: Mobility solution system input and output

The idea is to bring potential car buyers to the mobility system where the users can compare cars. The cars will have a rating based on critic reviews. Many car reviews do not contain a rating but only a verdict. The mobility system should generate a rating out of a car review, what will distinguish itself from other

[11] The mark of Zillow, Knight-Ridder Tribune Business News: NA, February 26, 2006 (accessed 2/5/2017)

automotive websites. Every car will get a page with all information about it. It should contain the specifications, models available and the new price of the car. To provide the potential users with more functions, the system should include second hand cars that are available. Depreciation predictions can be generated for cars and the system will have an interface that closes the gap between the users need and car specifications. This will result in a large mobility platform system. People will be able to search, compare and buy cars and make the car buying process easier.

2.5.2 The name

There are some requirements for choosing the correct name for the system. It needs to be easy to type, easy to remember and should not be too long [12]. Reviews and the search function are the two key components of the system. The name should use those two components.

"What is the best car" indicates that the best car is presented to the users and it will be because it is possible to search for cars with the highest ratings. This is a strong name because people can use Google to search literately for the best car and when a website name is the same as the searchwords used in Google, it will be the first hit.

Furthermore, "car selector" can be used as the name for the system. It is a generic name for the system because it selects cars based on the search of the user. Those two names can be combined to "select the best car". This implies that it is possible to search for cars and only the best cars are shown as results.

[12] https://www.godaddy.com/garage/smallbusiness/launch/10-tips-for-choosing-the-perfect-domain-name/ (accessed 16/6/2017)

2.5.3 Applying the three characteristics of Madnick & Siegel

To develop a mobility solution system that aggregates reviews, it should meet the three characteristics mentioned by Madnick & Siegel [2].

- *Access Transparency:* the car reviews should be publicly available and used to give each car a rating. This can be reviews in magazines, newspapers or automotive websites.

- *Contextual Transparency:* car reviews can obtain a number KellyBlueBook.com, a star rating like Autoweek.nl and autocar.co.uk, only a text rating like the automotive consumer guide [13] or a letter grade rating from Edmunds.com [14]. For the aggregation system there should be a uniform rating system to make effective comparisons of cars. This closes the gap between the contextual differences of car reviews.

- *Analysis:* the value-added information of the mobility system will be that each car has a rating based on multiple reviews. This will give the user a reliable number. With the data on-hand it is possible to do further data-analysis to provide more insight in ratings and car prices.

2.5.4 Applying the holistic framework

In section 2.4 the holistic framework is described. Now it will be applied to the idea of the review information aggregation system for a better understanding of the system.

- *Why:* the mobility system aggregates reviews. This will result in more reliable car ratings where people can depend on. By aggregating the reviews, different opinions of critics are merged together what results in an average

[13] http://consumerguide.com/ (accessed 8/5/2017)
[14] https://www.edmunds.com/new-car-ratings/ (accessed 8/5/2017)

overall rating. One critic can dislike a car and is not positive in the review while another reviewer can be positive about the car and gives it a good rating. If a car receives many high ratings the users can see that it is indeed a good car.

- *What:* the mobility platform uses the final verdict of reviews that are transposed to a number. The reviews come from renowned websites and magazines. Used-cars as well are shown in the system. The mobility system aims to focus on the 3rd-party automotive industry. The goal is to help people make a good decision in choosing the best car for the specific user.

- *Where:* the system is located on a server. It is technically not difficult to make the system. The content should be aggregated manually because of differences in contextual transparency. Eventually it will result in a large database that contains all the cars and their reviews.

- *When:* a sophisticated search engine will be built-in the system. Users can have different requirements for a car so the search engine should understand what the user wants. After the user has selected the car options a list of results is presented. In those results the best appropriate cars are shown with an average rating based on multiple reviews of critics.

- *How:* different reviews contains different verdicts. Some reviews do have a number as a rating, some a star rating and others have only a short verdict in text form. Star ratings and text verdicts should be transformed to a number so it can be compared to each other and a final rating can be made. Results can be shown from a high car rating to a low car rating. The user can see in one instant what the best car is. If the user has used the filter options to find which car fits most to his interest, the first result should be the car with the highest rating. It is possible that the user is interested in that car and clicks

on it. On the car page the car specifications are presented and the list of the reviews. Additionally the cars that are for sale are presented. If the user clicks on one of those cars, he will be redirected to that car advertisement. In this way, the system will generate revenue. See section 3.6.2 how revenue can be made.

- *Who:* the reviews will be used by publishers and the ratings will be published for the users of the system. The system aims for people who are looking for a new car or who are interested in cars. The system will use many 3rd-party websites to present the cars that are available for sale. They can receive more traffic to their websites if a user of the mobility system clicks on one of their cars.

- *How much:* in section 3.2.3 the sources of revenue are explained in a comprehensive way.

2.6 Example of aggregated car reviews

The idea and the concepts of review aggregation are now defined about review aggregation. An example of how different car reviews can be combined to obtain a final car rating will be given. For this example four reviews of the Audi A3 2017 sedan are used.

Figure 8: The Audi A3 2017 sedan

Kelley Blue Book, a large American automotive website assigns an expert rating of 9.4/10 to the car [15]. In figure 9 a part of the review is visible.

New York Daily News uses a text rating for the car [16]. This is the most difficult way to assign a number to it. Metacritic assigns a rating themselves to a review like that. Therefore, a rating for this example is given based on the impression of the review. In the last paragraph NY Daily News stated: *"Its better to look at, better equipped, more fun, and more of a logical buy than ever before, and that makes it better rounded than many of its harder-core competitors."* This review is very positive about the car and gives the impression that NY Daily News gives the car a 9/10.

[15] https://www.kbb.com/audi/a3/2017/premium-plus-expert_car_reviews/?vehicleid=421456 (accessed 17/6/2017)

[16] http://www.nydailynews.com/autos/latest-reviews/short-report-2017-audi-s3-article-1.2864253(accessed 17/6/2017)

The same applies for Edmunds [17]. They are only producing text reviews. In the review Edmunds is positive about the car. It is a small luxurious car with a higher price than other cars. Based on this review an 8.5/10 is acceptable.

US News uses the 1-10 scale for cars. The Audi receives an 8.2/10 from US News [18].

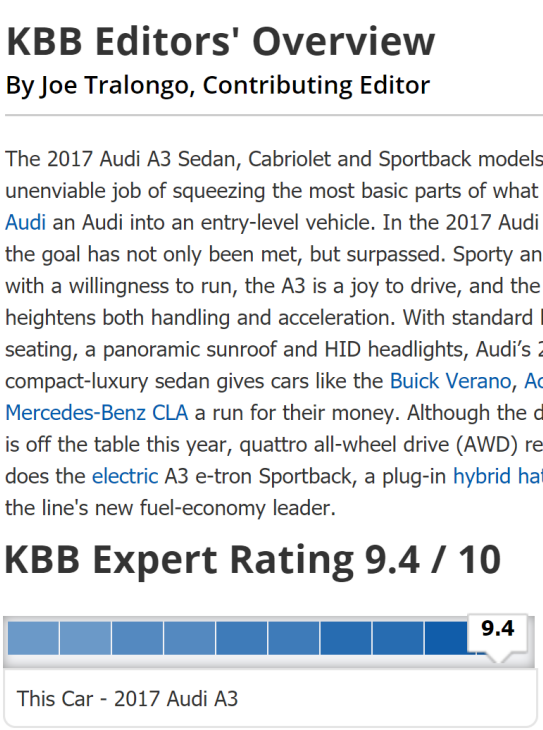


Figure 9: Part of the car review from Kelley Blue Book including the rating

Adding the numbers and dividing it by four will result in an 8.775. The final car rating for the Audi A3 sedan 2017 is an 8.8/10 or 88/100 if commas are not used.

2.7 SWOT analysis

2.7.1 What is SWOT?

The idea of the system has been presented. It is now possible to apply different frameworks to get a better understanding of the system. To start with the SWOT analysis will be carried out.

To start, the SWOT analysis is a basic model that provides direction and serves as a basis for the development of marketing plans. It accomplishes this by

[17] https://www.edmunds.com/audi/a3/2017/sedan/review/ (accessed 17/6/2017)
[18] https://cars.usnews.com/cars-trucks/audi/a3 (accessed 17/6/2017)

assessing the organizations *strengths* (what an organization can do) and *weaknesses* (what an organization cannot do) in addition to *opportunities* (potential favorable conditions for an organization) and *threats* (potential unfavorable conditions for an organization). SWOT analysis is an important step in planning and its value is often underestimated despite the simplicity in creation. The role of SWOT analysis is to take the information from the environmental analysis and separate it into internal issues (strengths and weaknesses) and external issues (opportunities and threats). Once this is completed, SWOT analysis determines if the information indicates something that will assist the firm in accomplishing its objectives (a strength or opportunity), or if it indicates an obstacle that must be overcome or minimized to achieve desired results (weakness or threat) [5].

2.7.2 SWOT analysis for the mobility system

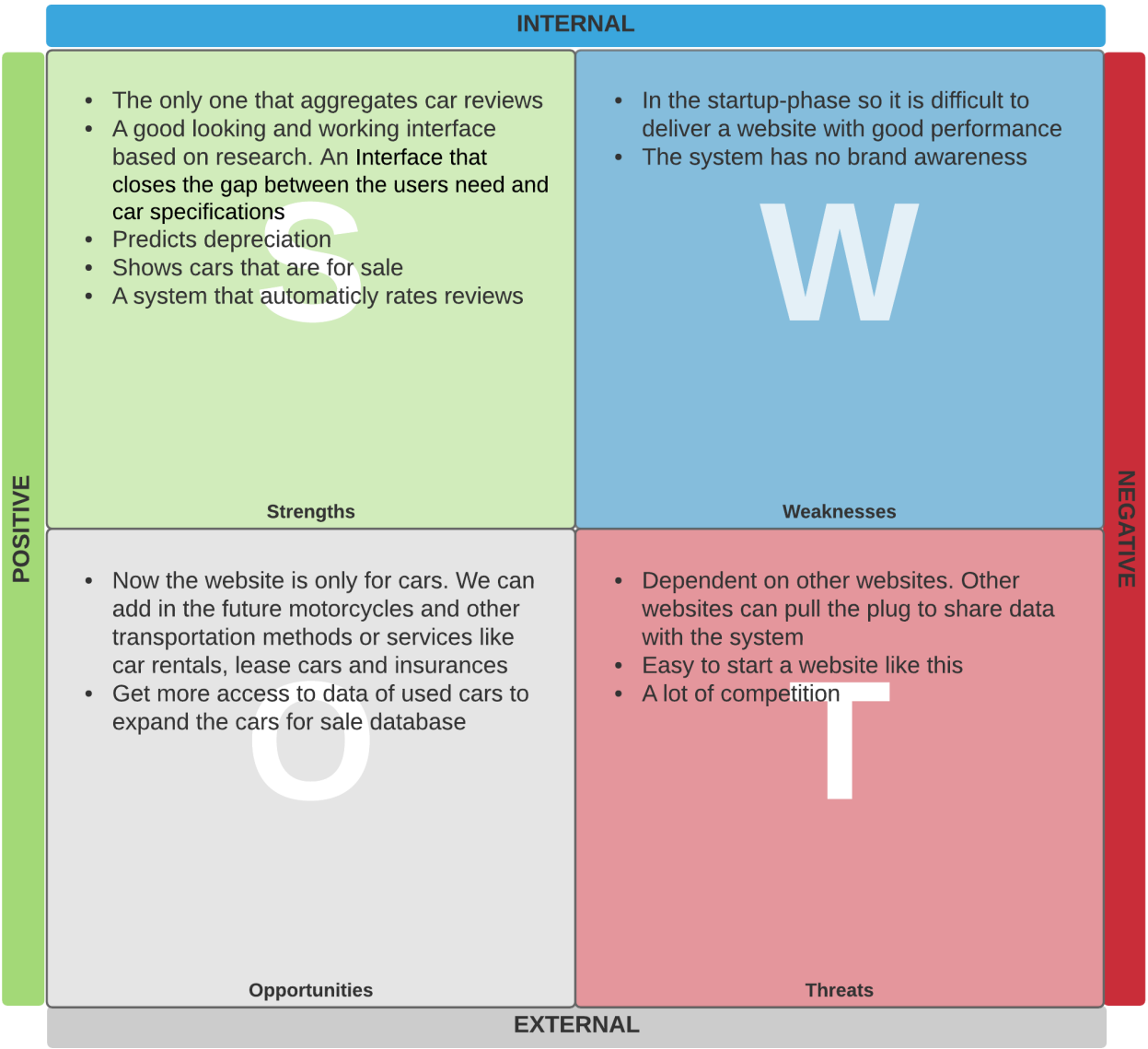


Figure 10: SWOT analysis for the mobility system

3 Business Models

3.1 What is a business model

The most important step to develop the mobility solution system is to have the most suitable business model. Osterwalder [6] provides a general definition of a business model: *"A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams."*. Afuah & Tucci [7] give another definition: *"a business model is the method by which a firm builds and uses its resources to offer its customers better value than its competitors and to make money doing so. It details how a firm makes money now and how it plans to do so in the long term. The model is what enables a firm to have a sustainable competitive advantage, to perform better than its rivals in the long term."*

According to the two definitions of business models it becomes understandable how a company or in this case, a system, can earn money. It is important that the mobility solution system will have competitive advantage that other websites do not have. This will add value to the potential customers and distinguish itself from the competitors.

In the following section an overview will be given of which internet business models exist for websites and in particularly websites that only contain information. From now on it will be called internet business models, because the mobility platform has only online presence and no physical presence.

3.2 Internet business models for aggregation websites

3.2.1 What business models are appropriate for information aggregators?

Hu [8] did extensive research to find appropriate business models for information aggregators. He looked at different research papers and selected only the business models that are fitted for information aggregators. Hu concluded that most of the business models described by Rappa [9] are a good fit. After analyzing the business models, Hu came up with the following list:

- *Advertising:* an extension of traditional media broadcast model. An information aggregator provides text or banner ads for various businesses and charges them per view or per click. The website provides the end-users of free content in exchange that they see advertisements. [9, 7]. Brokerage: bringing together buyers and sellers and facilitate transactions. Broker charges fees or commissions per transaction it enables [9].

- *Subscription:* fee for service/content model. Subscription fee can be periodic daily, monthly, or annual. Usually information aggregators combine free services with premium services that require subscription [7].

- *Licensing:* the sale of a product that involves only the transfer of usage rights to the buyer, in accordance with a terms of use agreement. It is widely used regarding software products [9].

- *Infomediary (information intermediaries):* an information aggregator has collective data. It can assist buyers and/or sellers understand a given market by providing data about consumers and their consumption habits [9].

- *Referral/click-through/affiliate:* an information aggregator receives fee from merchants if it generates sale for them by bringing in customers. Or the

information aggregator rely on fees for steering visitors to another company, this is called pay-per-click. [9, 7].

- *Customized/personalized service:* an information aggregator provides users tailored services by monitoring their actions and requesting their preferences. This approach is usually combined with advertising and subscription.

- *Professional service/consulting:* owning customer relationship and part of customer data gives information aggregators advantage to provide professional service/consulting. It is related to infomediary, but more complicated. Infomediary only involves data, while professional service/consulting involves data and consulting projects.

- *Application service provider:* an information aggregator hosts the application and data center and provides on-demand service to their clients via network.

To be sustainable and profitable, our mobility system should at least contain one of the described business models. It is possible to combine the business models as a part of an overall business strategy. To choose the right business model for the mobility site, strategies of other aggregator websites will be reviewed in a comparative case study in the next section.

3.2.2 Comparative case study among information aggregators

According to the case study in table 1, almost every website uses advertisements to earn money. Most websites have an affiliate/refferal/click-through program to other websites. For each click or transaction completed by the aggregator, the aggregetee pays a fee to the aggregator. This can be a good method for the system to generate money. When the user clicks on a car that is for sale, the user goes to the relevant website and the system earns a small amount of revenue.

Table 1: Case study among different information aggregators

Name **Sector** **Country**	**People in service**	**User performance (monthly)**	**Source of revenue**	**Data extraction method**	**Financial results**
Tweakers Tech NL	50	4 million[19]	(1) Advertisements on website (2) Click-out from the Pricewatch to a webshop (3) Win actions with third-parties (4) Job placements on website[20]	They have a content team that adds products to the Pricewatch. They use Icecat.nl to import the data but check it manually for errors or add information. For the prices they are using a product feed of the connected stores which are updated each hour.[21]	Not available
Metacritic Entertainment VS	Not available	31.9 million[22]	Advertisements	Manually search for reviews in a list of predefined websites. If not a score is assigned, they assign score based on impression[23]	Not available
Tripadvisor Travel VS	3,327	390 million[24]	(1) Click-based advertising and transaction revenue (2) Display-based and subscription-based advertising revenue (3) Commission for each transaction via online reservations system for attractions (4) Charging fee for each restaurant guest or seated table via reservation system (5) Commission based or subscription based fee for vacation rentals[25]	(1) Affiliate programs (2) API (3) Travel management systems[26]	1,480 million revenue 120 million net income
Skyscanner Travel SCO	800[27]	60 million	(1) Advertisements on site (2) Commision for each successful booking via site (3) White label platform[28]	APIs and deals with airlines and travel agents[29]	$183 million revenue in 2015[30]
Trivago Travel VS	1000[31]	120 million[32]	(1) Referral revenue based on Cost-Per-Click (2) Subscription fees paid by hotels[33]	APIs[34]	$53 million loss in 2015

[19] https://tweakers.net/info/advertising/ (accessed 4/5/2017)
[20]https://tweakers.net/info/over_tweakers/verdienmodel/ (accessed 4/5/2017)
[21]accessed information via mail exchange
[22]https://www.similarweb.com/website/metacritic.com#overview (accessed 4/5/2017)
[23]http://www.metacritic.com/faq#item11 accessed 5/5/2017
[24]https://tripadvisor.mediaroom.com/us (accessed 4/5/2017)
[25]Tripadvisor, Inc. (2017). Tripadvisor, Inc Annual report 2016
[26]https://www.quora.com/How-do-Kayak-TripAdvisor-HotelsCombined-and-other-hotel-price-comparisons-get-their-data (accessed 4/5/2017)
[27]https://www.skyscanner.net/aboutskyscanner.aspx (accessed 4/5/2017)
[28]https://www.quora.com/How-does-skyscanner-get-revenue (accessed 4/5/2017)
[29]https://www.quora.com/How-does-Skyscanner-work (accessed 4/5/2017)
[30]https://www.skyscanner.net/blogs/skyscanners-global-and-mobile-growth-accelerates-in-2015 (accessed 4/5/2017)
[31]http://company.trivago.com/about/our-story/ (accessed 5/5/2017)
[32]http://ihf.ie/sites/default/files/upload/trivago_improving_performance.pdf accessed 5/5/2017
[33]http://marketrealist.com/2016/11/a-close-look-at-trivagos-business-model/ (accessed 5/5/2017)
[34]https://www.quora.com/How-does-trivago-work-1 (accessed 5/5/2017)

3.2.3 Business model for the mobility system

Based on the case study and the possibilities for the system, the best fitting models are the *advertisements* and *affiliate programs*. With good targeted advertisements shown, people can click on it and the system earns a small fee. Car manufacturers, dealers, insurance companies or other car related businesses are potential advertisers. People who are using the system are interested in cars so they should be interested in those advertisements if those advertisements are targeted correctly. Two methods can be used to show advertisements: companies can buy banner space on the website for a fixed price or an advertising network can be used.

The most popular advertising network is Google Adsense [35]. This can generate revenue by pay-per-click or pay-per-impression based advertisements. Pay-per-click is a method were users bid on keywords and pay for each click on their advertisements [36]. With pay-per-impression the system will be paid per 1000 views of an advertisement [37] Google Adsense will automatically select the best and most relevant advertisement for the current user [38]. Using the Adwords Keyword Planner some estimates can be given how much can be earned per click [39], see figure 11.

[35]https://w3techs.com/technologies/overview/advertising/all (accessed 15/5/2017)
[36]http://www.wordstream.com/pay-per-click (accessed 21/6/2017)
[37]https://imu.nl/internet-marketing-kennisbank/begrippen/cost-per-impression-cpm/ (accessed 21/6/2017)
[38]https://www.google.com/adsense/start/how-it-works/#/ (accessed 15/5/2017)
[39]https://adwords.google.com/ko/KeywordPlanner (accessed 15/5/2017)

Zoektermen	Gem. maandelijkse zoekopdrachten	Voorgesteld bod
car reviews	10K – 100K	€ 1,22
best cars	10K – 100K	€ 3,91
used cars	1 mln. – 10 mln.	€ 2,08
compare cars	10K – 100K	€ 1,52

Figure 11: Estimate earnings per click of popular search words regarding cars. Retrieved from Google Keyword Planner

The second method of generating money is by using affiliate programs. The system provides cars and should show the available matching cars that are for sale. Those cars should come from 3rd-parties. If the user clicks on a car that is for sale, the user will be redirected to that advertisement on the selected website. Because the user goes to the website of the 3rd-party by the mobility platform, a fee will be collected for redirecting the user or when the user buys the car, but that differs per affiliate program.

When the system is live and running for a while, it has collected a preposterous amount of data. It knows all the prices changes in the market and it can analyze the search behavior of the system. If the platform uses the data and make reports about it, people or companies might be interested in buying the information. This can be an extra revenue source because the system becomes also an *information intermediary*. However, this is not relevant for this project and further research can be done to look at the possibilities for this.

3.3 Competitive advantage

The core competencies of a firm, or in this case the system, allows it to have a competitive advantage. This means that the system offers better value to the customers than the competitors do [7]. For the mobility solution system it is important to look at what the competitors are offering and compare it with the mobility platform idea. If the mobility system offers more than the competitors do, the system will have competitive advantage. In the next section an overview of 3rd-party automotive websites is given with similarities of the mobility system.

3.4 Case study competitive environment

Table 2: Case study among 3rd-party automotive websites

Website	**Monthly visitors (in millions)**	**Average Pageviews**	**Average time on website (in minutes)**[40]	**Number of cars listed (in millions)**	**Contains professional reviews**	**Contains user reviews**	**Individual people can sell their car**
Kelley Blue Book	19 unique[41]	8.5	5:54	3.44[42]	Yes	Yes	Yes to a dealer
Autotrader	15[43]	6.14	6:31	5[44]	Yes	No	Yes
Edmunds	18[45]	2.81[46]	3:30	0.03 new cars	Yes	Yes	No
CarGurus	15 unique[47]	2.88[48]	4:54	Millions of cars[49]	Yes	No	Yes
Cars.com	31.5[50], 9 unique[51]	4.23[52]	6:16	4.9[53]	Yes	Yes	Yes
TrueCar	7 unique[54]	3.37[55]	5:48	0.75 used cars[56]	Yes	No	No
Autoblog	10.9 unique[57]	8.17	2:06	"Millions"[58]	Yes	Yes	Yes
Average	13.414 unique	5.16	4:59	-	-	-	-

3.5 Business Model Canvas

3.5.1 What is the Business Model Canvas?

Osterwalder [10] believes that a business model can be best described through nine building blocks that show the logic how a company intends to make money. These nine blocks cover the four main areas of a business: customers, offers, infrastructure and financial viability. These blocks have some similarities with the holistic framework. The Business Model Canvas provides more the added value for customers while the holistic framework gives an overview of what the system is. The nine blocks of the Business Model Canvas are:

- *Customer segments:* an organization serves one or several customer segments. It defines the different groups of people and organizations an enterprise aims to reach and serve.

- *Value propositions:* describes the bundle of products and services that create

[40]ComScore Media Metrix January 2015 (Multi-Platform) (accessed 20/5/2017)
[41]https://b2b.kbb.com/wp-content/uploads/2014/05/Our-Reach-07.2016.pdf (accessed 20/5/2017)
[42]https://www.kbb.com/cars-for-sale/?distance=none (accessed 20/5/2017)
[43]http://wardsauto.com/digital-marketing/autotrader-looks-serious-shoppers-buying-triggers (accessed 20/5/2017)
[44]http://wardsauto.com/digital-marketing/autotrader-looks-serious-shoppers-buying-triggers (accessed 20/5/2017)
[45]https://www.edmunds.com/dealers/visitor-demographics.html (accessed 20/5/2017)
[46]http://www.alexa.com/siteinfo/edmunds.com (accessed 20/5/2017)
[47]https://www.cargurus.com/press/20150318.html (accessed 20/5/2017)
[48]http://www.alexa.com/siteinfo/cargurus.com (accessed 20/5/2017)
[49]https://www.cargurus.com/Cars/aboutCargurus.html (accessed 31/5/2017)
[50]https://dealers.cars.com/audience/ (accessed 20/5/2017)
[51]https://roadloans.com/blog/shopping-online-top-5-websites-research-new-used-cars (accessed 20/5/2017)
[52]http://www.alexa.com/siteinfo/cars.com (accessed 20/5/2017)
[53]https://www.cars.com/for-sale/searchresults.action/?page=1(accessed 20/5/2017)
[54]http://www.alexa.com/siteinfo/cars.com (accessed 20/5/2017)
[55]http://www.alexa.com/siteinfo/truecar.com (accessed 20/5/2017)
[56]https://www.truecar.com/#/search (accessed 20/5/2017)
[57]http://advertising.aol.com/properties (accessed 20/5/2017)
[58]http://www.autoblog.com/used-list (accessed 31/5/2017)

value for a specific customer segment.

- *Customer relationships:* describes the types of relationships a company establishes with specific customer segments.
- *Channels:* value propositions are delivered to customers through communication, distribution, and sales Channels.
- *Revenue streams:* revenue streams result from value propositions successfully offered to customers. It represents the cash a company generates from each customer segment.
- *Key resources:* key resources are the most important assets required to make the business model work.
- *Key activities:* describes the most important things a company must do to make its business model work.
- *Key partnerships:* Some activities are outsourced and some resources are acquired outside the enterprise. It describes the network of suppliers and partners that make the business model work.
- *Cost structure:* the business model elements result in the cost structure. The cost structure describes all costs incurred to operate the business model.

3.5.2 Business Model Canvas for the mobility system

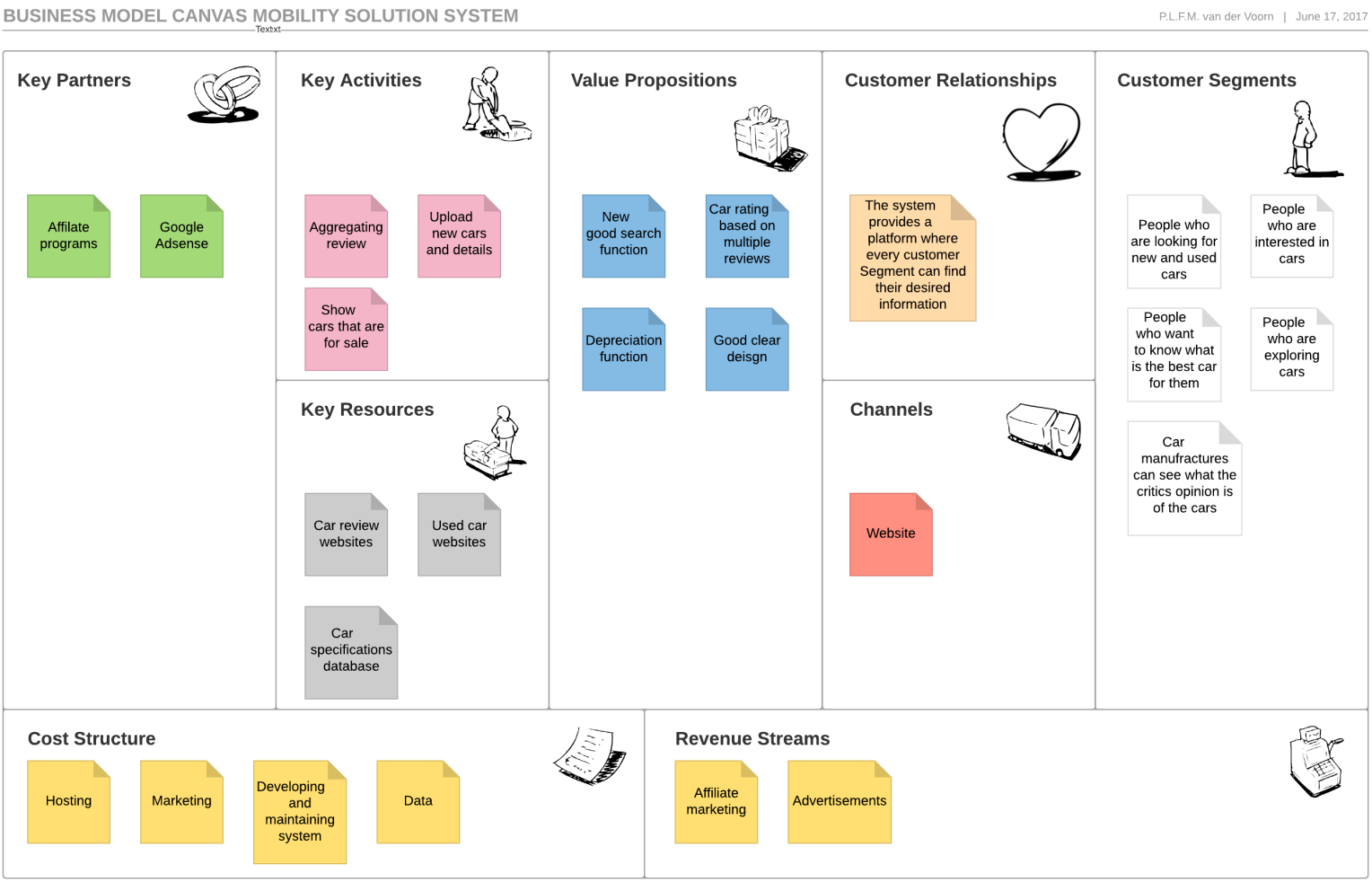


Figure 12: The Business Model Canvas for the mobility solution

3.6 Costs & revenue

3.6.1 Cost structure

Hosting: For developing the system different kind of fixed and variable costs needs to be made. First, the system should be hosted and the domain name should be

registered. According to GoDaddy [59], a large domain name registration website, the cost of a domain name is only a few dollars. For hosting GoDaddy charges around $20.- per month, so in total $240.- a year.

Building and maintaining: The system should be developed and be maintained. According to websitebuilderexpert.com [60] the costs for designing websites can fluctuate. A custom website can start from $5,000.- to $10,000.- so this is an expensive cost. Maintenance can be $1,000.- a year. A developer costs on average $140.- per hour[60]. If the platform takes one month to develop, the developer costs (40 hours a week, 160 per month) $22,400.- in total. This is a big cost item, but the website needs to be developed and therefore it is a one-time cost. The costs for starting and developing the system will be around $33,000.-

Marketing: To create brand awareness marketing is essential. Search Engine Optimization (SEO) is commonly used to create awareness. SEO is a series of modifications and techniques, which make it easier for search engines to crawl, index, and understand the content of a website [11]. By using this technique, the system will be visible for Google rankings when people are searching for cars or car reviews. According to Searchenginewatch.com, a monthly retainer to a specialized online marketing agency is the most common form of conducting business because this will result in the highest Return On Investment. Monthly retainer arrangements usually include regular analytics reports, on-site content improvements, press releases, link building, keyword research, and optimization [61]. The costs will be between $750,- and $5,000.- per month. The online presence is the only presence of the system so investing in marketing is important. The system should focus at the higher end of this estimation because awareness needs to be cre-

[59] https://nl.godaddy.com/ (accessed 22/5/2017)

[60] http://www.websitebuilderexpert.com/how-much-should-a-website-cost/ (accessed 22/5/2017)

[61] https://searchenginewatch.com/sew/how-to/2267471/how-much-should-you-spend-on-seo-services accessed (24/5/2017)

ated. $4,000.- Per month invested in marketing will increase the brand awareness of the system.

Data: the system needs many data-resources to be operating. Data-resources can be free or a fee needs to be paid. At this point it is not possible to know exactly which data sources will be used. After contacting the sources, deals can be negotiated and the prices are known.

3.6.2 Revenue streams

Advertisements: To be profitable, the system should generate more revenue than costs. Section 3.2.3 stated that advertisements will be shown to users of the system. To estimate the revenue for advertisements, three variables are needed: how many people are using the system, the percentage of those people who click on advertisements and how much dollar does one click on an advertisement generate. In the beginning the system will not have much users, but once it uses intensive SEO marketing, the user base should grow. With the use of SEO, a 10 to 20% monthly growth of visitors is a good considered benchmark [62] (for this benchmark it is assumed that this growth will continue for the first 48 months). With a budget of $4,000.- for SEO per month, a thousand visitors in the first month should be feasible. This will be the starting number for users of the system. The number of users will not grow forever with 20%. The first 48 months are used to show what happens with the revenue if a 20% growth is realized.

The average click-through rate of websites in the auto industry is 0.41% [63] . This means that 0.41% of the users click on an advertisement that is shown in the system. According to Wordstream, the average value for words in the car industry

[62] https://www.geckoboard.com/learn/kpi-examples/marketing-kpis/website-traffic-growth/#.WSP0Dmjyg2w (accessed 23/5/2017)

[63] http://www.wordstream.com/blog/ws/2016/02/29/google-adwords-industry-benchmarks (accessed 22/5/2017)

is $1.45.- [64]. This implies that the companies on average are willing to pay $1.45.- when someone clicks on their advertisement. With this available information it is possible to do calculations about how much revenue can be generated with advertisements. Figure 13 shows the estimation of revenue for the first 48 months of advertisements. See appendix A for the values and calculations.

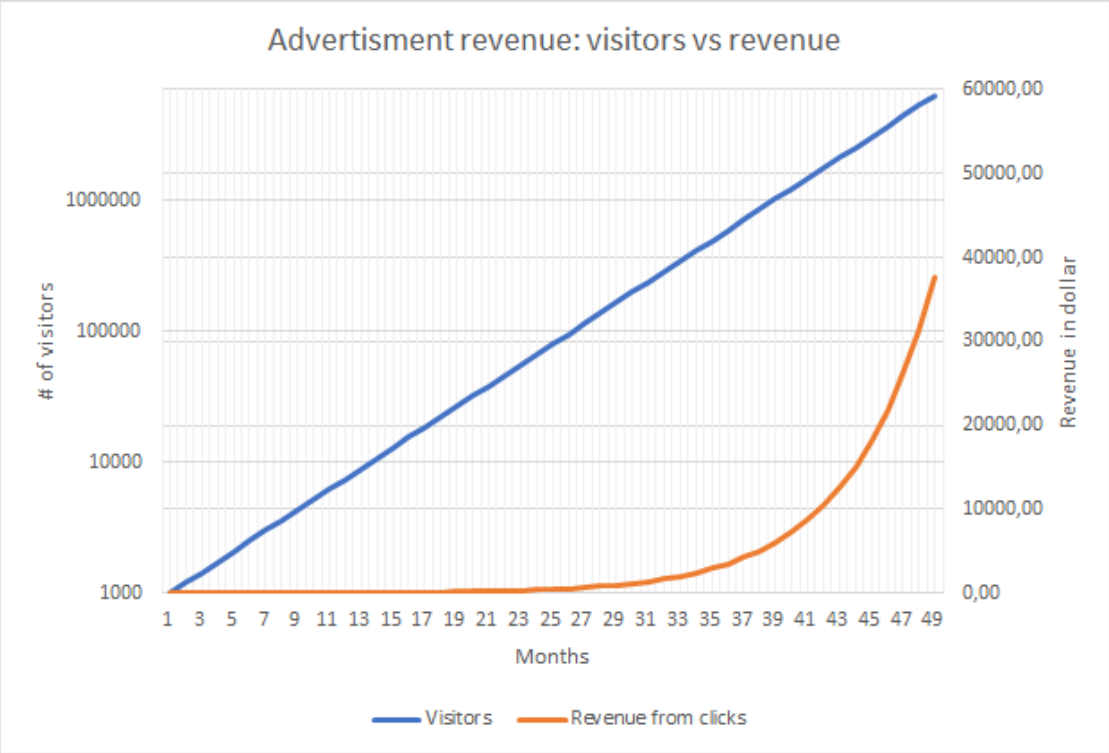


Figure 13: Revenue from clicks for the first 48 months

Affiliate programs: In Affiliate programs for cars the affiliate gets rewarded when a purchase is conducted (in most cases), called Pay-Per-Sale (PPS) [12]. When a user buys a car via the affiliate program in the mobility system, revenue will be generated. In section 4.3.1 an overview of affiliate programs is given. In this calculation the data of Ebay is used because it is a very accessible affiliate program.

[64] http://www.wordstream.com/blog/ws/2016/02/29/google-adwords-industry-benchmarks (accessed 22/5/2017)

When a purchase is done via the Ebay affiliate program, the affiliate gets rewarded with $30.- to $62.5.- [65], on the average $46.25.-. To make an estimation it is necessary to know how many percent of the visitors actually buy a car online. There is no data available for this question, but an estimation can be made with the use of the data from the competitor case study in section 3.4. TrueCar sold 218,807 units [66] in the fourth quarter of 2016. A unit is defined as the number of automobiles purchased by our users from TrueCar Certified Dealers through TrueCar.com and our mobile applications or the car buying sites and mobile applications we maintain for our affinity group marketing partners. In the fourth quarter TrueCar had 7 million unique visitors. To generate a unique-visitor-to-sale ratio the units are divided by the unique visitors what results in 0.031%. With the number of visitors, the percentage of visitors that buys a car and the affiliate reward it is possible to calculate the revenue and the total revenue from advertisements and the affiliate revenue combined. See appendix A for the calculations and figure 13.

[65] http://pages.ebay.com/help/sell/motorfees.html#Selling-your-vehicle (accessed 24/5/2017)

[66] https://globenewswire.com/news-release/2017/02/16/918281/0/en/TrueCar-Reports-Fourth-Quarter-and-Full-Year-2016-Financial-Results.html (accessed 24/5/2017)

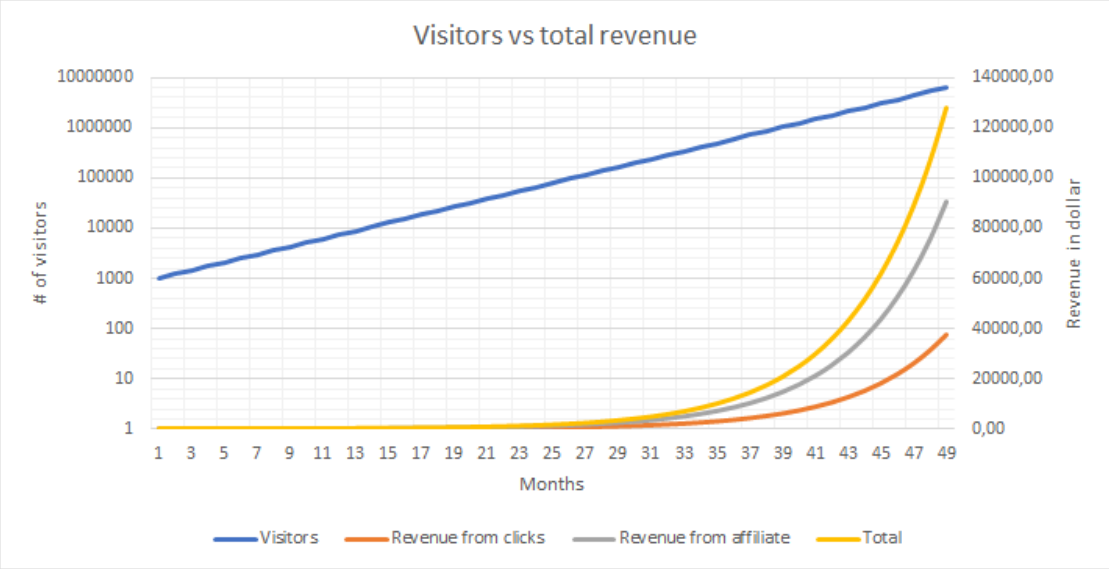


Figure 14: Total revenue for the first 48 months

In figure 15 the accumulated costs and revenue are plotted. This graph shows that in 41 months after the system started, profits will be generated. From that point in time only profits will be made.

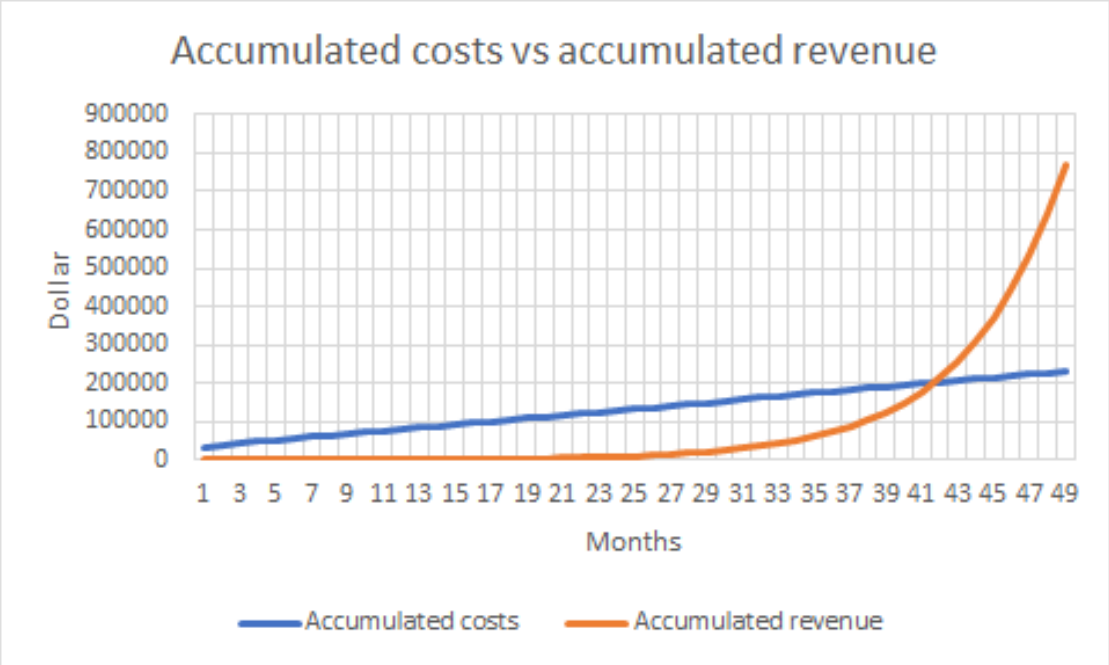


Figure 15: Accumulated costs vs accumulated revenue

3.7 Macro environment

When analyzing the environment it is important to look in a broad view and not only to the competitors. The macro environment consists of the government policies, natural environment, national boundaries, (de)regulation and technological change [7]. For the mobility solution, government policies are important because of the use of information and data of 3rd-parties. It is important to look for the boundaries in which countries the mobility system operates. Every country can have different laws and regulations and the mobility solution has to comply with it. In section 4.4 the legal constraints regarding the use of 3rd-party data are outlined.

3.8 Porter's Five Forces model

3.8.1 What is the Porter's Five Forces model?

A company is profitable if it generates more money that it spends. Michael Porter [13] pointed out that there are five forces that can prevent a company from being profitable. The state of competition in an industry depends on those five forces.

- *Bargaining power of suppliers:* how strong is the position of sellers, are there many or only few potential suppliers.
- *Bargaining power of buyers:* how strong is the position of buyers, can they work together.
- *Threat of new entrants*: how easy or difficult it is for new entrants to start to compete and which barriers exist.
- *Rivalry among existing players:* is there a strong competition between the existing players.
- *Threat of substitute products:* how easy can the product or service be substituted.

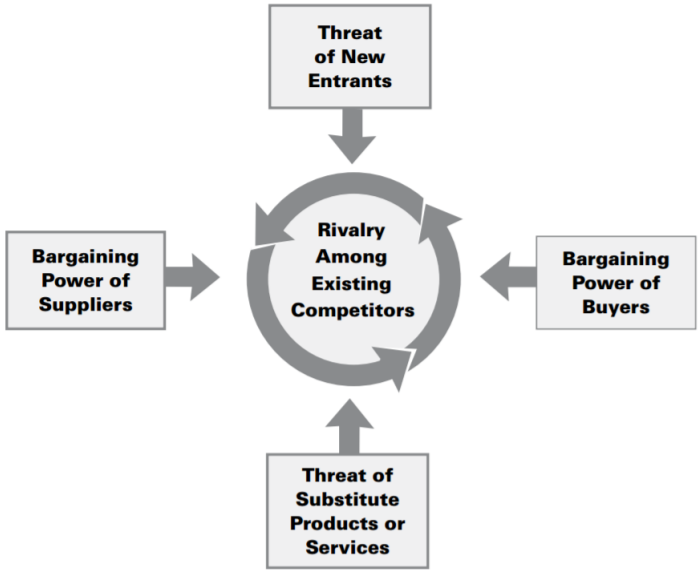


Figure 16: Porter's five forces

3.8.2 Porters five forces applied to the mobility system

- *Bargaining power of suppliers:* the suppliers of the system will be car review websites and used car websites. It is necessary for the system to get access to their databases. The system depends on the suppliers of the data. This means that the system can not work if it can not have access to that data. They have a dominant position. They can charge money for the use of their systems or demand more. It is important to maintain a good relationship with the suppliers and have a good collaboration that is profitable for both parties.

- *Bargaining power of buyers:* the users will be people who are interested in cars. They can search for reviews about new cars or look for used cars when they want to buy a car. It is easy for people to switch from website. In America, Kelley Blue Book is the most recognized brand for used cars [67].

[67] Consumer Brand Tracker, Ipsos, Q4 2015 (accessed 4/5/2017)

This makes it difficult to convince people to switch to the mobility system. It is important that people can recognize the system. People are spending on average 14 hours and 44 minutes to buy a vehicle [68], of which 59% is online research. This implies that people are thoroughly looking online for the car that is best suited for them. They will look at 3rd-party automotive websites and therefore it is easy to switch websites. The system should show those people the best information available for their choice. The longer people are using the system, higher the chance that more revenue will be generated.

- *Threat of new entrants:* the mobility platform consists only online and has no physical elements. The whole system is digital and online. The reviews and cars are aggregated via APIs and affiliate programs. Anyone can apply online for those affiliate programs and use it. Therefore, it is easy to make a copycat website. Online there are many websites that show how easy it is to start an online business [69]. The barriers to entry are low and it is not expensive to enter the industry. There is no specific skill required and this makes it easy for new entrants. This can be problematic for the mobility system. It is important to differentiate the system so it offers more value to the users. When the name is established among the users, they are more likely to keep using it. Brand awareness seems to play an important part in explaining habitual choice patterns [14].

- *Rivalry among existing players:* the American market consists of many websites that show reviews of cars and websites that present used cars. There is a fierce competition going on. The system should be a car platform that will combine all those features. This will result that people do not have to switch from websites to see reviews and cars that are available for sale.

[68] http://agameautotrader.com/agame/pdf/2016-car-buyer-journey.pdf (accessed 4/5/2017)
[69] https://www.entrepreneur.com/article/175242 (accessed 4/5/2017)

- *Threat of substitute products:* a substitute product of car reviews or used-car websites is not likely. It is plausible that there will be more competitors, but a product that replaces the system is not thinkable. The internet has made it possible that the market shifted towards online buying of used cars instead of going directly to the nearest dealer. It is not likely that in the near future a disruptive change will happen that is better than the mobility system.

3.9 Sustainability

If a website gains competitive advantage, there is a chance that competitors will catch up or even copycat the idea. There are three strategies to maintain sustainable according to Afuah [7]:

- *Block strategy:* The firm will build barriers around its product market space. It can do this by patenting intellectual property. Because the mobility solution is using information of third parties, it is not possible to apply. On the contrary, if those third parties restrict the use of their information, the mobility platform can not operate.

- *Run strategy:* The run strategy is changing some elements of the business model or the whole business model to offer the consumers better value. The run strategy can result in a first mover advantage if the changed business model operates in a new environment or market.

- *Team-up strategy:* Sometimes a company can not operate by itself to remain sustainable. Therefore it can follow a team-up strategy. This can be an alliance, joint venture or acquisition. This allows firms to share resources, information and knowledge.

When the system is developed and running it needs to be sustainable. When there is heavily competition and the system is not making money, the run and

team-up strategy can be applied to try to be sustainable. When using the run strategy the system can focus on other markets like car rental or even complete other industries in the transportation sector. To change focus or expand the reach, the system can attract new users and try to earn revenue by targeting those users.

The team-up strategy is more difficult to use. If the system is making a loss and has a low number of users, it is tough to find a party for a joint venture or acquisition. But when the number of users is increasing it can be interesting. With a joint venture or acquisition the other company can redirect those users to them and earn money or use the mobility system in an other way what might be more usable for them. These two strategies are the last resorts for the system when the results are not good.

4 Data Sources

4.1 Sources for cars

The system will not contain any information in the beginning. The database is empty and needs to be filled. The first goal is to obtain the essential data of cars like brand, model, year and specifications. It is possible to do this manually but that will be a long process. There are multiple sources that provide car APIs. Edmunds provides an API that contains all the information about cars [70] and CarQuery [71] does. To get access to the features of CarQuery, a payment of $95 is required. The Edmunds API provides many different features like the true cost of owning a car and service information. Implementing this in the system will result in a full database with information about the cars. The next goal is to attach reviews to each car.

4.2 Sources for reviews

According to research of J.D. Power in 2016, the most important element of third-party automotive websites is the content that includes the car ratings [72]. J.D. Power also stated that *"opinions can vary dramatically on issues such as the look of a vehicle, the smoothness of its ride, and the level of its performance. Hard numbers are important, but they dont tell the full story"* [73]. Therefore it is important to aggregate the car reviews not only based on the information of one single review, but on multiple ones. Combining the reviews will eventually increase the quality of the car ratings and therefore increase the value for the customer.

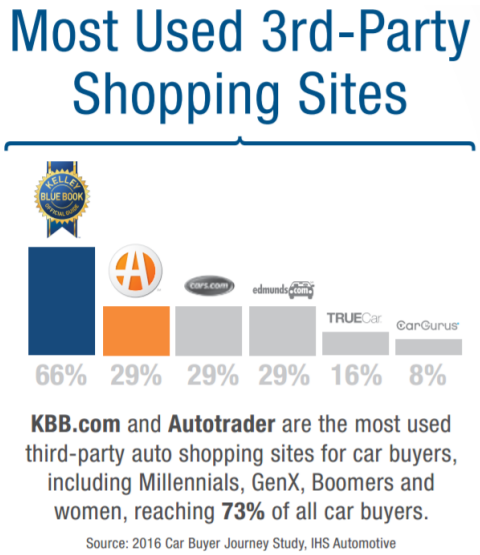
[70] http://developer.edmunds.com/api-documentation/vehicle/ (accessed 7/5/2017)
[71] http://www.carqueryapi.com (accessed 8/5/2017)
[72] http://www.jdpower.com/press-releases/2016-third-party-automotive-website-evaluation-study accessed 9/5/2017
[73] http://www.jdpower.com/cars/articles/jd-power-studies/2016-third-party-automotive-website-evaluation-study-visual-web (accessed 9/5/2017)

To obtain a car rating based on reviews, the reviews should be reliable and independent. The sources should provide a good quality of reviews, a good quantity and should be well-regarded in the industry. Therefore, the reviews should be published by well established websites, magazines or newspapers and not user reviews. Critics provide more detailed, more insightful and more articulate information than others [74]. Metacritic uses a minimum of four reviews before calculating the Metacritic score [75]. The mobility platforms should rate the cars if they have at least 3 reviews. This will result in a more reliable rating for the cars. In Appendix B, a list of resources for the car reviews is given.

[74] http://www.metacritic.com/faq#item11 (accessed 7/5/2017)
[75] http://www.metacritic.com/faq#item13 (accessed 7/5/2017)

4.3 Sources for new and used cars

The system should show new and used cars that are available for sale. To obtain all the cars that are available, the system needs to have access to that data. The system is focused at the American market and therefore it needs to aggregate the cars from American websites. The six most used and most visited third-party websites that show used cars are KellyBluebook.com, Autotrader.com, CarGurus.com, Cars.com, Edmunds.com and TRUECar.com [76] [77]. See figure 17a and figure 17b. Car buyers are using 3rd-party sites mostly as an online resource according to the Car Buyer Journey study, IHS automotive. 78% Percent of the people are using a 3rd-party site versus 57% are using dealership websites versus 36% are using original equipment manufacturer (OEM) websites.



(a) Most used 3rd-party websites

(b) Most visited 3rd-party websites

Figure 17: 3rd-party websites

[76] 2016 Car Buyer Journey study, IHS automotive, (accessed 27/4/2017)

[77] comScore Media Metrix Multi-Platform, September 2015, (accessed 27/4/2017)

4.3.1 Affiliate programs

Edmunds.com has an affiliate program that will provide all the cars that are for sale on their website usable for others [78]. There is one drawback "Only U.S.A. affiliates are accepted into the program". When the system is live it is possible to negotiate terms to come to an agreement with Edmunds.

Cars.com provides data about their cars via APIs and it is possible to set up a lead generation network. It is not possible to provide much information about it because Cars.com states the following: *"currently API-based data access is only available for approved business partners through our Business Development team and is not publicly available. If you are interested in becoming a business partner please contact us by email"* [79].

CarsDirect.com provides an affiliate network to get access to the data of CarsDirect.com and Autos.com. Autos.com is a separate website that CarsDirect owns and operates specifically to help consumers research new vehicles and be matched up with a local dealer [80]. If the visitor clicks on a link in the system, the user gets redirected to CarsDirect. If the visitor generates a lead (leads are qualified when a visitor fully completes and submits a purchase request) a reward of $15 will be given.

Ebay has a large affiliate network available for their products [81]. If a purchase is made within 24 hours on Ebay via an affiliate link, the partner receives 50% of what Ebay earns with the transaction [82] for vehicles. For cars below $2,000.-, Ebay receives $60.- and for cars above $2,000.-, they receive $125.- [83]. So respectively, the partners earn $30.- to $62.5.- per transaction. Ebay currently lists more than

[78] https://www.edmunds.com/affiliate-program/ (accessed 16/5/2017)
[79] https://developer.cars.com/ (accessed 16/5/2017)
[80] http://affiliate.carsdirect.com/faq.htm (accessed 16/5/2017)
[81] https://partnernetwork.ebay.com/ (accessed 22/5/2017)
[82] https://partnernetwork.ebay.com/legal#program-details (accessed 22/5/2017)
[83] http://pages.ebay.com/help/sell/motorfees.html#Selling-your-vehicle (accessed 22/5/2017)

59,000 cars on their website[84]. If those care are implemented in the system, Ebay could be a powerful affiliate partner.

4.4 Legal contraints 3rd-party data

The core of the system should be the aggregated reviews of cars. The reviews should come from 3rd-party websites that write and make reviews about the cars. But it is not possible just to take that information and use it for the system. All the content on websites is protected with copyrights and trademarks. Kelley Blue Book states in their terms of use:

"You may make personal use of all of the information you access on KBB.com ("Information"), but you may not take any of the Information and reformat and display it, or copy it on your website or in any other format, and you may not store or migrate any of the Information or other data from KBB.com without Kelley Blue Book's written permission. By using the Service, you agree not to sell, store, distribute, transmit, display, reproduce, modify, migrate, create derivative works from, or otherwise exploit any of the Information content or data related to any portion of the Service. You may print a copy of particular vehicle values and prices and use the Information for your personal, non-commercial use, but you may not otherwise reproduce any material appearing on KBB.com. If you want to make commercial use of the Kelley Blue Book Information or Services, you must enter into an agreement with us to do so in advance." [85]

The mobility platform wants to use information for commercial use, because profit is needed to be sustainable. Kelley Blue Book mentioned on their website that information can be used for commercial use if they approve the request for using their data. The system will only read the review and assign a number to it

[84] http://www.ebay.com/sch/Cars-Trucks-/6001/i.html?&_trksid=p2050890.m1603 (accessed 31/5/2017)

[85] https://www.kbb.com/company/terms-of-service/ (accessed 31/5/2017)

and only that number will be shown in the system and not the real content of that review. The system will provide a link to the origin of the review to the site of the reviewer. By using this method, users of the system can be redirected to the website of the reviewer. By doing this, the mobility platform provides visitors for those 3rd-party websites. It is likely that the system gets permission to use the reviews from review websites because the actual content will not be shown in the system, what will lead towards more visitors to the review websites.

Appendix B describes how the information of the review website can be retrieved. Most of those websites have stated in their legal terms that the data can be used by 3rd-parties with written permission.

5 Conclusion

This paper has examined the idea and different aspects of a sustainable review information aggregation system for mobility solutions. To answer the main question: *how can a sustainable review information aggregated based system be created for mobility solutions*, the three sub-questions need to be answered first.

What is the function of an information aggregation website? The function of an information aggregation website is to collect and analyze information and perform analysis to add value of that data for the users. For the mobility system, reviews are collected and contextual differences are resolved to provide a final number for a car rating. To get a good overview what an information aggregator does and what the value is, the holistic framework designed by Crawley for information aggregators should be applied.

Secondly, what business model is a good fit for the car information aggregation system? After analyzing the possible internet business models mentioned by Hu, not only one, but two business models are a good fit for the information aggregation mobility system. The system should be built around advertisements and affiliate programs. To perform estimated calculations of the costs and revenue, the system should be profitable after 41 months. In the beginning funding is needed to perform operations during the first three years but in time, after establishing brand awareness and a user base, the system can be very profitable.

Finally, what are the data sources for the system? The system can not operate if it has no data sources. For obtaining the cars and their specifications the Edmunds API should be used. To add reviews in the system good and reliable websites should be accessed for obtaining their reviews. Before using their reviews, written permission and agreements are needed for using their information. The system should be accessing information legally and have respect for intellectual property and laws. To get access to cars that are available for sale, Ebay provides

at this moment the best API affiliate program for cars. It is easy to participate in the program. There are other affiliate programs like Edmunds, but it is necessary to be a real business and at this moment the system is not developed yet.

The answer of the main question is given by combining the three answers of the sub-questions above. A sustainable review information aggregation system for mobility solutions can be created by producing car ratings based on aggregated car reviews and having access to the cars-for-sale APIs.

The foundation of the review information aggregation system for mobility solution is now given.

6 Future work

This research provides a foundation for a mobility solution review information aggregation system. The next step is to combine the research of the "mobility team" to make it a complete paper. When all the single parts are developed, the mobility system can be tested and launched.

In the near future the business models in this paper can be reviewed to see how it works in practice and they might be applied to other mobility solutions. During the information aggregation research part, the information about information aggregation was very limited. There is not much research done about information aggregation. Information aggregation can be very useful in decision making and selecting cars. Decision making with information aggregation can be interesting research in addition to the mobility solution.

During this project only cars are reviewed but "mobility" is a broad word. Other transportation vehicles and methods can be included like recreational vehicles and campers. Further research can look at the possibilities to add car rentals and public transportation services or airlines and ferries.

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A Data for estimating advertisements revenue

Growth rate	Earnings per click	Average click through rate	People who buy a car online	Affiliate reward		
1.2	$1.45	0.0041	0.00031	$46.25		
Month	Visitors	Revenue from advertisements	Revenue from affiliate	Total revenue	Accumulated revenue	Accumulated costs
0	1000	5,95	14,34	20,28	20	34400
1	1200	7,13	17,21	24,34	45	38503
2	1440	8,56	20,65	29,21	74	42606
3	1728	10,27	24,78	35,05	109	46709
4	2074	12,33	29,73	42,06	151	50812
5	2488	14,79	35,68	50,47	201	54915
6	2986	17,75	42,81	60,56	262	59018
7	3583	21,30	51,37	72,68	335	63121
8	4300	25,56	61,65	87,21	422	67224
9	5160	30,67	73,98	104,65	527	71327
10	6192	36,81	88,77	125,58	652	75430
11	7430	44,17	106,53	150,70	803	79533
12	8916	53,01	127,83	180,84	984	83636
13	10699	63,61	153,40	217,01	1201	87739
14	12839	76,33	184,08	260,41	1461	91842
15	15407	91,59	220,90	312,49	1774	95945
16	18488	109,91	265,08	374,99	2149	100048
17	22186	131,90	318,09	449,99	2599	104151
18	26623	158,28	381,71	539,99	3139	108254
19	31948	189,93	458,05	647,99	3786	112357
20	38338	227,92	549,67	777,58	4564	116460
21	46005	273,50	659,60	933,10	5497	120563

22	55206	328,20	791,52	1119,72	6617	124666
23	66247	393,84	949,82	1343,66	7961	128769
24	79497	472,61	1139,79	1612,39	9573	132872
25	95396	567,13	1367,74	1934,87	11508	136975
26	114475	680,56	1641,29	2321,85	13830	141078
27	137371	816,67	1969,55	2786,22	16616	145181
28	164845	980,00	2363,46	3343,46	19959	149284
29	197814	1176,00	2836,15	4012,15	23972	153387
30	237376	1411,20	3403,38	4814,59	28786	157490
31	284852	1693,44	4084,06	5777,50	34564	161593
32	341822	2032,13	4900,87	6933,00	41497	165696
33	410186	2438,56	5881,05	8319,60	49816	169799
34	492224	2926,27	7057,25	9983,52	59800	173902
35	590668	3511,52	8468,71	11980,23	71780	178005
36	708802	4213,83	10162,45	14376,27	86156	182108
37	850562	5056,59	12194,94	17251,53	103408	186211
38	1020675	6067,91	14633,92	20701,83	124110	190314
39	1224810	7281,49	17560,71	24842,20	148952	194417
40	1469772	8737,79	21072,85	29810,64	178762	198520
41	1763726	10485,35	25287,42	35772,77	214535	202623
42	2116471	12582,42	30344,90	42927,32	257463	206726
43	2539765	15098,90	36413,88	51512,79	308975	210829
44	3047718	18118,69	43696,66	61815,35	370791	214932
45	3657262	21742,42	52435,99	74178,42	444969	219035
46	4388714	26090,91	62923,19	89014,10	533983	223138
47	5266457	31309,09	75507,83	106816,92	640800	227241
48	6319749	37570,91	90609,40	128180,30	768980	231344

B Resources for car reviews

List of car review resources	Review verdict	Legal
http://www.autoblog.com/reviews/	Text	Need written permission to use their data
http://www.autotrader.com/car-topics/car-reviews.xhtml	Text	Need written permission to use their data
http://www.autoweek.com/	Text	Not available on website
http://www.jdpower.com/cars	5-star scale	Need written permission to use their data
https://www.edmunds.com/car-reviews/	Text	Need written permission to use their data
https://www.cargurus.com/Cars/autos/	1-10 scale	Need written permission to use their data
https://www.cars.com/news/car-reviews/	Text	Need written permission to use their data
http://consumerguide.com/	Text	Not available on website
http://www.automobilemag.com/	Text	Need written permission to use their data
http://www.caranddriver.com/	Text	Need written permission to use their data
http://www.trucktrend.com/truck-reviews/	Text	Need written permission to use their data
http://www.superstreetonline.com	Text	Need written permission to use their data
http://www.fourwheeler.com/vehicle-reviews/	Text	Need written permission to use their data
http://www.leftlanenews.com/	Text	Doesnt mention anything on using their data
http://greencarjournal.com/	Text	Doesnt mention anything on using their data
http://www.kbb.com	1-10 scale	Need written permission to use their data
http://www.motortrend.com/	5-star scale	Need written permission to use their data
http://www.thetruthaboutcars.com/	Text	Need written permission to use their data
http://www.thecarconnection.com	1-10 scale	Need written permission to use their data
http://www.vroomgirls.com/	Text	Need written permission to use their data
http://wardsauto.com/	Text	Not available on website
http://www.nydailynews.com/autos/latest-reviews	1-10 scale	Not available on website
https://cars.usnews.com/cars-trucks	1-10 scale	Need written permission to use their data
http://www.consumerreports.org/cars/	Membership needed	Not available on website
https://www.whatcar.com/reviews/	5-star scale (British)	Not available on website