Adoption of the electric car. Why do people buy an electric car?

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1. Introduction

The improvement in the internal combustion engine and the low price for petrol made that conventional vehicles have had an obsolete share in the market; pure electric vehicles have almost disappeared since 1930’s (Shen, Shan and Gao 2011). However in the late 21st century more emphasis was placed on environmental issues and the internal combustion engine became a subject of debate. Nowadays there are strict emission rules for petrol powered cars. For example The European Commission has set emission performance standards for car manufacturers to decrease the CO2 output from car transport (European Commission, 2009).

Manufacturers have reacted on the emission performance standards in several ways. Some manufacturers have developed cleaner petrol and diesel cars; others have developed hybrid cars (HEV) or electric cars (PEV’s) (Shen et al., 2011). An EV, electric vehicle, is a road vehicle with electric propulsion (Shen et al., 2011). EV’s can be classified into three types: pure electric vehicles (PEVs), hybrid electric vehicles (HEVs) and fuel cell electric vehicles (FCEVs) (Shen et al., 2011). The PEV is only driven by electric energy stored in batteries and has therefore no tailpipe emission. A HEV is a vehicle which combines an internal combustion engine with an electric motor. In most cases the electric motor drives the car while at low speeds, for example in the city, while the combustion engine takes care of propulsion on the longer distances at higher speeds. The advantage of a HEV, compared to an EV, is the longer range. A HEV can drive while the batteries are dead, an EV can only drive when the batteries are charged. A recent development has been the plug-in hybrid electric vehicle (PHEV) which has a larger battery than the HEV but still has an internal combustion engine for longer distances. The PHEV can drive pure electric for longer distances than a HEV, more like a PEV, but still has the advantage of a “range extender” in the form of a petrol engine.

For this research only PEVs (Pure Electric Vehicles) and HEVs (Hybrid electric vehicles) are taken into account because FCEVs (Fuel Cell Electric vehicles) are hardly for sale in The Netherlands. Society depends on reliable and safe transport by cars. There are many commuters, driving daily from home to work and vice versa. People are used to the properties of petrol and diesel cars, for example a large range and refill on many places which only takes a few minutes. Electric cars however lack these properties.

1.1. Description of the problem

The automotive industry has shown a very stable incremental change in the core technology. But in recent developments car manufacturers are challenged with a demand for sustainable cars and are forced to make cars more environmental friendly. The recognition of environmental problems such as global warming has led to international protocols, such as the Kyoto-protocol, to reduce emission of greenhouse gasses.
Dutch government stimulates use of environmental friendlier transport by lowering the taxes on those environmental friendlier cars and exemption from taxes for electric cars. However the electric car is not yet a success. According to trade organization RAI the total market share of the electric car in 2011 was 0.09 percent in the EU, The Netherlands is, in percentage of market share, leading in Europe. In the Netherlands electric cars accounted for 0.3% of total new car sales, thereof just 5% were bought for private use. An analysis of the buyers of electric cars in The Netherlands would provide information that may be useful to other countries as well. A study of Accenture (2011) has focused on possible adopters and why they did not adopt this new innovation. They found that there are several factors influencing the decision to buy an electric car. The most important factors were absence of taxes on electric car, the ability to charge at home, driving range in comparison to conventional car. Further the choice between a plug-in hybrid and a full electric vehicle are influenced by the perceived insufficient battery range of PEV. For the Accenture study see Appendix 1.

In order to find an answer how to improve the adoption this research will focus on the factors influencing adoption behaviour. Rogers (2003) has developed a model with which adoption can be explained. Rogers (2003) emphasizes the importance of the first adopters of a new innovation in the adoption process. If the first adopters are satisfied with the product this will influence the rate of adoption. With the information from the first adoption an advice can be made to companies in the automotive industry how to sell more electric cars.

1.2. Theoretical contribution

The diffusion of innovation is a research topic which has received a lot of interest in the last 50 years. Rogers is one of the leading researchers in this field and has published a lot of work regarding the subject diffusion of innovation. The definition proposed by Rogers (1983) is: “Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system.” (Rogers 1983, p5). An innovation is described as an idea, practice or object perceived as new by an individual or other unit of adoption. In general the diffusion of innovation is about the process where a new product, in this case the electric car, is being adopted by the consumers. This process of adoption takes place within a social system where people interact and is influenced by government and social pressure also know as institutional pressure (IP).
The majority of the diffusion research has focused on the innovation characteristics, or the characteristics of the people who adopt new innovations. The research so far on the electric car specifically has focussed on potential buyers and why they would, or would not buy an electric vehicle (Kahn, 2007; Lieven, Mühlmeier, Henkel and Waller, 2011). This research will develop a new model including the perceived characteristics of an innovation (Rogers, 2003), but also other factors perceived to influence adoption behaviour. In this research it is suggested that there are more factors influencing adoption behaviour. Bansal and Roth (2000) suggest that institutional pressures influence adoption behaviour. Secondly Brewer (1991) suggest different social identities can be distinguished. In this research the different social identities are suggested to have an effect on adoption behaviour.

Thirdly it is suggested by Kahn (2007) that a car is a status symbol. Agarwal and Prasad (1997) also identified Image as a construct explaining adoption behaviour, therefore Image is suggested to influence adoption behaviour. Finally marketing is suggested to influence adoption behaviour. In the first stages of innovation advertisements have a big influence on adoption, but in later stages word of mouth becomes an important marketing tool (Mahajan Muller and Bass, 1990).

1.3. Central research question

The purpose of this study is to develop a model that integrates different theories about adoption behaviour. The widely used model by Rogers (1962) does not include all influences important in the adoption of innovation (research gap). The influence of institutions (institutional pressure), image, social identity and marketing are perceived to be influential in the adoption behaviour. This research will develop a model combining different theories about adoption to explain adoption behaviour.

By collecting data from owners and potential owners of electric cars an analysis on the adoption can be made. The group of owners is of particular interest because the first buyers, or early adopters as Rogers (2003) refers to them, have a large influence on the development of the diffusion of innovation.

Rogers (2003) suggests that the first adopters of an innovation, the innovators, are an important group to study because they are important for the adoption of the innovation. The experience of the innovators will help to gain insight in several aspects of the electric car. Some aspects are common knowledge in the field, for example the limited range of the electric vehicle, but other aspects are unknown. By studying the early adopters this research will indicate what influences people to buy an electric car. Recommendations arising from this research can help to accelerate the adoption of the electric car.

The central research question is What is the influence of Perceived attributes, Institutional Pressure, Social Identity, Marketing and Image on the adoption of the electric car?
In this research the influence of five different factors on the diffusion of innovation will be combined to one adoption model. The five factors are:

- Perceived Attributes of an Innovation
- Institutional Pressure
- Social Identity
- Marketing
- Image

1.4. Structure of the research

In order to answer the research question a literature review is conducted in chapter two. In this chapter the subject automotive industry will be outlined first. Then delineation on the subject of diffusion of innovation will be given. Thereafter a review of the literature will be presented on (1) Perceived Attributes of Innovation, (2) Institutional Pressure, (3) Social Identity, (4) Image and (5) Marketing. Each theoretical part will be ended with one or several hypotheses. In chapter three insights in the methodology of this research will be given. A description of the research method, construction of the questionnaire and procedures will be included. Chapter four gives a summary of all results from this research. The results are presented in the same order as in the literature review. The results are analyzed in two ways, with a regression analysis as well as with descriptive statistics. The discussion and conclusion chapter finalizes this research.
2. Literature review

In the following section a review of the existing literature on the diffusion of innovation will be given as well as an outline on the market of the electric car. This chapter will start with review of the literature about the automotive industry.

2.1. Automotive industry

The automobile is one of the most advanced consumer products and has been developed for over a century to improve reliability, durability, speed, range, fuel efficiency etc. The automobile is entrenched in the social system and people’s ways of life; it is part of a larger technological system involving gas stations, automobile repair shops and an extensive road infrastructure (Kemp, 1994). According to Kemp (1994) the social system and larger technological system explains why shifts in the transport system are slow. Some try-outs from the automotive industry to introduce alternative ways of driving have failed. The reasons for failure are not always because the car is not a good alternative, it also seems like the automotive industry is not willing to change (Hard and Knie, 2001).

2.1.1. Electric car

According to Tran, Banister, Bishop and McCulloch (2012) there are several factors affecting the diffusion of the electric car, for example the range anxiety; the anxiety to end up with an empty battery before reaching destination. This anxiety will be important for the adoption of the electric car and can be lowered by recharging convenience. A lack of access to charging stations, a poor infrastructure for recharging, is therefore an important factor for the adoption of the electric car (Pierre and Jemelin, 2011). In contraire Pierre and Jemelin (2011) found that the driving range is not really perceived as a problem. People expect the price of an electric vehicle to be about the same (Pierre and Jemelin, 2011) compared to traditional vehicles, however this is not always the case.

Margusson and Berggren (2011) underline that for the electric car to be a success it needs to be a good alternative to traditional cars The high cost of battery packs, the limited range and the long charging times restrict the market appeal of the all-electric car. Margusson and Berggren (2011) further suggest that the market for all-electric vehicles should be confined to small urban models, or a specific sub-segment such as customers with a need for a second or third car. Peerre, Kempton, Guensler and Elango (2011) however showed that even with limited range, electric vehicles could provide in a large part of transportation needs. The latter result suggests that other factors than the characteristics of the electric car are important for the adoption behaviour. There is some discussion about whether or not the electric car is a good alternative; this research will try to give some new insights regarding this subject.
2.1.2. Do environmentalists drive electric cars?

Within a single product class, the brand, product type, and “buy or not buy” choices may be driven by completely different consumption values. For the electric car we could make an analysis and find the main focus is on the Social Value, where driving an electric vehicle can show you are caring about the environment. Kahn (2007) found that people who think a lot about the environment tend to use more public transport and drive more environmental friendlier cars. In this research social value will be researched, it will be explained further in paragraph 2.5 concerning institutional pressure.

2.2. Innovation

The concept of innovation has had interest since the beginning of the 20th century, as Schumpeter (1934) wrote about innovation as creative destruction. Schumpeter had a definition for an innovation: ‘an innovation is a new or improved product, process or technology, which is commercially successful on the market’ (Schumpeter, 1934). However a distinction needs to be made between an innovation and an invention. An invention is a tangible product from new ideas, but an innovation is the subsequent translation of the invention into the economy (Trott, 2008). Therefore an innovation is more seen as a management process which makes a distinction between an innovation and a product, the latter being the output of innovation. An innovation is the successful implementation of new and appropriate ideas (Trott, 2008). In this research the electric car is seen as an innovation, because it is an implementation of the product: electric car, in the environment.

2.3. Diffusion of Innovation

The diffusion of innovation is a research topic which has received a lot of interest in the last 50 years. Rogers is one of the leading researchers in this field and has published a lot of work regarding the subject diffusion of innovation. The definition proposed by Rogers (2003) is: “Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system.”(Rogers 2003, p5). An innovation is described as an idea, practice or object perceived as new by an individual or other unit of adoption. This definition is recognized by many researchers and used in their research. (Valente, 1995; Nutley & Davies; 2000, Deffuant, Huet and Amblard, 2005; Iyengar, van den Bulte and Valente, 2010).

2.3.1. Diffusion within a social system

Geels (2004), who referred to diffusion as a kind of social change, emphasised the importance of social interaction, people interacting with each other to adopt a new way of doing. The communication within a social system is of particular interest in the diffusion of innovation, because for adoption of a new innovation people need to be aware of the existence.
Rogers (1983) also emphasized that social interaction is at the heart of the diffusion of innovation. Objective evaluations of new products are not entirely irrelevant, but most individuals depend upon a subjective evaluation of an innovation by other individuals like themselves. Therefore the importance of the first users, or early adopters as they are called, is evident. (Rogers, 1983). The importance of first users has been recognized in recent research as well (Gjoen and Hard, 2002).

Regarding sustainable innovations Woersdorfer and Kaus (2011) found that knowledge or environmental attitude are important for purchase of solar panels, but not sufficient. It is peer group behaviour that triggers diffusion of the technology (Woersdorfer and Kaus, 2011). Further Nutley and Davies (2000) have found that adoption of innovation does not always rely on rational and technically efficient choices of the adopters, but can also relate to institutional pressure associated with certain fashions. It is obvious that in the research field there are more factors influencing adoption behaviour than just the characteristics of the product.

Iyengar et al. (2010) have found that members of a social network influence behaviour of other members of the network. Opinion leaders are members of a social network with strong influence on other members, because they tend to be early adopters and heavy users. Other members of the social network rely on the opinion of these Opinion leaders, and therefore they are an important target group for marketing. Opinion leaders are also recognized by Rogers (2003).

Obviously the adoption of innovation is not just a case of a good product, with the right attributes, but is also influenced by the social system in which it is present. When innovation gains acceptance the others may adopt more in order to seek legitimacy. Apparently there is a difference in the people within the social system; there are people who adopt first and people who adopt to seek legitimacy. This has been recognized by many scholars and Rogers (1983) has constructed categories of adopters to differentiate the people. The different categories can be found in figure 1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Adopter characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovators (2.5%)</td>
<td>- Express a high level of risk-taking propensity</td>
</tr>
<tr>
<td></td>
<td>- Are active information seekers about new ideas</td>
</tr>
<tr>
<td></td>
<td>- Possess advanced technical knowledge</td>
</tr>
<tr>
<td></td>
<td>- Able to handle a high degree of uncertainty about an innovation at the time of adoption</td>
</tr>
<tr>
<td></td>
<td>- Enjoy trying out a new innovation</td>
</tr>
<tr>
<td></td>
<td>- Find it easy to imagine, understand, and appreciate the benefits of an innovation</td>
</tr>
<tr>
<td>Early adopters (13.5%)</td>
<td>- Act as opinion leaders</td>
</tr>
<tr>
<td></td>
<td>- Share similar characteristics with those of innovators but at a slightly lower degree</td>
</tr>
<tr>
<td>Early majority (34%)</td>
<td>- Exhibit a deliberate willingness in adopting innovations</td>
</tr>
<tr>
<td></td>
<td>- Do not want to be the last to adopt but do not want to be the first to adopt either</td>
</tr>
<tr>
<td>Late majority (34%)</td>
<td>- Are skeptical about innovations</td>
</tr>
<tr>
<td></td>
<td>- Adopt a new innovation when it becomes an established standard</td>
</tr>
<tr>
<td></td>
<td>- Will not adopt unless they are comfortable with the ability to handle the technology</td>
</tr>
<tr>
<td>Laggards (16%)</td>
<td>- Are cautious about innovations</td>
</tr>
<tr>
<td></td>
<td>- Adopt when it becomes necessity</td>
</tr>
<tr>
<td></td>
<td>- Have less knowledge and little experience with innovations</td>
</tr>
</tbody>
</table>

Figure 1. Categories of adoption and Adopter characteristics. Rogers (2003)
In the literature about diffusion of innovation Rogers’ (2003) categorization is widely used and will be used in this research. There are five adopter segments in the diffusion of innovation which can also be found in figure 2; Innovators, Early adopters, Early majority, Late majority, Laggards.

![Adoption curve by Rogers (2003)](image)

Rogers (1962) has proposed an S-curve (see figure 2) for the adoption of new innovations, the innovators form just 2.5% of the total market. In this regard we could say the innovation of the Electric car is still in its early stages, the people who are using electric cars right now are the innovators and early adopters. The second group the Early Adopters are also regarded as Opinion leaders by Rogers (2003) (see also figure 2), this latter group is discussed in more depth later as it is an important group for the diffusion of innovation (Rogers, 2003).

### 2.4. Perceived Attributes of Innovation

The first factor which influences the diffusion of innovation is the Perceived Attributes of Innovation. Rogers (2003) has found five attributes of an innovation which influence its rate of adoption. These attributes are aspects which make the innovation special or different from the already existing products on the market. Rogers (2003) has found that five attributes are the key attributes for a fast adoption. The five perceived attributes of innovation, has seen lots of attention by scholars and the attributes are well defined and consistent throughout the field of research (Ostlund, 1974). In the following section all attributes will be discussed.

*Relative Advantage* is the degree to which an innovation is perceived as being better than its precursor. To which extent and in what ways is the innovation better than products already available on the market. Relative Advantage can be measured in economic terms, but social prestige, convenience and satisfaction are also important factors. It is important that the individual perceives the innovation as advantageous (Rogers, 2003).
*Compatibility* is the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters. Is there room for the new innovation in the existing infrastructure? Is there a need for this product, or can it fill in any gaps which are not filled with the current product. If the product is not compatible with current values, needs etc. the adoption process will be relatively slow (Rogers, 2003).

*Complexity* is the degree to which an innovation is perceived as being difficult to use. An innovation which is difficult to use will not be adopted by the majority of people. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills (Rogers, 2003). In this research Complexity will be researched in terms of ease of use.

*Observerability* is the degree to which the results of an innovation are observable to others. Can the new innovation be observed, because when people cannot see the innovation they can not adopt to it. Visibility can stimulate peer discussion of a new idea among friends and neighbours of the adopter (Rogers, 2003).

*Trialability* is the degree to which an innovation may be experimented with before adoption. If there is a new product people will want to try it out to see what it is worth. If it is not possible to try it out for themselves they will be more unlikely to adopt it. An innovation that is triable has less uncertainty for the potential adopter as it is possible to learn by doing (Rogers, 2003).

The attributes as described above are important for a fast adoption according to Rogers (1983), and this has also been empirically tested by several scholars (Agarwal and Prasad, 1997, Moore and Benbasat, 1991, Heri and Mosler, 2008 and Tornatzky and Klein, 1982). The research of Tornatzky and Klein (1982) has found a positive relation of compatibility and relative advantage to the adoption of innovation (p<0.05). For the other three attributes this research could not find a significant relation. Agarwal and Prasad (1997) found relative advantage, compatibility, observerability, and trialability to be predictors for adoption. Ease of use, or complexity, were not found as a significant predictor for adoption behaviour in the study by Agarwal and Prasad (1997), this is contrary to what Moore and Benbasat (1991) have found. They found that all factors had were predictors for adoption of innovation. Moore and Benbasat (1991) made an adjustment in their research by splitting the Observerability in result demonstrability, “the tangibility of the results of using an innovation” (Moore and Benbasat, 1991, p. 203) and visibility, the extent to which potential adopters see the innovation as being visible in the adoption context. The last adjustment has been adopted by Agarwal and Prasad (1997) as well.

In the current research we stick to the five attributes of Rogers, however the addition of Moore and Benbasat has had an effect on the construction of the questionnaire in a later stage. While some research has shown no significant relation between a few characteristics and the adoption of innovation we will in this research stick to the definition of Rogers (1983) and test all five attributes.
Tornatzky and Klein (1982) emphasized the importance of a good definition of the attributes, because for example relative advantage is an ambiguous term. This was recognized by Rogers (2003) as well who emphasized that specific ways in which the five attributes of the innovation are expressed differ in each study and that these attributes should therefore be uniquely created afresh in each investigation in preference to utilizing existing scales borrowed from previous investigations. In the current research we therefore make use of validated questions belonging to the different constructs, to be sure that we measure what we want.

H1
Relative advantage is positively related to the adoption of the electric car.

H2
Compatibility is positively related to the adoption of the electric car

H3
Complexity (ease of use) is positively related to the adoption of the electric car

H4
Trialability is positively related to the adoption of the electric car

H5
Observerability is positively related to the adoption of the electric car

2.5. Institutional pressures to adopt electric car

Institutional theory also provides cues as to why actors adopt new products. Institutional theory suggests that organizations are influenced by external sources such as state, or sometimes from inside the organization itself (Zucker, 1987). Institutional theory is characterized by three processes: Coercive, Normative and Mimetic processes (DiMaggio and Powell, 1983; Zucker, 1987). Coercive processes result from both formal and in-formal pressures exerted on organizations by other organizations upon which they are de-pendent and by cultural expectations in the society within which organizations function (DiMaggio and Powell, 1983). An example of such a pressure is regulation by governments.

Mimetic processes are driven by uncertainty; organizations tend to model themselves after similar organizations in their field that they perceive to be more legitimate or successful (DiMaggio and Powell, 1983). Organizations copy other organizations because they perceive the other organization as
successful, however there is no concrete evidence that the adopted models enhance efficiency (DiMaggio and Powell, 1983).

_DiMaggio and Powell (1983)_, Normative Processes stem primarily from professionalization. It is the collective struggle of members of an occupation to define the conditions and methods of their work, to control "the production of producers". Professionals must compromise with nonprofessional clients, bosses, or regulators (DiMaggio and Powell, 1983). In other words normative processes are forces that exist within a certain profession, for example knowledge developed at universities considering a certain profession. People performing that profession need to keep up with the latest knowledge developments in order to stay in business.

This typology by Dimaggio and Powell (1983) is an analytic one: the types are not always empirically distinct. While the three types intermingle in empirical setting, they tend to derive from different conditions and may lead to different outcomes (Dimaggio and Powell, 1983). The typology is directed towards the changes within an organization and while widely used it is not directly applicable to this research. Research from Muller and Kolk (2010) and Bansal and Roth (2000) give further grip to the different pressures and are therefore adopted for this research.

Pressures from outside the individual are seen as extrinsic drivers (Muller and Kolk, 2010, Bansal and Roth, 2000). Pressures may arise through, for example, agitation by specific stakeholder groups, competitive pressures arising from the market, or regulatory pressures stemming from government policymaking for example environmental legislation (Muller and Kolk, 2010). The extrinsic pressure is seen as reward-induced behaviour and is distinct from intrinsic drivers, or moral behaviour (Muller and Kolk, 2010).

Derived from Bansal and Roth (2000) there are three motivations to adopt a “green” innovation; _Competitiveness, Legitimation and Social responsibility_. These three motivations are in line with the findings of Muller and Kolk (2010). _Competitiveness_ is described by Bansal and Roth (2000) as the potential for ecological responsiveness to improve long-term profitability. Competitive advantage is for example: higher profits, process intensification, larger market share, lower costs, and differentiation. By adopting a green innovation a company for example can improve its image as it shows the environmental responsibility of that firm and thereby improve their competitive advantage. Before firms were competing on price and quality and are now competing more on the environmental issues, as well (Bansal and Roth, 2000).

A motive of _legitimation_ refers to the desire of a firm to improve the appropriateness of its actions within an established set of regulations, norms, values, or beliefs, for long-term sustainability as well as avoiding fines and penalties, lessening risks.
Social responsibility is viewed as a motivation that stems from the concern that a firm has for its social obligations and values. Feel-good factors, employee morale, individual satisfaction. This is an intrinsic driver.

H6
Competitiveness is positively related to the adoption of the electric car

H7
Legitimation is positively related to the adoption of the electric car

H8
Social responsibility is positively related to the adoption of the electric car

2.6. Social identity as a motive adopting an electric car

According to Rogers (2003) the most innovative member of a social system is often perceived as a deviant of the system and therefore its ability to persuade others is limited. There are members of the system who are seen as opinion leaders; they provide information and advice about innovation to many in the system (Rogers, 2003). Opinion leaders are different from their followers on three points, they (1) are more exposed to all forms of external communication, have (2) a somewhat higher social status and (3) are more innovative (Rogers, 2003). The most important characteristic of the Opinion leader is the unique and influential position in their social system (Rogers, 2003). The last characteristic means that opinion leaders can influence other individuals in a social system, and thereby they are influential in the adoption process. Also Opinion Leaders are linked to the early adopters, see figure 2. In other words early adopters are in most cases opinion leaders. If that is true the current research should include many opinion leaders. Therefore this research will include several items considering the social identity of consumers.

Brewer (1991) suggests there are two other different social identities besides the opinion leader namely; the need for distinctiveness and the need for assimilation.

The need for distinctiveness is concerned with personal identity that differentiates one individual from others within a given social context (Brewer, 1991). The need for assimilation is concerned with personal identity where other individuals need to feel “the same” as the other group members (Brewer, 1991). Both characteristics do not exclude one another, so a person can have some need for distinctiveness as well as some need for assimilation.

According to Brewer (1991) need for assimilation, is fulfilled within large groups while need for distinctiveness is fulfilled within small groups. In this research we suggest three different social
identities, opinion leaders, people with a need for distinctiveness and people with a need for assimilation.

This research will differentiate between these social identities. Rogers (2003) marked early adopters as opinion leaders, we therefore suggest that the other social identities can also be linked to different categories of adoption (see figure 1). In this research it is suggested that innovators, the first people to adopt an innovation, have a need for distinctiveness. Early adopters can be seen as opinion leaders (following Rogers, 2003) and the early- and late majority consists of people with a need for assimilation. As Brewer (1991) suggests different social identities can exist next to each other, the results can show overlap between different groups. Further this research will not include early- and late majority as the innovation does not exist long enough. We expect to find most participants to be opinion leaders and people with a need for distinctiveness.

H9

Electric car users are more opinion leaders than potential users

H10

Electric car users are more likely to have a need for distinctiveness than potential users

H11

There is a negative relation between need for assimilation and adoption of the electric car

2.7. Image as a motive to buy an electric car

The importance of the social system has been made clear in the description of diffusion of innovation. The different roles of people in the social system are evident. To know how to influence people to buy a product it is important why people buy products. Sheth Newman and Gross (1991) found multiple values influencing consumer behaviour. Functional value: the perceived characteristics or attributes such as reliability, durability and price, this is in line with the perceived characteristics of Rogers (2003). The other factor influencing buying behaviour of consumers is Social Value: the association of a product, mostly highly visible products, within specific social groups. For examples associations of a certain product with positively or negatively stereotyped demographic, socioeconomic, and cultural-ethnic groups. In other words it can be seen as the image which a certain product entails; the association with specific groups, which gives the owner of a product a certain status.

In this research social value is captured within the construct Image. The importance of Image is recognized by others, among them Rogers (2003) who defined it as the degree to which the use of an innovation is perceived to enhance one’s image or status in one’s social system. Rogers (2003) argued that Image was already included as an aspect of relative advantage. In other research however Image
was seen as a separate construct (Moore and Benbasat, 1991, Agarwal and Prasad, 1997, Teo and Pok, 2003, Steg, 2005, Wilcox, Kim and Sen 2009). Rogers (2003) also argued that one of the most important motivations for almost all individuals to adopt an innovation is the desire to gain social status. Rogers thereby emphasizes the importance of Image in the adoption of innovation.

Teo and Pok (2003) found significant effect of Image on the adoption behaviour of consumers. The effect of Image was larger than some of Rogers’ perceived characteristics. In other research however Image did not show a significant effect on adoption behaviour (Moore and Bensabat, 1991, Agarwal and Prasad, 1997). This difference could be due to the product which is studied, or the reason why a product is bought. Lieven et al. (2011) have found that the usage of the car is important in the decision to buy a car: is it for transporting a family, driving long distances or as a leisure car. In this research a distinction will be made between private use and business use. According to Steg (2005) the car seems to be a status symbol for many people, they can express themselves by means of their car. Because Image is used in other research as a separate factor, and because it is showed by Steg (2005) that a car is a status symbol this include image as a driver in the decision to adopt an innovation.

H12

Image is positively related to the adoption of electric cars

2.8. Marketing influences on adoption

If people talk about marketing one of the first things that come up their minds is advertisement, because that is one of the most visible forms of marketing. Here we discuss marketing from an academic perspective and we start by, what we think, is on of the founders of the marketing literature Philip Kotler.

Marketing is the task of finding and stimulating buyers for the firms output (Kotler, 1969), it involves product development, pricing, distribution and communication. In progressive firms it also involves continuous attention to the changing needs. Organizations are concerned about their product in the eyes of certain consumers and are seeking to find tools for furthering their acceptance (Kotler, 1969). Here the link with the adoption literature is evident, because with marketing organizations try to make potential adopters push to adopt the new product.

Marketing has shown effective for creating superior customer performance (satisfied and loyal customers who are relatively efficient to serve). Secondly, by creating superior market performance (sales volume and market share) through meeting customer requirements effectively (Hooley, Greenley, Cadogan Fahy 2005). Further Hooley et al. (2005) found that marketing is useful to create satisfied and loyal customers by well-developed customer-linking capabilities, such as the ability to identify customer requirements, the ability to create, maintain, and enhance customer relationships,
together with marketing innovation capabilities such as the ability to launch successful new products and services.

2.8.1. Two forms of marketing

As was have outlined people are influenced by other people in their social system. It was acknowledged that opinion leaders in particular have a great influence on other people in their social system and thereby can influence the behaviour of others to adopt a new innovation (Rogers, 2003, Timmor and Katz-Navon, 2008). However the people of marketing departments will think their marketing activities will also influence other people.

The Bass Model (Bass, 1969) assumes that potential adopters of an innovation are influenced by two means of communication: Mass Media and Word of Mouth. In the Bass Model mass-media communication is considered to be external influence and word of mouth is considered to be internal influence (see figure 3). Word of Mouth is a way of communication between consumers of information about a brand, product, an organization or a service (Brown Barry, Dacin and Gunst, 2005). In figure 3 the Bass Model (derived from Mahajan et al. 1990) is presented. In this model the first group of buyers, by Rogers identified as the innovators, is mainly influenced by external factors. At the second group of buyers, the largest group of buyers, the adoption behaviour is to a large extent influenced by internal influences, i.e. Word of Mouth.

![Adoption model derived from Mahajan et al. (1990)](image)

Figure 3. Adoption model derived from Mahajan et al. (1990)

Trusov, Bucklin and Pauwels. (2009) in their empirical study have found that the elasticity, how changing on economic variable affects others, of WOM is 20 times higher than the elasticity for marketing events and 30 times higher than the elasticity for media appearances. Therefore Trusov et al. (2009) advocate WOM as is among the most effective marketing communication strategies. Also
Brown et al. (2005) acknowledge the importance of WOM and found in the existing literature that researchers state that it is the primary driver of diffusion of new innovations.

Because the Bass Model is a widely used model and Word of Mouth is recognized as one of the most important drivers for diffusion of innovation, this research takes WOM and advertising as the two most important marketing factors influencing diffusion of innovation. The Bass model also suggests that the first group of adopters is only influenced by external influences, see figure 3. This can be easily explained because for the first group of adopters there are no people to receive WOM from, because they are the first. Therefore the external influences are more important in the first phase of the adoption and WOM will have little influence on adoption.

For WOM we study the information received via WOM as well as the willingness to give positive WOM about the electric car. The latter is especially important for the further diffusion of the innovation. As WOM is an important factor for the diffusion, the willingness to give positive WOM is of great importance for the further diffusion of the electric car (Rogers, 2003).

H13
*Advertisement is positively related to adoption of the electric car*

H14a
*Word of mouth is negatively related to the adoption of the electric car*

H14b
*Adopters of electric cars are willing to give positive WOM*

### 2.9. Combined theory

The leading theory in this research is the Perceived Attributes of Innovation by Rogers (2003) as this is also a well recognized theory by innovation studies. Arising from the reviewed literature, there are more drivers which influence the adoption behaviour. In figure 4 there is a visual explanation of the model used in this research.

The perceived attributes of Innovation are empirically tested and suggested to have an influence on the adoption of new innovations.

Institutional pressure is suggested to have an influence on organizations behaviour. In this research it is suggested that all three factors of institutional pressure will have a positive relation to adoption.

Rogers (2003) suggested that the first buyers of an innovation are likely to be opinion leaders. Together with people with a need for assimilation and people with a need for distinctiveness there are three social identities distinguished. It is suggested that the adopters will be opinion leaders and/or
people with a need for distinctiveness. People with a need for assimilation are not likely to be the first adopters and therefore it is expected, that need for assimilation has a negative relation to adoption.

Image has an important influence on the adoption behaviour, as is suggested by Rogers (2003). Therefore it is suggested that adopters of the electric car will be influenced by the Image the product gives them, therefore a positive relation between image and adoption is likely to be found.

Finally marketing has an effect on the adoption of the electric car. It is suggested that, because it is the first group of adopters, advertisements will have a positive relation with adoption and word-of-mouth will have a negative relation.

In figure 4 the model for this research is presented. All different factors are clustered by their overarching theory, but will be tested separately. This research suggests that the combined model is better in explaining adoption behaviour that the model of Perceived Characteristics by Rogers (2003).
3. Methodology

The topic of diffusion of innovation has been studied in the past and there is a lot known about the process of diffusion. This knowledge can be helpful for the current research. However because the electric car is a relatively new product some exploratory fieldwork can provide new insights (Saunders, Lewis, and Thornhill 2009). Therefore some exploratory interviews are planned with entrepreneurs in the automotive industry involved in the electric cars. There will be no recordings of the interviews, but mainly for exploring the market by the researcher.

For the empirical research a quantitative method will be most useful, to be able to research a larger group of first users (Saunders et al., 2009). Self-administered questionnaires can be administered electronically and can therefore have a large sample size and take less time to complete than other types of questionnaires (Saunders et al., 2009).

3.1. Participants

The survey will be distributed via The New Motion, a Dutch company which promotes electric mobility and provides customers, or possible customers with information. Furthermore they provide a solution to charge your electric car, either by presenting the nearest charging point, or by installing an own charging point at home. The New Motion co-operates with most car manufacturers which sell electric cars in The Netherlands and therefore have two third of the owners of electric cars as their clients (Approximately 3000 electric car owners). The New Motion is a service provider for many different car brands, all different kinds of electric cars will be included in this research. No bias will exist concerning the type of electric vehicle. Plug-in hybrid electric vehicles are also taken into account but will be considered as a separate group while the researcher suggests there will be a difference in use of the PEV (pure electric) and the PHEV (plug-in hybrid electric).

3.2. Study design

Length of the questionnaire needs to be between four and eight pages to be acceptable for self-administered questionnaires. (Saunders et al., 2009). Adopting questions from previous research can allow reliability to be assessed and is also more efficient than developing own questions. (Saunders et al., 2009). However, one must be aware there are several bad questions in circulation so the questions have to be assessed carefully. Also considerable care need to be taken with translating questions as the meaning has to be the same to all respondents.

For this research the choice is to use rating questions because they are an easy way to collect opinion data (Saunders et al., 2009). Most questions in the questionnaire are answered on a five-point Likert scale: Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree.
3.3. Definition of the constructs

Perceived characteristics innovation
The definitions of the Perceived Characteristics of Innovation are based on Rogers’ (1983) definitions.

Relative Advantage: the degree to which an innovation is perceived as being better than its precursor

Compatibility: the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters

Complexity: the degree to which an innovation is perceived as being difficult to use

Observerability: the degree to which the results of an innovation are observable to others

Trialability: the degree to which an innovation may be experimented with before adoption.

Image
The study of Steg (2005) was conducted among car users, and found that car users are more likely to buy a car for its Symbolic value (or perceived image) instead of its characteristics. Rogers (1983) also emphasized the importance of Image for the adoption of technology. He defined Image as the degree to which the use of an innovation is perceived to enhance one’s image or status in one’s social system.

WOM
According to Brown et al. (2005) the basic idea behind WOM is that information about products, services, stores, companies, and so on can spread from one consumer to another. In its broadest sense WOM communication includes any information about a target object (e.g. company or brand) transferred from one individual to another either in person or via some communication medium.

Institutional Pressure
The external pressure on an individual to make decisions is explained by the theory of Institutional Pressure. Derived from Bansal and Roth (2000) there are three motivations to adopt a “green” innovation; Competitiveness, Legitimation, Social responsibility.

Social Identity
In this research three different social identities are recognized. First opinion leaders provide information and advice about innovation to many in the system (Rogers, 2003). Second people with a need for distinctiveness have personal identity that differentiates them from other individuals within a given social context (Brewer, 1991). People with a need for assimilation want to feel “the same” as the other group members (Brewer, 1991).
3.4. Constructions of the items

The Questionnaire was composed of existing questions used in other researches. A table with the used constructs and questions, with the references can be found in Appendix 2 for the user group and Appendix 3 for the potential user group. The survey is in Dutch because the customers of The New Motion are Dutch. Most questions from the literature were in English and had to be translated into Dutch, this has been done with the most care, because mistakes in the translation of questions can change the meaning of them (Saunders et al. 2009).

3.5. Constructs

Perceived Attributes of Innovation
At first questions for the Perceived Attributes of Innovation (Rogers, 1983) were selected. Because Rogers’ Attributes are widely used in research many usable questions were found. To produce a reliable Questionnaire questions were selected by comparing the Crombach's Alpha and selecting those questions which have the highest Crombach's Alpha. The research of Moore and Bensabat (1991) and Agarwal and Prasad (1997) were found to have many similar questions also used in modern research such as Park and Chen (2007). Because the Cronbach’s Alpha’s of the questions were high, these questions were used in the research. To make the questionnaire applicable for electric car user some questions were composed at hand of qualitative research of Gerpott (2011). In Gerpott (2011) users of electric cars were interviewed and their findings are used to compose questions specific for electric car users.

Institutional pressure
Institutional pressure is measured with four items answered on a five point Likert-scale. The questions are derived from Bansal and Roth (2000) and Muller and Kolk (2010) and adapted for research on consumers instead of businesses. Due to limitations to the length of the scale Competitiveness and Legitimation are measured by one item, Social responsibility is measured by two items.

Social identity
The items for social identity from Timmor and Katz-Navon (2008) are translated and adapted to this particular research. Due to restrictions to the length of the questionnaire three items per construct are selected which seemed to be most appropriate. Therefore the internal reliability can be different from the original research by Timmor and Katz-Navon (2008).

Image
The items for this scale are adapted from different research because no scale from single research seemed applicable for this research. The first item was used by Agarwal and Prasad (1997, Steg (2005)
and Wilcox et al. (2009). The second item was derived from Wilcox et al. (2009). The third item was derived from Teo and Pok (2003). All items were adapted for this particular research by including the product in the question.

WOM

For word-of-mouth one item from Maxham (2011) is used. The items from Maxham (2011) had a high Cronbach’s -Alpha, however closer examination revealed that they were all about the same. Because we are only interested if people are willing to give positive WOM, this is measured by one item.

3.6. Construction of the Questionnaire

For this research an online survey was the best option, because it is easy to complete and easy to send to the large customer base of The New Motion. The survey was conducted via surveymonkey.com, an online survey tool. The data is collected by this tool and compressed into an excel sheet, which can be transformed to use in SPSS for analysis. The Questionnaire was constructed online and could be completed by participants following a web link. This method of data collection was preferred for several reasons (Saunders et al, 2009). First the online questionnaire is easy to complete by participants, which increases the likelihood for people to cooperate. Second the online questionnaire can be completed at any time the participant wants. Finally it saves time because the data is collected by the survey tool and digital available.

3.7. Procedures

The final questionnaire contained 64 questions, including questions for The New Motion’s own research. The total amount of questions used in this research was 47; these were distributed on six pages and took about 5-8 minutes to complete. Because there were legal problems at The New Motion in sending the questionnaire to all electric car users the actual number of receivers of the questionnaire was 174. The Questionnaire was online from October 26th 2012 until the 9th of November 2012. The questionnaire was sent via mail to 174 electric car users on October 26th of 2012, no follow up was sent due to the same legal problems, and this led to the decision to send an additional questionnaire for potential users.

The additional questionnaire for potential users included 34 questions distributed on 4 pages, this questionnaire and took 2-4 minutes to complete. This adapted questionnaires consisted of the same questions as the original questionnaire, but with little adaptations in formulation (the Questionnaire to potential users can be found in appendix 3). The additional Questionnaire for potential electric car users was online from 1st of November 2012 until the 9th of November 2012. The questionnaire was promoted via the website of The New Motion.
3.8. Analysis

Because a second questionnaire was sent to potential users of electric cars there is a dependent variable; user or non user. The influences of independent variables on the dependent variable can be explained via regression analysis (Andy Field, 2005). Further descriptive statistics (Andy Field, 2005) are used to analyze the data from the electric car users to identify which reasons were important to buy an electric car.
4. Results

Most of the variables measured in this research are ordinal because they measure if an attribute is present and not in what extent. The five point Likert-scale which is used in this research creates ordinal results (Field, 20005).

According to Field (2005) the data for the dependent variable, user or nonuser, is a categorical dichotomy; i.e. two categories user or potential user (just two options which cannot be both true). This will have some implications on the type of statistical tests which can be performed.

4.1. Sample Population

The questionnaire was send via email to 164 customers of The New Motion. The response after one week was just 60. Because a follow up could not be sent the decision was to send the questionnaire to potential customers as well. This was agreed with The New Motion and an adapted questionnaire (which can be found in appendix 2) was promoted on the website of The New Motion. Via social media the questionnaire was promoted as well and the response after one week was 43 (N=43). With the additional response a distinction can be made between users and potential users of electric vehicles. The questionnaire was promoted in such way that only people who have affinity with electric cars would be asked to fill in the questionnaire. After two weeks the response for the original questionnaire was 64 and the response for potential owners was 43 which make the total number of participants 107 (N=107). Response rate for the users group was (64/174)*100 = 37%.

Gender did not show much variety with 96 male (89,7%) versus 11 female (10,3%) participants. A significant difference was found in gender between owner (woman = 2, man = 62) and potential owner (woman = 9, man = 24). There were relatively more females in the potential owner group ($X^2 (1) = 8.84, p < .01$). The owners and potential owners also differ in age. Owners are older (Mean = 48.38) than potential owners (Mean =39.44) ($F(2,105) = 4.645, p< 0.05$).

From the potential owners (N=43) 20 people (46.5%) indicated they have the intention to buy an electric car.

In figure 5 the distribution of the different cars (N=64) is shown. More than half of the electric car users own an Opel Ampera Plug-in Hybrid, the second largest group is the Nissan Leaf owners and the third largest group is Toyota Prius Plug-in Hybrid drivers. A small percentage drives a Tesla Roadster (high value sports car) and the ‘other’ group drives four different cars; Volkswagen Beatle (own conversion), Volvo (type not indicated), Fisker Karma (high value luxury Plug-in car) and a Renault Fluence.
In figure 6 the distribution of number of electric years of driving (N=64) is displayed. In this distribution it is obvious that the largest group is the group of zero to one year of ownership. The other groups are relatively small in comparison with the first group. This can also partly explain the large group of Opel Ampera drivers, because this car is available from this year. The New Motion already indicated that Opel Ampera drivers were a fast growing group of their customers.

The distribution of profession of owners (N=64) is displayed in figure 7. Most electric drivers have a high management function (43,8%), are professionals, e.g. Lawyer, Accountant etc. (32,8%) or Engineers (14,1%). Further there is a small group of Marketing / Sales (7,8%) and Administrative personnel (1,6%). Excluded are Skilled / craft trade, Student and labourer because there were none in this population.
In Figure 8 the company size of the group of owners (N=64) is shown. The majority of owners work in a small company with 0-50 employees.

The mean amount of kilometres per week was Mean: 567.97 (SD: 307.22). The large Standard Deviation can be explained by the fact that some people are driving a full electric vehicle with a limited range and others are driving a Plug-in Hybrid vehicle.

Another interesting finding is the difference in Range provided by the manufacturer and perceived range. There was a significant difference between Range and Perceived range (p<.0001). This could be important for the owners of full electric vehicles, because it is not easy to recharge quickly.
The distribution of the different variables is not normal. This is investigated at hand of a blog plot of all different variables, but none of the plots showed a normal distribution. Further the descriptive statistics were studied and Zskewness and Zkurtosis calculated (discriptives can be found in the appendix). The Z-scores differed all from zero. Finally the Kolmogorov-Smirnov test also showed for all variables a significant (p<0.05) non-normal distribution. Because the data is not normal distributed non parametric tests have to be used.

4.2. Factor analysis

A factor analysis was conducted in order to understand the relations between variables. A factor analysis can also cluster variables in order to check if the items of this research correspond within a construct (Field, 2005). In this research a factor analysis is used to analyze the different items (variables) and to test if the variables correlate to each other. Before conducting any analysis item Complex3 (the electric car is frustrating to use) was deleted because data was missing for potential users.

In this research a combination of items from different research are combined to test the constructs. To conduct a factor analysis sample size should at least be 100 (N=100), for this research N=107, which is more than 100. However the reliability of the factor analysis rises with sample size (Field, 2005), and a sample size of 100 is perceived as poor. Another rule of thumb is to have at least 5-10 participants per variable, in this research there are 29 variables which means at least 150 participants would be needed. The questionnaire was designed for a large sample, but was eventually not conducted among a large population.

An alternative is to use the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) to test the assumption that there are significant correlations between the items. The results are presented in table 1. The value of p < 0.05 and the sampling adequacy is above 0.5 (Field, 2005), so factor analysis is appropriate for these data.

Table 1. KMO and Barlett’s Test

<table>
<thead>
<tr>
<th>KMO and Bartlett's Test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</td>
<td>.691</td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>859.573</td>
</tr>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td>df</td>
</tr>
<tr>
<td></td>
<td>253</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
</tr>
<tr>
<td></td>
<td>.000</td>
</tr>
</tbody>
</table>

KMO can be calculated for all variables, these should also be above 0.5 for each variable (Field, 2005). The KMO test revealed that COMPat1, TRIAL1, OBSER1, OBSER2 and NEAS1 did not
show enough relation to the other variables and therefore are excluded from the research. Because OBSER1 and OBSER2 were deleted the construct observeability was not included in the model.

Next the factor analysis revealed that IM3 did not show relation to IM1 and IM2. The same is true for RELAD2 which did not relate to RELAD1 and RELAD3. A critical look at the questionnaire showed a difference in type of questions for both IM3 and RELAD2, therefore these two items were also deleted from the research.

4.3. Instrument reliability

In order to perform the analysis new variables needed to be formed. For each construct the item scores were added up and divided by the number of items in order to calculate the mean score for every construct.

To check the reliability of the instrument the Cronbach’s Alpha is calculated for the different constructs. In general a value of .7 - .8 is an acceptable value for Cronbach’s Alpha, however also values below .7 can be realistic (Field, 2005). The reliability tends to rise with the number of items per scale, a scale with a large number of items, but a low correlation between the items can still have a high Cronbach’s Alpha (Field, 2005). The factor analysis revealed some items which did not relate to other items in the questionnaire and were therefore deleted. As a result several constructs are explained by one item and therefore have no Cronbach’s Alpha. Trialability, Observerability, Competitiveness, Legitimation, Marketing effects is left out of the table because there is only one item per construct. The constructs which are explained by more than one item are displayed in table 1.

Table 1. Cronbach’s Alpha overview N=104

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s Alpha</th>
<th>N=107</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>.774</td>
<td></td>
</tr>
<tr>
<td>Compatibility</td>
<td>.718</td>
<td>N=107</td>
</tr>
<tr>
<td>Complexity</td>
<td>.674</td>
<td>N=107</td>
</tr>
<tr>
<td>Image</td>
<td>.761</td>
<td>N=107</td>
</tr>
<tr>
<td>Social responsibility</td>
<td>.621</td>
<td>N=107</td>
</tr>
<tr>
<td>Need for assimilation</td>
<td>.827</td>
<td>N=107</td>
</tr>
<tr>
<td>Need for distinctiveness</td>
<td>.535</td>
<td>N=107</td>
</tr>
<tr>
<td>Opinion Leader</td>
<td>.816</td>
<td>N=107</td>
</tr>
</tbody>
</table>

Social responsibility ($\alpha = .621$) and Need for Distinctiveness ($\alpha = .535$) have a low Cronbach’s Alpha and therefore need some attention. For Social responsibility item IP4 is deleted, because item IP3 is perceived to cover Social responsibility best. For Need for Distinctiveness the Cronbach’s Alpha does not exceed .7 by deleting one item and therefore will be explained by one item as well. NEDI2 is perceived to cover Need for Distinctiveness best.
4.4. Testing of hypothesis

In order to test the hypothesis a Regression analysis is most appropriate, because it can predict relationships between variables. Because the data of the dependent variable is a categorical dichotomy Logistic Regression analysis is used to model the relationship between variables (Field, 2005). The level of significance (p value) of each proposed relationship, exp b and percentage of variance explained (adjusted R²) will be evaluated. The exp b is crucial in the interpretation of logistic regression, because it is an indicator of change in odds resulting from a unit change in the predictor (Field, 2005). If exp b is greater than 1 it indicates that when the predictor (independent variable) increases the odds of the outcome occurring increases. Conversely, a value less than 1 indicates that as the predictor increases the odds of the outcome occurring decrease. For this particular research it means that when exp b for one construct is greater than 1 it indicates that if the score on that construct increases the likelihood of that person adopting an electric car increases. And for a value less than one for exp b, it means if the score increases the likelihood of adopting the electric car decreases.

To ensure that the model which is tested fits the data a Hosmer & Lemeshow’s goodness-of-fit test is conducted. If the value for the Hosmer & Lemeshow’s test is not significant it is indicative that the model is predicting the real-world data fairly well (Field, 2005). In this research the value for the Hosmer & Lemeshow’s test was 12.455 and the significance value was .132 (non-significant) which indicates the model is predicting the real world data (see table 2). Further the model is correctly classifying 85% of the cases.

Table 2. Hosmer and Lemeshow Test

<table>
<thead>
<tr>
<th>Step</th>
<th>Chi-square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.455</td>
<td>8</td>
<td>.132</td>
</tr>
</tbody>
</table>

Because the Hosmer and Lemeshow Test showed non significant results the data is appropriate for further analysis by logistic regression. In table 3 the results of the logistic regression are presented. In the logistic regression analysis all hypothesis (H1 – H14a) but two are tested. Observerability was excluded from the analysis because both items did not correlate to the other variables in the model (see factor analysis). Hypothesis H14b will be tested in paragraph 4.8.
The Logistic Regression analysis provides the Wald statistics which indicate that Compatibility (p<0.05), Complexity (p<0.05), Trialability (p<0.01), Need for Assimilation (p<0.05), Image (p<0.05) and Word of Mouth (p<0.01) significantly predict adoption (see table 3). The other constructs are not significantly related to the adoption behaviour.

Compatibility, Complexity, Image and Competitiveness are related in such way that if the scores would go up, the probability that someone adopts also rises, because the Exp (B)>1. For Trialability, Need for Assimilation and Word of Mouth the relation is inverted, so if the score would rise the probability to adopt would drop, because Exp (B) <1. For all variables the confidence interval does not limit the generalizability of these findings, because both Lower and Upper values are either <1 or >1.

The R-statistic is a measure for the partial correlation between the outcome variable and each of the predictor variables, in other words it is the amount of variance explained by the model (Field, 2005). To calculate the R-statistic or R² the following formula is needed: $R^2 = \frac{\text{Model Chi-square}}{\text{original - 2LL}} = \frac{92.649}{144.185} = 0.64$ which means that the model can account for 64% of the variance in adoption behaviour.
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Sig.</th>
<th>exp $b$</th>
<th>Reject or accept</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H1</strong> Relative advantage is positively related to the adoption of the electric car</td>
<td>.374</td>
<td>.652</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H2</strong> Compatibility is positively related to the adoption of the electric car</td>
<td>.049</td>
<td>4.875</td>
<td>Accept</td>
</tr>
<tr>
<td><strong>H3</strong> Complexity (ease of use) is positively related to the adoption of the electric car</td>
<td>.041</td>
<td>3.641</td>
<td>Accept</td>
</tr>
<tr>
<td><strong>H4</strong> Trialability is positively related to the adoption of the electric car</td>
<td>.000</td>
<td>.076</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H5</strong> Observerability is positively related to the adoption of the electric car</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>H6</strong> Competitiveness (measured as the influence from work to adoption) is positively related to the adoption of the electric car</td>
<td>.367</td>
<td>1.299</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H7</strong> Legitimation (adoption by rules and regulation) is positively related to the adoption of the electric car</td>
<td>.197</td>
<td>.613</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H8</strong> Social responsibility (care about the environment) is positively related to the adoption of the electric car</td>
<td>.233</td>
<td>.565</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H9</strong> Electric car users are more opinion leaders than potential users</td>
<td>.576</td>
<td>.614</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H10</strong> Electric car users are more likely to have a need for distinctiveness than potential users</td>
<td>.183</td>
<td>2.408</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H11</strong> There is a negative relation between need for assimilation and adoption of the electric car</td>
<td>.014</td>
<td>.190</td>
<td>Accept</td>
</tr>
<tr>
<td><strong>H12</strong> Image is positively related to the adoption of electric cars</td>
<td>.019</td>
<td>6.977</td>
<td>Accept</td>
</tr>
<tr>
<td><strong>H13</strong> Advertisement is positively related to adoption of the electric car</td>
<td>.686</td>
<td>.834</td>
<td>Reject</td>
</tr>
<tr>
<td><strong>H14a</strong> Word of mouth is negatively related to the adoption of the electric car</td>
<td>.003</td>
<td>.230</td>
<td>Accept</td>
</tr>
</tbody>
</table>
Hypothesis 2, 3, 11, 12 and 14 are accepted (table 4). Trialability showed a significant relation, but in the wrong direction and is therefore rejected. However Trialability is significantly related to adoption. The hypotheses are translated into the model of this research (figure 9). The constructs which relate to the adoption are marked red, the significance level is also shown.

![Adoption Model with significant relations](image)

* significant related to adoption p<0.05
** significant related to adoption p<0.01

Figure 9 Adoption Model with significant relations

The widely used model by Rogers’ is perceived to explain adoption behaviour. In this research it was suggested that the model by Rogers (1962) did not include all pressures influencing adoption behaviour. In order to compare the adoption model proposed in this research, and the adoption model by Rogers (1962) a regression analysis was carried out including only the Perceived attributes of innovation. This analysis revealed that the amount of variance explained by the model was 33% \((R^2 = 0.33)\). This is almost half of the amount of variance explained by the model proposed in this research \((R^2 = 0.66)\). In figure 10 the model by Rogers (1962) is displayed. Complexity and Trialability were the only significant predictors of adoption behaviour in this model. Relative advantage Compatibility and Observerability were not found to significantly explain adoption behaviour.
4.5. Additional Findings

In this section the data will be analyzed by descriptive statistics. The data for the users of electric cars (N=64) is collected via questions asking people for their motives to buy an electric car. These motives will be observed and described in paragraph 4.6. In paragraph 4.7 some additional findings will be presented.

4.6. Why did people buy an electric car

In table 5 the most important reasons for people to buy, or not to buy, an electric car are displayed. All questions are scaled from 1-5 points, 1 = strongly disagree, 2 = disagree, 3 = nor agree nor disagree, 4 = agree, 5 = strongly agree. The mean scores also vary from 1 to 5, 1 suggesting strong disagreement, 5 suggesting strong agreement. There are some reverse scaled items, those have the opposite scale, 1 = strongly agree, 2 = agree etc. The results in table 5 are ordered from high to low Mean values. The results show that enhanced image by driving an electric car and the electric car being better for the environment were indicated as important factors for adoption. The results will be explained in the following paragraphs.
Table 5. Why did people buy an electric car

<table>
<thead>
<tr>
<th>Item Code</th>
<th>Item</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM1</td>
<td>I enjoy it when people know I am driving an electric car</td>
<td>4.42</td>
<td>4.00</td>
<td>5.00</td>
<td>0.612</td>
<td>0.375</td>
</tr>
<tr>
<td>IP4</td>
<td>I am driving an electric car because it is better for the environment</td>
<td>4.13</td>
<td>4.00</td>
<td>4.00</td>
<td>0.934</td>
<td>0.873</td>
</tr>
<tr>
<td>COMPAT1</td>
<td>The electric car suits my needs for personal transport</td>
<td>3.98</td>
<td>4.00</td>
<td>4.00</td>
<td>0.968</td>
<td>0.936</td>
</tr>
<tr>
<td>IM2</td>
<td>Owning an electric car is good for my image</td>
<td>3.88</td>
<td>4.00</td>
<td>4.00</td>
<td>0.864</td>
<td>0.746</td>
</tr>
<tr>
<td>NEOP1</td>
<td>People whom I know rely on my recommendations when buying new products</td>
<td>3.88</td>
<td>4.00</td>
<td>4.00</td>
<td>0.549</td>
<td>0.302</td>
</tr>
<tr>
<td>RELAD2</td>
<td>I think the driveability of an electric car is better than from traditional cars</td>
<td>3.72</td>
<td>4.00</td>
<td>5.00</td>
<td>1.215</td>
<td>1.475</td>
</tr>
<tr>
<td>RELAD3</td>
<td>The costs for electric cars are too high (reversed)</td>
<td>3.00</td>
<td>3.00</td>
<td>2.00</td>
<td>1.234</td>
<td>1.524</td>
</tr>
<tr>
<td>IP1</td>
<td>My boss stimulated me to drive electric</td>
<td>2.72</td>
<td>3.00</td>
<td>1.00</td>
<td>1.385</td>
<td>1.92</td>
</tr>
<tr>
<td>IP2</td>
<td>I am driving an electric car as a reaction / anticipation for law and regulations</td>
<td>2.47</td>
<td>2.00</td>
<td>1.00</td>
<td>1.512</td>
<td>2.285</td>
</tr>
<tr>
<td>OBSER2</td>
<td>I see a lot of electric cars around me</td>
<td>2.45</td>
<td>2.00</td>
<td>2.00</td>
<td>0.975</td>
<td>0.950</td>
</tr>
<tr>
<td>COMPAT2</td>
<td>There are plenty of charging points for my electric car</td>
<td>2.31</td>
<td>2.00</td>
<td>2.00</td>
<td>1.167</td>
<td>1.361</td>
</tr>
</tbody>
</table>

4.6.1. Perceived characteristics

Relative advantage was not found to be a significant predictor for adoption. However, electric car users think the driveability of electric cars is better than traditional cars (RELAD2). Mean score for this item was 3.72, but more noticeably a Mode of 5, which is the highest possible. The question if the costs for an electric car are too high was most people (36%) answered with agree (Mode=2, reversed).

While the electric car suits the needs for most people (COMPAT1, Mean = 3.98, Mode = 4), the number of charging points is too little (COMPAT2, Mean = 2.31). This also explains why COMPAT1 and COMPAT2 did not relate to each other.

The visibility of the electric car (OBSER 2), showed a negative mean (Mean = 2.45) and the majority of users answered disagree (Mode = 2) to that question.

4.6.2. Institutional Pressure

The expected influence of institutional pressure was not found in the regression analysis. Electric car users indicated that neither pressure from their boss (IP1, Mean = 2.72) or law and regulations (IP2,
Mean = 2.47), influenced their decision to buy an electric car. However people did indicate that the electric car being better for the environment was a reason to buy one (IP4 Mean = 4, Mode = 4).

4.6.3. Image

Image already showed a significant relation to the adoption of the electric car in the logistic regression analysis. In table 5 it is noticeable that for both image items the scores are high (Mean = 3.88 and Mean = 4.42 respectively). Electric car users thereby indicated that they enjoy it when people know they are driving electric (IM1). Further owning an electric car was marked as ‘good for their image’ (IM2). The variance in answers was relatively low, which means that most people answered about the same which is also evident in Figure 11.

![Figure 11. Response IM1 and IM2](image_url)

4.7. Opinion Leaders

The regression analysis did not show a significant relation to adoption behaviour, however in table 6 the tree questions do show a positive result on the construct Opinion Leader. The results in table 6 show that on average the first users are opinion leaders. The Mean scores are 3.88, 3.39 and 3.41 respectively, the Median for all three items is 4. This convincingly tells us that the electric car users are opinion leaders.

<table>
<thead>
<tr>
<th>Item Code</th>
<th>Item</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEOP1</td>
<td>People whom I know rely on my recommendations when buying new products</td>
<td>3.88</td>
<td>4.00</td>
<td>4.00</td>
<td>0.549</td>
<td>0.302</td>
</tr>
<tr>
<td>NEOP2</td>
<td>People ask for my advise before buying new products</td>
<td>3.39</td>
<td>4.00</td>
<td>4.00</td>
<td>0.847</td>
<td>0.718</td>
</tr>
<tr>
<td>NEOP3</td>
<td>I often convince people to buy products I like</td>
<td>3.41</td>
<td>4.00</td>
<td>4.00</td>
<td>0.938</td>
<td>0.880</td>
</tr>
</tbody>
</table>
## 4.8. Marketing

An addition to the marketing construct a question is asked where users found information about the electric car. This could be an interesting addition for companies to adapt their marketing channels. In figure 12 the results of the question are displayed. The main channels of information are automotive manufacturer websites, independent websites and newspapers or general magazines. The New Motion also scored relatively high. Interesting is that owners did not find information in TV advertisements or Brochures, which could be the channels via which manufacturers advertise their products. These findings correspond to the decision to reject Hypothesis 13, because advertisements are not indicated as information source.

![Marketing channels graph](image)

**Figure 12 Marketing channels**

<table>
<thead>
<tr>
<th>Information source</th>
<th>Response percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive manufacturer web sites</td>
<td></td>
</tr>
<tr>
<td>Independent web sites</td>
<td></td>
</tr>
<tr>
<td>Newspapers or general magazines</td>
<td></td>
</tr>
<tr>
<td>The New Motion</td>
<td></td>
</tr>
<tr>
<td>Brochures from automotive manufacturers</td>
<td></td>
</tr>
<tr>
<td>Specialty car magazines</td>
<td></td>
</tr>
<tr>
<td>TV advertisements</td>
<td></td>
</tr>
<tr>
<td>Consumer magazines</td>
<td></td>
</tr>
</tbody>
</table>

**Word of Mouth**

As was predicted Word of Mouth was negatively related to the adoption of the electric car. However in the literature section it was found that the further adoption success of a product is related to the willingness of adopters to give positive Word of Mouth. Therefore a question about the willingness to give positive Word of Mouth was added to the research. The results on willingness to give positive Word of Mouth about electric driving are displayed in figure 13. It is obvious that most people ‘totally agree’ or ‘agree’ to give positive Word of Mouth. The mean (mean = 4,5) and median (median = 5) also show the willingness to give positive Word of Mouth. Therefore hypothesis 14b is accepted.
Figure 13. Willingness to give positive Word of Mouth
5. Conclusion and discussion

This chapter will discuss the results found in chapter four and the implications of the outcome. The research question will be answered in this chapter, but also the practical implications and contributions of this research will be discussed. Finally the limitations and recommendations for future research are discussed. The objective of this research was to develop a model that explains why people buy an electric car. The following research question was formulated: What is the influence of Perceived attributes Institutional Pressure, Social Identity, Marketing and Image on the adoption of the electric car?

In order to answer this question the five factors were defined at hand of existing literature, which are supposed to influence the adoption behaviour. The five factors are:

- Perceived Attributes of an Innovation
- Institutional Pressure
- Social Identity
- Marketing
- Image

5.1.1. Conclusion

On the basis of logistic regression analysis Compatibility (p<0.05), Complexity (p<0.05), Trialability (p<0.01), Need for Assimilation (p<0.05), Image (p<0.05) and Word of Mouth (p<0.01) are statistically significant predictors on the adoption of the electric car. Compatibility, Complexity (Ease of use) and Image influence the adoption of the electric car positively. Trialability, Need for Assimilation and Word of Mouth have a negative impact on the adoption process. Almost all related factors are showing a result according to the expectations. Trialability however was expected to show a positive relation to adoption behaviour. This will be discussed later.

The theory about perceived characteristics by Rogers was leading in this research as it is a widely used model for adoption behaviour. The perceived characteristics are believed to influence the adoption of innovations (Rogers, 2003). Only two of the five perceived characteristics positively explained adoption behaviour. The amount of variance explained by the proposed model was 64%. Compared to the amount of variance explained by the perceived characteristics of Rogers (33%), the proposed model performed much better. This research showed that there are more important factors explaining adoption behaviour.
The electric car was perceived as easy to use and compatible with the needs for personal transport. Descriptive statistics revealed that electric car users perceive the electric car as a good substitute for the traditional car in terms of driveability, but the price is still too high. The electric car being better for the environment was an important reason to buy an electric car. Further the electric car was perceived to be good for the image of the user; this could be an important factor in explaining the adoption of the electric car. The enhancement of image by driving an electric car was noticed by the users. Unexpectedly marketing in the form of advertisements did not show a relation to adoption behaviour. Further analysis revealed that this group of (early) adopter found information about the electric car on car manufacturers’ websites and independent websites mainly. Next to the enhancement of image this is suggested to be an important reason for people to buy an electric car. The main drawbacks of the electric car indicated by the adopters are the limited availability of charging points and the high costs of the electric car.

The importance of Image for the adoption of the electric car was evident. While it was suggested by Rogers (2003) that image could have some influence, this research showed that it might be more important than the perceived attributes, but at least important enough to consider when studying adoption of innovation. Social responsibility (Institutional pressure) was found as an important factor by descriptive statistics as well. The group of adopters is found to be opinion leaders, and therefore have a special role in the social system (Rogers, 2003). The combination with the high willingness to give positive Word of Mouth, and the role in the social system, the early adopters from this research could be important for the further adoption process of the electric car.

5.2. Discussion

This research started with an outline of the factors which have an influence on adoption behaviour. The items explaining each factor were extracted from previous research, to be sure that the items were measuring what was intended to measure. However for some constructs the different items were extracted from multiple articles. It was found that the items within a construct concerned different subjects and thereby were not always related to one another. When performing another study with the same questionnaire it should be revised.

5.2.1. Perceived Characteristics

Leading in the literature review was the work of Rogers (1962). The perceived characteristics of the innovation are according to Rogers (2003) important to the adoption of that particular innovation and therefore were suggested to have a positive effect on the adoption. In this research the perceived characteristics were studied as well. Relative Advantage, Compatibility, Complexity (Ease of Use), Trialability and Observerability.
Relative advantage did not show a significant predictor of adoption in the regression analysis, this is contrary to Rogers (2003). The additional analysis showed that electric car user did like the driveability of the electric car, but thought that the costs were too high. One advantage was present (driveability), the other was negative (costs too high). Two items concerning costs were the two items explaining Relative Advantage, however did not show a significant predictor for adoption. In the literature review the importance of a good definition of the attributes was emphasized (Tornatzky and Klein, 1982), this construct need to be revised for further research. As driveability of the electric car this could be a better item explaining relative advantage.

Compatibility did show a significant positive predictor for the adoption after deletion of one item. The deleted item did not show a relation to the other two items of the construct. The deleted item showed negative attitude from the adopters of electric cars to the amount of charging points available, which is a component of Compatibility. The limited number of charging points was marked by Tran et al. (2012) as a reason not to buy an electric car. If the product is not compatible with current values, needs etc. the adoption process will be relatively slow (Rogers, 2003). The limited number of charging points could therefore be a factor slowing down the adoption process, however not taken into regression analysis due to low correlation to other items in the Compatibility scale.

Complexity, or in this case ease of use, showed a significant positive predictor for the adoption also after deletion of one item, this is in line with the expectations based on Rogers (2003). Users indicated that the electric car is easy to use. The deleted item was not much different from the other two, but it was reversed scaled which could be a reason for the low correlation between the items.

Trialability showed a significant, but negative, relation to the adoption. This result is remarkable, because it was expected to find a positive relation according to Rogers (2003). One explanation could be that the potential users nowadays have more possibilities to try electric cars that the people that already adopted. In the time that the first adopters bought their electric car they were a minority. Another explanation lies in the choice of population; most research testing the attributes is conducted among non – users of an innovation and measures the willingness to adopt an innovation (Agarwal and Prasad, 1997, Moore and Benbasat, 1991, Heri and Mosler, 2008 and Tornatzky and Klein, 1982). This is contrary to the present research which was conducted among users and potential users. The two groups could therefore be different in access to resources, for example possibility to try the electric car. The non users have more possibilities to try an electric car nowadays, because there are more manufacturers selling electric cars.
Observerability was excluded from the regression analysis, but was analyzed via descriptive statistics. It showed that the electric car was not observable by the car owners. This implies that observerability was not a reason for people to buy an electric car. While contrary to the expectation based on Rogers (2003), it is in line with the research of Tornatzky and Klein (1982) who did not find a relation between observerability and adoption.

5.2.2. Institutional pressure

Derived from Bansal and Roth (2000) three motivations to adopt a “green” innovation; Competitiveness, Legitimation and Social responsibility. All constructs were measured by one item. The regression analysis showed no significant predictive power from institutional pressure on the adoption behaviour. This is contrary to Bansal and Roth’s (2000) suggestion. The difference could be due to the choice of item defining the construct. The descriptive statistics confirmed the results for Competitiveness and Legitimation, no notable results were found there. For one item defining Social Responsibility however a very high score was measured (Mean = 4.13), car users indicate that they bought an electric car because it is better for the environment. For this sample people seem to adopt the electric car because it is better for the environment, this is in line with the findings of Kahn (2007).

5.2.3. Social identity

Three different social identities were distinguished, that is Need for Assimilation, Need for Distinctiveness and Opinion leaders. Need for Assimilation showed a significant (p<0.05) relation to adoption of the electric car. There was a negative predictive power from Need for Assimilation to the adoption. This is in line with the findings of Brewer (1991) who did not expected early adopters to be people with a need for assimilation. The relation between a need for distinctiveness could not be showed, neither it could be showed that early adopters are opinion leaders by logistic regression This could be due to the fact that the non-user group was a group which consists of almost 50% potential users, and all non-users are interested in electric cars (they were selected via the website of The New Motion).

The potential users could be considered as early adopters as well, if they actually adopt, because the electric car is still in the early stages of the adoption curve (Rogers, 2003). This may have influenced the outcome, because potential users are, in terms of their social identity, the same as the users. Further there was not much variety in the sample; most people owned their electric car less than a year. If the sample was bigger it was possible to distinguish innovators and early adopters, but in this research the sample was too small.
The descriptive statistics showed high scores on all three questions explaining Opinion Leader. It can therefore be assumed that the adopters are opinion leaders. This is in line with Brewer (1991) and Rogers (2003). This implies that the group of early adopters will have an important influence on the further adoption of the electric car (Rogers, 2003). Therefore their experiences are important for the further adoption.

5.2.4. Image

Image is considered as another important factor for the diffusion of innovation, defined by Rogers (2003) as the degree to which the use of an innovation is perceived to enhance one’s image or status in one’s social system. The logistic regression analysis revealed that Image is a significant (\(p<0.05\)) positive predictor for adoption of the electric car. Image had the largest exp b, which implies it has the most predictive power from all constructs (Field, 2005).

Descriptive statistics showed a positive answer to both items explaining Image. Further one item explaining Image showed the highest mean value. This also points out that Image is very important in adoption behaviour. Owners of an electric car indicated that it enhanced their image; this is in line with Steg (2005) who found that a car is a status symbol. Agarwal and Prasad (1997), who also studied Image next to the perceived characteristics, did not find Image as a predictor of adoption. Teo and Pok (2003) did find significant effect of Image on the adoption behaviour of consumers. The difference in results could be due to difference in products studied. As Steg (2005) had found that a car is a status symbol it was expected to find a relation between image and adoption. However if a product is studied which is not seen as a status symbol, the influence of image could be smaller.

The questions explaining Image did not differentiate between personal image or work related image. There could be a difference between the two (Muller and Kolk, 2010, Teo and Pok, 2003). This could imply that an overlap exists between institutional pressure, competitiveness, and social status (Image). If the image questions are interpreted that driving an electric car is good for the “green image” of the company, and therefore as a competitive advantage, there is a bias with competitiveness.

5.2.5. Marketing

Finally marketing was suggested to have an influence on adoption behaviour in two ways: via advertisements and via Word of Mouth (Mahajan et al., 1990). Both forms of marketing were studied independently with one item. Advertisement was not a significant predictor for adoption, this against the expectation. According to Mahajan et al. (1990) the first phase of the adoption curve external marketing effects are most influential. This could however not be confirmed in this research. The question about marketing channels revealed that the buyers of the electric car found information
mostly on websites of car manufacturers and independent websites (figure 11). Hardly any electric car users marked advertisements as information channel before buying their car.

Word of mouth was found as a negative predictor for adoption. This was in line with the expectation based on Mahajan et al. (1990). The most interesting finding related to WOM is the willingness of adopters to give positive WOM. Rogers (2003) indicated the early adopters as an important group for the adoption curve. If the early adopters are satisfied with an innovation and are willing to give positive WOM, they will affect other people to adopt as well. The willingness to give positive WOM is an indicator if the product is good or not. The users of electric cars indicated that they are willing to give positive WOM (see figure 12). This is an indicative factor that the further adoption of the electric car will advance. This is however a very conservative estimate, because there are more factors influencing the further adoption.

5.3. Limitations

When interpreting the results of this research there are limitations that need to be taken into account. First the sample size (N = 107) is small. The group of users (N = 64) and non users (43) is even smaller. This means that generalizability is considered with caution. The amount of users (N = 64) compared to the total amount of electric car users in the Netherlands, in 2012 approximately 4000\(^5\), is 1.6%.

Secondly a bias exists because the data list was gathered via The New Motion, who could only access people that were subscribed to their newsletter. The people who were attending the research, are interested in the developments concerning electric cars and are perhaps different from the other car owners. The participants for the non user group were also gathered via The New Motion which again could cause a bias.

Thirdly, as explained in paragraph 4.2 and 4.3, several items were deleted from the analysis. This could have some effect on the predictive power of the constructs, as well as the outcome of the regression analysis.

Finally, all items were adopted from existing research and translated from English to Dutch, this could have influenced the reliability (Saunders et al., 2009). Because there were a lot of constructs measured in this research, some constructs are only explained by one item selected from several items. The researcher made a choice in the selection between different items on basis of logical thinking, however other items could have been better in defining the constructs.

5.4. Recommendations

The suggested model for explaining adoption behaviour was found to better predict adoption behaviour than the original Rogers’ model of perceived characteristics (64% of variance explained vs. 33% by perceived characteristics. Therefore a recommendation is that further research on adoption behaviour takes other factors into account than just the perceived attributes. In particular Image was found to have a large effect on adoption behaviour. Further research on image could provide more insight on the adoption behaviour.
References


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Tran, M., Banister, D., Bishop, J.D.K. and McCulloch, M.D. (2012) Realizing the electric-vehicle revolution. Nature Climate Change, 2, 328-333


Trusov, M., Bucklin, R.E. and Pauwels, K. Effects of Word-of-Mouth Versus Traditional Marketing: Findings from an Internet Social Networking Site. *Journal of Marketing* 73, 90-102


6. Appendices


<table>
<thead>
<tr>
<th>Question</th>
<th>Answers ranked by times cited</th>
</tr>
</thead>
</table>
| Importance of component in the decision to purchase electric vehicles   | 1) Costs of filling batteries in relation to filling a gas tank  
2) Back-up availability of diesel or gasoline, plug-in hybrids are more popular than full electric vehicles (EV)  
3) Time to charge battery  
4) Total cost of purchasing and maintaining the car                         |
| Critical factors that may influence decision                            | 1) The ability to charge at home  
2) Battery range equal to conventional car  
3) Total cost of buying and running the car  
4) Government subsidies or tax exemptions to compensate for the extra costs |
| Why buy an electric car?                                                | 1) No tax on the car  
2) Parking availability                                                                                                                        |
| Full electric or plug-in hybrid?                                        | 71% plug-in hybrid  
29% full electric                                                                                                                            |
| Why plug-in hybrid instead of full EV?                                  | 1) perceived insufficient battery range of full EV  
2) Availability of charging points  
3) Perceived long time of charging for full EV                                                                                           |
| What would be the main reason to choose a full EV instead of a plug-in hybrid? | 1) lower running costs  
2) Greater impact on reducing carbon emissions  
3) Concerns about reliability of the plug-in hybrid compared to full EV’s (smaller proportion)                                   |
| Where would you prefer to charge?                                       | 1) at home (over two third of people)  
2) charging at gasoline stations                                                                                                                  |

Table 1. Results of Accenture (2011) research
### 6.2. Appendix 2. Items from questionnaire adopter with references.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>References</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative advantage</strong></td>
<td>- De kosten voor de elektrische auto zijn te hoog</td>
<td>Vollink et al. (2002)</td>
<td>RELAD3</td>
</tr>
<tr>
<td></td>
<td>- De kosten voor de elektrische auto zijn goed in verhouding met de prestatie</td>
<td>Gerpott (2011)</td>
<td>RELAD1</td>
</tr>
<tr>
<td></td>
<td>- Ik vind de rijeigenschappen van mijn elektrische auto beter dan van traditionele auto’s</td>
<td>Own addition</td>
<td>RELAD2</td>
</tr>
<tr>
<td><strong>Compatibility</strong></td>
<td>- De elektrische auto sluit aan bij mijn wensen voor persoonlijk vervoer</td>
<td>Moore &amp; Bensabat (1991), Park &amp; Chen (2007), Agarwal &amp; Prasad (1997)</td>
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<tr>
<td></td>
<td>- De elektrische auto sluit goed aan op de manier hoe ik een auto gebruik</td>
<td>Moore &amp; Bensabat (1991), Agarwal &amp; Prasad (1997)</td>
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<td>- Er zijn voldoende oplaadpunten voor mijn auto</td>
<td>Truman et al. (2003)</td>
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<td><strong>Complexity</strong> (ease of use)</td>
<td>- Ik denk dat de elektrische auto gemakkelijk is in gebruik</td>
<td>Moore &amp; Bensabat (1991), Park &amp; Chen (2007), Agarwal &amp; Prasad (1997)</td>
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<tr>
<td></td>
<td>- Het gebruik van de elektrische auto is vaak frustrerend</td>
<td>Moore &amp; Bensabat (1991), Graham-Rowe et al. (2012)</td>
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<td>- Het opladen van mijn elektrische auto is eenvoudig</td>
<td></td>
<td>COMPLEX2</td>
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<td>- Ik heb onvoldoende mogelijkheden gehad om de elektrische auto te proberen</td>
<td>Moore &amp; Bensabat (1991)</td>
<td>TRIAL1</td>
</tr>
<tr>
<td><strong>Observability</strong></td>
<td>- Ik zie veel elektrische auto’s om mij heen</td>
<td>Park &amp; Chen (2007), Agarwal &amp; Prasad (1997)</td>
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<td>- De elektrische auto is niet echt zichtbaar in het straatbeeld</td>
<td>Agarwal &amp; Prasad (1997)</td>
<td>OBSER1</td>
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<tr>
<td><strong>Image</strong></td>
<td>- Een elektrische auto is een status symbool</td>
<td>Agarwal &amp; Prasad (1997), Steg (2005), Wilcox et al. (2009)</td>
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<td>Wilcox et al. (2009)</td>
<td>IM1</td>
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<td>- Het hebben van een elektrische auto is goed voor mijn image</td>
<td>Teo &amp; Pok (2003)</td>
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<tr>
<td><strong>WOM</strong></td>
<td>- Het is waarschijnlijk dat ik positiieve mond-op mond reclame</td>
<td>Maxham (2001)</td>
<td>WOM1</td>
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</table>
maak voor elektrisch rijden

| Institutional Pressure | - Van uit mijn werk werd het gestimuleerd om elektrisch te gaan rijden | Taylor & Todd (1995) | IP1 |
| - Ik ben elektrisch gaan rijden als reactie / anticipatie op wet- en regelgeving (uit angst voor straffen of oplopende kosten) | Bansal and Roth (2000) and Muller and Kolk (2010) | IP2 |
| - Ik ben elektrisch gaan rijden omdat ik mij daartoe moreel verplicht voelde | Bansal and Roth (2000) and Muller and Kolk (2010) | IP3 |
| - Ik ben elektrisch gaan rijden omdat het beter is voor het milieu dan traditionele auto’s | Bansal and Roth (2000) and Muller and Kolk (2010) | IP4 |

| Marketing effects | - Advertenties hebben mij beïnvloed bij de keuze om elektrisch te gaan rijden | Mahajan et al. (1990) | MARK1 |
| - Mijn keuze om elektrisch te gaan rijden is beïnvloed door aanbevelingen van anderen | Mahajan et al. (1990) | MARK2 |
| o Artikelen in kranten of magazines | | |
| o Artikelen in consumentengidsen | | |
| o Artikelen in autobladen | | |
| o Brochures van autofabrikanten | | |
| o TV reclames | | |
| o Websites van autofabrikanten | | |
| o Onafhankelijke websites | | |
| o Andere, nl: | | |

| Need for assimilation | - Ik vind het belangrijk om me hetzelfde te dragen als mijn vrienden | Timmorn and Katz-Navon (2008) | NEAS1 |
| - Ik luister meestal naar dezelfde muziek als mijn vrienden | Timmorn and Katz-Navon (2008) | NEAS2 |

| Need for distinctiveness | - Ik kan mij meestal goed identifieren met mensen die verschillend en uniek zijn | Timmorn and Katz-Navon (2008) | NEDI1 |
| - Het is belangrijk voor mij om anders, uniek en niet gewoontjes te zijn. | Timmorn and Katz-Navon (2008) | NEDI2 |
| - Ik denk dat ik anders ben dan mijn vrienden | Timmorn and Katz-Navon (2008) | NEDI3 |

- Mensen die ik ken vertrouwen op mijn aanbevelingen als ze nieuwe producten kopen.
- Ik overtuig vaak mensen om producten te kopen die ik goed vind.

Timmor and Katz-Navon (2008)

**Basis vragen**
- Hoe lang rijdt u al elektrisch?
- Hoeveel kilometer rijdt u per week?
- In welke stad woont u?
- Welke elektrische auto heeft u?
- Heeft u een eigen laadpaal?
- Wat is de officiële range van uw auto?
- Hoeveel kilometer durft u per dag te rijden (hoeveel kilometer denkt u dat de range is)
- Hoe vaak laadt u uw auto op?

**Specific questions plug-in hybride**
- Ik rij voornamelijk op benzine en laad mijn auto nooit op.
- Ik heb voor een plug-in hybride gekozen, omdat een elektrische auto niet voldoende bereik heeft.
- Ik heb voor een plug-in hybride gekozen omdat ik denk dat er te weinig oplaadpunten zijn.
- Ik heb voor een plug-in hybride gekozen omdat ik de range van een volledig elektrische auto onvoldoende vind.

**6.3. Appendix 3 Items from questionnaire potential adopters with references**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>References</th>
<th>Code</th>
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<tr>
<td>Relative advantage</td>
<td>- De kosten voor de elektrische auto zijn te hoog</td>
<td>Vollink et al. (2002)</td>
<td>RELAD3</td>
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<tr>
<td></td>
<td>- De kosten voor de elektrische auto zijn goed in verhouding met de prestatie</td>
<td>Gerpott (2011)</td>
<td>RELAD1</td>
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<td></td>
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<td>Own addition</td>
<td>RELAD2</td>
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<td>Compatibility</td>
<td>- De elektrische auto sluit aan bij mijn wensen voor persoonlijk vervoer</td>
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<td>- De elektrische auto sluit goed aan op de manier hoe ik een auto gebruik</td>
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<td>Truman et al. (2003)</td>
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<td>Complexity (ease of use)</td>
<td>- Ik denk dat de elektrische auto gemakkelijk is in gebruik</td>
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<td>COMPLEX1</td>
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<td>Agarwal &amp; Prasad (1997)</td>
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<td>- Ik heb onvoldoende mogelijkheden om de elektrische auto te proberen</td>
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<td>TRIAL1</td>
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<td>- Ik zie veel elektrische auto's om mij heen</td>
<td>Park &amp; Chen (2007), Agarwal &amp; Prasad (1997)</td>
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<td>- De elektrische auto is niet echt zichtbaar in het straatbeeld</td>
<td>Agarwal &amp; Prasad (1997)</td>
<td>OBSER1</td>
<td></td>
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<tr>
<td>Image</td>
<td>Agarwal &amp; Prasad (1997), Steg (2005), Wilcox et al. (2009)</td>
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<td>- Een elektrische auto is een status symbool</td>
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<td>IM1</td>
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<tr>
<td>- Ik vind het leuk als mensen weten dat ik een elektrische auto heb</td>
<td>Teo &amp; Pok (2003)</td>
<td>IM2</td>
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<tr>
<td>- Het hebben van een elektrische auto is goed voor mijn image</td>
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<tr>
<td>Institutional Pressure</td>
<td>Taylor &amp; Todd (1995)</td>
<td>IP1</td>
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<td>- Vanuit mijn werk wordt het gestimuleerd om elektrisch te gaan rijden</td>
<td>Bansal and Roth (2000) and Muller and Kolk (2010)</td>
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<td>- Ik zou elektrisch gaan rijden als reactie / anticipatie op wet- en regelgeving (uit angst voor straffen of oplopende kosten)</td>
<td>Bansal and Roth (2000) and Muller and Kolk (2010)</td>
<td>IP3</td>
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<tr>
<td>- Ik ga elektrisch rijden omdat ik mij daartoe moreel verplicht voelde</td>
<td>Bansal and Roth (2000) and Muller and Kolk (2010)</td>
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<td>Marketing effects</td>
<td>Mahajan et al. (1990)</td>
<td>MARK1</td>
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<tr>
<td>- Advertenties beïnvloeden mijn keuze om elektrisch te gaan rijden</td>
<td>Mahajan et al. (1990)</td>
<td>MARK2</td>
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<td>- Mijn keuze om elektrisch te gaan rijden wordt beïnvloed door aanbevelingen van anderen</td>
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<tr>
<td>- Waar heeft u informatie gevonden voordat u een nieuwe auto heeft gekocht? (meerdere antwoorden mogelijk)</td>
<td>Graham (2001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Artikelen in kranten of magazines</td>
<td></td>
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<td>o Artikelen in consumentengidsen</td>
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<td>o Artikelen in autobladen</td>
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<tr>
<td>o Brochures van autofabrikanten</td>
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<tr>
<td>Need for assimilation</td>
<td>- Ik vind het belangrijk om me hetzelfde te gedragen als mijn vrienden</td>
<td>Timmor and Katz-Navon (2008)</td>
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<td>- Ik luister meestal naar dezelfde muziek als mijn vrienden</td>
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<td>Need for distinctiveness</td>
<td>- Ik kan mij meestal goed identificeren met mensen die verschillend en uniek zijn</td>
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<td>Timmor and Katz-Navon (2008)</td>
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<td>Timmor and Katz-Navon (2008)</td>
<td>NEOP1</td>
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<td>- Ik overtuig vaak mensen om producten te kopen die ik goed vind</td>
<td>Timmor and Katz-Navon (2008)</td>
<td>NEOP3</td>
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</tbody>
</table>

**Standard Questions**
- Wat is uw geslacht?
- Wat is uw leeftijd?
- Bent u van plan een elektrische auto te kopen? (ja/nee)
6.4. Appendix 4 Classification Plot

Step number: 1

Observed Groups and Predicted Probabilities

<table>
<thead>
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<th>Group</th>
<th>Predicted Probabilities</th>
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<td>0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1</td>
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</table>

Predicted Probability is of Membership for Owner
The Cut Value is .50
Symbols: P - Potential Owner
O - Owner
Each Symbol Represents 1.25 Cases.

6.5. Appendix 4 Descriptive Statistics

<table>
<thead>
<tr>
<th>Relative Advantage</th>
<th>Complain</th>
<th>Complexity</th>
<th>Instability</th>
<th>Observability</th>
<th>Competitiveness</th>
<th>Legitimacy</th>
<th>Social Response</th>
<th>Need for assimilation</th>
<th>Need for distinctive</th>
<th>Opinion Leadership</th>
<th>Image</th>
<th>Advertisements</th>
<th>Word of Mouth</th>
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